

**THE UNIVERSITY OF DURBAN~WESTVILLE**



**DEPARTMENT OF CIVIL ENGINEERING**

**URBAN POVERTY REDUCTION THROUGH MUNICIPAL SOLID WASTE  
MANAGEMENT (MSWM): A CASE STUDY OF MASERU AND MAPUTSOE IN  
LESOTHO**

**BY**

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**A THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE  
AWARD OF A DEGREE OF DOCTOR OF PHILOSOPHY**

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SOUTH AFRICA.**

**PROMOTER: PROFESSOR FREDRIC A.O.OTIENO**

**MAY 2002**

## **DEDICATION**

**To the Sweet Memories of my Parents: late Father - Fallow Mvuma and My Mother - Dyles Mvula, for making me into what I am, and whose encouragement and inspiration enabled me to have this dream, realised. My wife Ruth and our beloved children: Thandiwe, Chiyembekezo (Tamara), Obed and Godfrey (Jr.)**

## DECLARATION

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Hereby declare that the thesis entitled:

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30 May 2002

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**Date**

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## ABBREVIATIONS/ACRONYMNS

AD	Anaero,bic Digestion
ATP	Affordable to Pay
CAC	Command and Control Approach
CBOs	Community Based Organisations
C&D	Construction and Demolition
CMA	Common Monetary Area
COWMAN	Committee on Waste Management (Lesotho)
CREED	Collaborative Research in the Economics of Environment and Development
CSIR	Council for Scientific and Industrial Research, South Africa
DOE	Department of Environment (UK)
DWA	Department of Water Affairs (Lesotho)
DWAF	Department of Water Affairs (South Africa)
EIGs	Economic Interest Groups
EPA	Environmental Protection Agency (USA)
GDP	Gross Domestic Product
GNP	Gross National Product
GOL	Government of Lesotho
Ha	Hectares
HDI	Human Development Index
HDR	Human Development Report
HHs	Households
IEMS	Inform – Educate – Motivate Strategy
IPRSP	Interim Poverty Reduction Strategy Paper (Lesotho)
ISWM	Integrated Solid Waste Management
IWB	Itinerant Waste Buyer
IWMS	Integrated Waste Management Systems
IT	Information Technology
IUCN	International Union for the Conservation of Nature
Kg	Kilogram
Kg/a/day	Kilogram per area per day

Kg/a/week	Kilogram per area per week
Kg/cap/day	Kilogram per Capita per Day
Kg/cap/week	Kilogram per Capita per Week
Kg/esta/day	Kilogram per establishment per day
Kg/esta/week	Kilogram per establishment per week
Kg/hh/day	Kilogram per household per day
Kg/hh/week	Kilogram per household per week
LA	Local Authority
LCD	Least Developed Countries
LCN	Lesotho Council for Non-Governmental Organisation
LEAD	Leadership for Environment and Development
LEC	Lesotho Electricity Corporation
LHDA	Lesotho Highlands Development Authority
LHRDF	Lesotho Highlands Revenue Development Fund
LHWP	Lesotho Highlands Development Project
LNDC	Lesotho Highlands Development Corporation
LTD	Limited
MCC	Maseru City Council
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NAP	Nation Action Plan
NEAP	National Environment Action Plan
NES	National Environment Secretariat (Lesotho)
NEYC	National environment Youth Corps (Lesotho)
NGOs	Non - Governmental Organizations
NIMBY	Not In My Back Yard
NSWMA	National Solid Waste Management Authority (USA)
NUL	National University of Lesotho
NZA	National Waste Authority (Germany)
PDB	Public Dust Bin
PHHW	Potential Hazardous Waste
POPs	Persistent Organic Pollutants
PQLI	Physical Quality of Life Index

RCV	Refuse Collection Vehicle
RSA	Republic of South Africa
SA	South Africa
SACU	Southern Africa Customs Union
SADC	Southern Africa Development Community
SAIChE	South Africa Institute of Chemical Engineers
SHD	Sustainable Human Development
SME	Small and Medium Enterprise
SWM	Solid Waste Management
UK	United Kingdom
UNDP	United Nations Development Programme
UNCED	United Nations Conference on Environment and Development
UNCHS	United Nations Centre for Human Settlement
UNEP	United Nations Environment Programme
UNESCO	United Nations Education, Scientific and Cultural Organization
USA	United States of America
USEPA	United States Environment Protection Agency
UWEP	Urban Waste Expertise Programme
WASA	Water and Sewerage Authority (Lesotho)
WB	World Bank
WCA	Waste Collection Authority
WDA	Waste Disposal Authority
WHO	World Health Organization
WRF	World Resources Foundation

## ABSTRACT

The study was designed to generate data and information necessary for designing an appropriate sustainable solid waste management system, and examining the socio-economic benefits of urban municipal solid waste management through job creation opportunities (albeit mainly informal) in Lesotho.

The review of literature on the integrated solid waste management systems at international, regional and local levels in relation to job creation was carried out with a view to establish the necessity of carrying out this research. In addition, specific solid waste management experiences and practices in other countries have been cited.

In Lesotho, investors and donors have, for long expressed the need for formulation of solid waste management policy and guidelines formulated in the country in order to create an enabling environment for investment. However, the process of preparing policy and guidelines requires substantial data and information. This study supplemented this effort by gathering data and information. The data and information gathered were on the existing policies and regulatory framework concerning waste management; waste generation rates, types and quantity from domestic, industrial and commercial establishments; recycling activities; and the waste harvesting (scavenging) activities. The study was undertaken in Maseru and Maputsoe, being the hub of commercial and industrial activities in the country. The data and information may also be useful to other SADC countries

From the results of the study, it has been concluded that in Lesotho, paper was the most commonly generated waste in all the categories: domestic, industrial and commercial establishments. Plastic was the second category of the most commonly generated waste, which was followed by organic waste, and then, beverage cans. The study established that the weighted average household generation rate for the surveyed areas was: 0.13 Kg per capita day<sup>-1</sup>. In the same findings, it occurred that overall, households contribution to waste generation in the surveyed areas ranked second to commercial establishments despite their low per capita, in comparison with industrial establishments. The study has further concluded that out of an estimated total quantity of 157552 tonnes per annum of waste generated in Maseru, commercial establishments contributed 82%, while households contribute 15% and industrial establishments 3%. Households generated more waste than industries because they

were in large numbers and hence contributed more than fewer industries. It has also been established that the household waste generation is dependent on incomes of these households, but had poor relationship with regard to the number of persons per household. To this effect, it was seen that high-income households generated more waste than low-income. The study further showed that where the municipal council offered waste collection service, not all recipients paid for this service. However, there was a general willingness- to- pay for the waste collection service by all sectors, on condition that there was an improvement in the offering of this service; and if made available where currently not offered. Furthermore, there was a general indication of affordability for these services up to a certain amount (albeit minimal) per different sectors. On the other hand, the information collected strongly indicated the need to invest more in solid waste management if this would be a means of employment creation and improvement of the environment.

On the overall, the study revealed that there was a low level of awareness on waste related policy and regulatory instruments, and fragmented legal framework on waste management in Lesotho. The study also established that currently, solid waste as an informal sector generated an estimated profit of M0.7million per annum from waste recycling related activities and that this informal sector generated about 282 jobs. In addition to these benefits, the question of solid waste as a source of biomass energy was another beneficial route in Lesotho. It has been established that the combustible organic waste was highly sought after as a source of energy for cooking and heating. However, besides the benefits, these activities also gave rise to some adverse impacts. The waste harvesters expressed that their health had been negatively impacted upon by the waste scavenging activities. Needless to suggest that there would be a need by the government to intervene in this problem by formalising these waste harvesting activities.

It is hoped that this study would serve as a reservoir for the source of data and information and for Lesotho and that other countries in the SADC Region shall find this document a useful tool.

**ABBREVIATED TITLE: WASTE, A PATH FOR JOB CREATION IN LESOTHO.**

# **1: LESOTHO'S ENVIRONMENTAL AND SOCIO ECONOMIC STATUS AND OBJECTIVES OF THE STUDY**

## **1.0 INTRODUCTION**

This chapter outlines the biophysical environment, socio-economic status and the major environmental problems in Lesotho. In addition, solid waste management problems are discussed and linked to environmental degradation. This background information is pre-requisite for a clear picture concerning issues related to solid waste management problems in the country, with a view to generating jobs. Furthermore, problems of solid waste management must be seen in the context of poverty, on the one hand, and conversely, considered for the potential of job creation.

## **1.1. LOCATION**

Lesotho occupies an area of 30,335 square kilometres, between latitudes 28<sup>0</sup>35' and 31<sup>0</sup>40' South, and longitudes 27<sup>0</sup>00 and 29<sup>0</sup>30' East, (UNDP, 1984; Environmental Resource Institute Limited, 1990; McLeod 1989). It is a landlocked, mountainous country surrounded by the Republic of South Africa (See Map 1.1). General elevations exceed 1,000 metres with highland peaks rising to 3,482 metres above sea level. Four distinct agro-ecological zones exist, as shown in Map 1.2: Highlands, Lowlands, Foothills and the Senqu River Valley (GOL, 1989). Of the total land area, only 9% is suitable for arable agriculture and 66% for grazing (GOL, 1994). The terrain is generally rugged with steep slopes and fragile soil formations. The mountains constitute the headwaters and important catchment area for a number of major rivers in the country and in South Africa.

## **1.2 CLIMATIC CONDITIONS <sup>1</sup>**

Climatic conditions in Lesotho are largely determined by latitude and altitude, and is the subject of wide seasonal and geographical variations resulting in four seasons: summer, autumn, winter and spring. Mean annual rainfall ranges from 600mm in the southern and western lowlands, to 1,600mm in the northeastern highlands. Nevertheless, the country remains vulnerable to recurrent

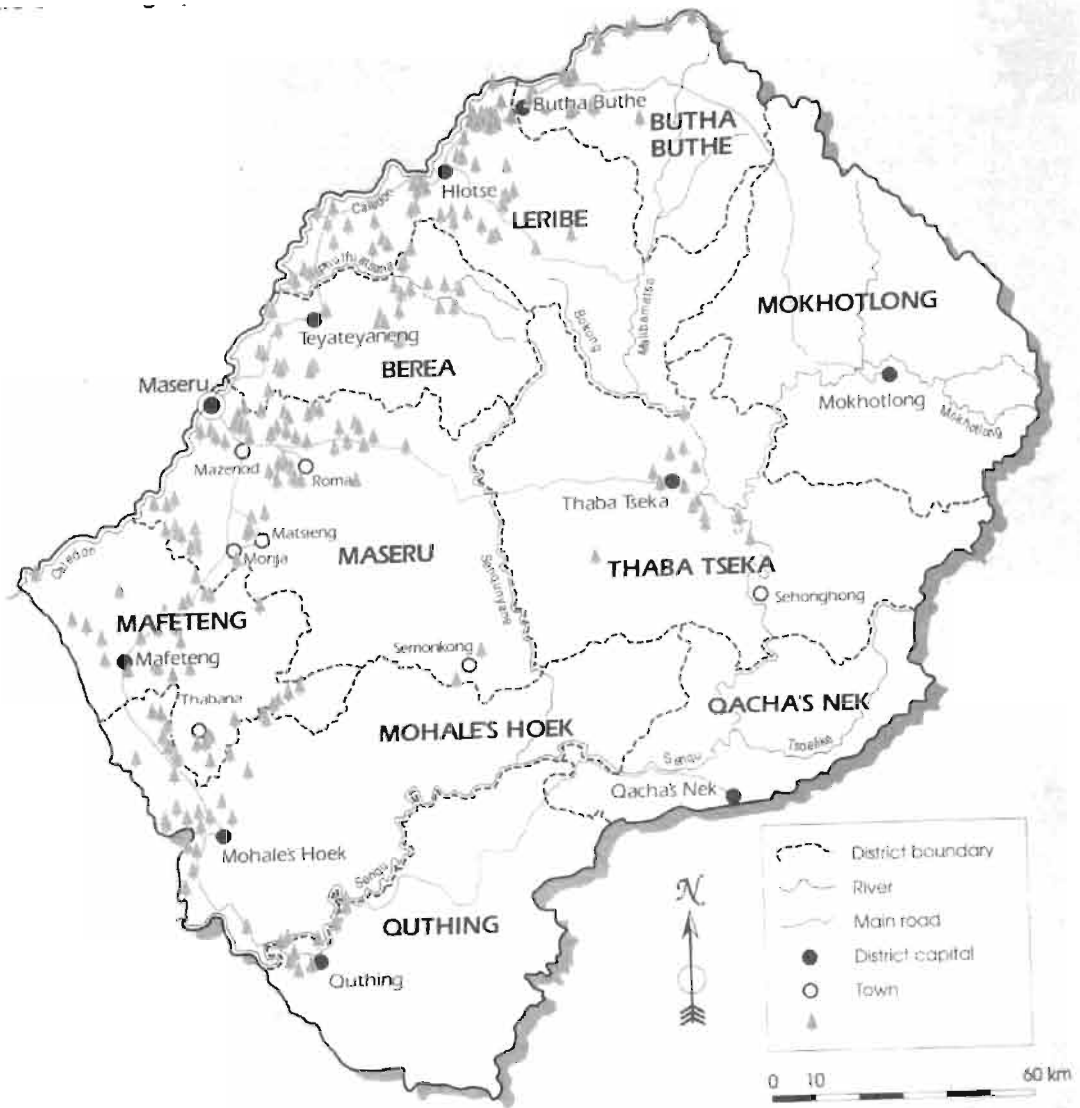
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<sup>1</sup> According to the State of Environment Report, the climate of Lesotho is so much colder by the altitude of the ecological zone (The Lesotho State of Environment Report, 1997).

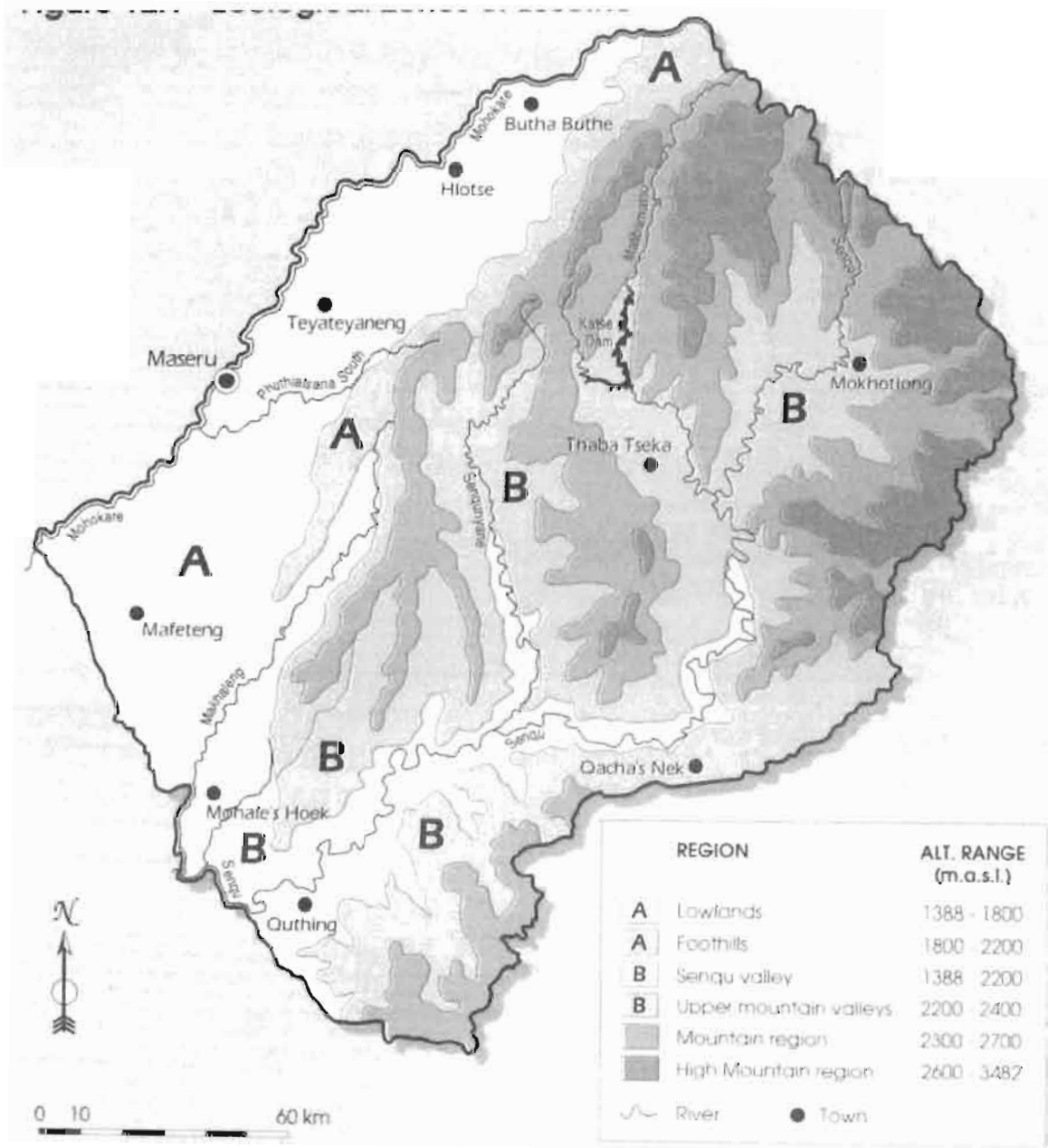


periods of drought. Lesotho receives an average of 310 sunshine days per annum, (Molapo, 1999). January is the hottest month of the year, with average temperature of over 20<sup>0</sup>C being recorded in the lowlands (GOL, 1994). The coldest months are June and July with an average temperature of 8<sup>0</sup> C. Temperature in excess of 35<sup>0</sup> C, particularly during droughts, has been recorded. Very low winter temperatures are also observed in Lesotho. For example, in 1993 winter temperature went as low as - 7<sup>0</sup> C (GOL, 1994). These variations in climatic conditions have a direct bearing on the degradability of solid wastes, and systems designed for solid waste management should consider these factors. For example, high temperatures lead to increased microbiological activities and thus an increase in reactivity and degradability of wastes. The opposite is the case when the temperature is low.

Map 1.1: The Physical Features of Lesotho



**Map 1.2: The Agro-Ecological Zones of Lesotho**



Source: Ruvale 1003.

Source: State of the Environment Report, 1999

## 1.3 NATURAL RESOURCES ASSETS

### 1.3.1 Water Resources

Lesotho's greatest natural asset is its water resources, which are now being developed through the Lesotho Highlands Water Project (LHWP), at an estimated cost of US\$2.5 billion. It is administered by the Lesotho Highlands Development Authority (LHDA). Despite contributing to improvement of socio-economic status of the people through job creation, the developmental activities of LHDA generate solid wastes management (Maro, 1996).

### 1.3.2 Agriculture Resources

Agriculture, which has been the main economic activity for more than 80% of the rural population, has continued to suffer from long-term decline in production and productivity.<sup>2</sup> For example, domestic food production fell 45% short of national requirements in 1990 (GOL, 1994). Many factors have contributed to this situation. These include decline of cultivation land from 450,000 hectares in the 1960s to 300,000 hectares in 1990s (GOL, 1994), drought, soil erosion, and unsustainable land management practices.

### 1.3.3 Human Resource

In the absence of a complete registration system, Lesotho utilises censuses and surveys as major important sources of demographic data.<sup>3</sup> According to demographic projections, human population was estimated at 2 million in 1994, with a growth ratio 2.6% per year and a doubling time estimated at 27 years (UNDP, 1998). Of this population, 84% are in rural areas.

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<sup>2</sup> Agriculture used to be the single largest contributor to GDP, but its share declined from 47% in 1970 to 20% in 1988 (Europa, 1991. Africa South of the Sahara, Europa publications Ltd, London, UK).

<sup>3</sup> Census data are available from 1875, and Lesotho has conducted population censuses each decade since 1926. All these censuses have shown steady trend of growth, at an average of 2.63% per annum, giving a projection of almost 4 million people by 2025 (Lesotho Bureau of Statistics, 1998. Incomes, Expenditure, and Consumption of Basotho Households. Bureau of Statistics, Maseru, Lesotho).

On the other hand, 41% of the population are under the age of 15, while 7.4% are more than 60 years old. Thus, the dependency ratio in 1990 was estimated at 84% (GOL, 1994 -1998). Population density per unit of arable land rose from 443 per square kilometre in 1976, to 700 in 1992 (GOL, 1994). However, these statistics will markedly be altered because of HIV/AIDS impacts.<sup>4</sup>

## **1.4 SOCIO-ECONOMIC AND POVERTY STATUS IN LESOTHO**

### **1.4.1 Socio-Economic Development Measurement**

This study considers how solid waste management activities can contribute to poverty reduction and job creation, thus improving the socio-economic well-being of the communities. It is therefore important to examine how theories of measurement for socio-economic development have evolved. For most of the 1950s, and up to the mid-1980s when most developing countries were emerging from colonialism, the dominant schools of developmental thought measured socio-economic progress purely in economic terms, calibrated by changes in gross national product (GNP) or gross domestic product (GDP) and per capita income (UNDP, 1998). Economic growth and increase in per capita income were viewed as synonymous with development.

However, it was later observed in the 1990s that for many developing countries, economic growth and associated high per capita income have many times been accomplished without commensurate improvements in the lot of the masses for whom the development effort was designed. Economic growth could occur without the anticipated “trickle down” as hypothesised in theory. High levels of economic growth, concurrent with deepening poverty, unemployment and other evidences of deteriorating human conditions prompted to alternative schools of thought. The new schools of thought shifted the focus to poverty and the well-being of the people including the quality of life, fulfilment of basic needs and human capital formation. These concepts were still limited in design, though important considerations such as equity and poverty reduction were introduced. The concepts were further improved by formulating the physical quality of life index (PQLI) (Morris, 1979).

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<sup>4</sup> The Kingdom of Lesotho, 1996. Population Census Analytical Report, Vol. IIIA: Population dynamics, Bureau of Statistics.

PQLI is a composite of life expectancy at age one, infant mortality, and literacy rate. (PQLI has limitations due to the overlap between life expectants and infant mortality). However, the paradigm shift towards a people-centred approach championed by UNDP through the publication of first global Human Development Report (HDR) in 1990 accelerated the process of redefining socio-economic development of a society. Social-economic development is defined in terms of process that provides people with the capabilities for a healthy and happy life, including provision of choices and abilities to expand such capabilities: the freedom to exercise such choices and the ability to participate in decision making at all appropriate levels (UNDP, 1990 /1-7).

#### **1.4.2 Economic Structure and Poverty Situation in Lesotho**

The economy of Lesotho is largely influenced by the Republic of South Africa (RSA), and to a lesser extent, other SADC countries. Being a member of Southern African Customs Union (SACU), which consists of Botswana, Swaziland, RSA and Namibia, its economy is especially tied closely to the economies of these countries. The same countries, with the exception of Botswana, are also members of Common Monetary Area (CMA), further intertwining their economies. (Molapo, 1999). For example, commodities from RSA comprise 80% of Lesotho's imports (GOL, 1997).

Despite having links with South Africa, Lesotho is still ranked as one of the 50 poorest countries in the world (World Bank, 1999). To address this situation the Government of Lesotho has paid considerable attention to poverty, making poverty reduction through job creation its key policy objective. The central theme for poverty reduction is "the promotion of sustainable human development" as adopted by the 6<sup>th</sup> National Development Plan of 1996/97-1998/99. This approach has three components:

- Enabling people to lead long and healthy lives;
- Enabling people to acquire knowledge; and
- Enabling people to have access to resources needed to accommodate acceptable levels of human need (GOL, 1997, IPRSP, 2000).

In addition to National Development Plans, more policy documents on poverty reduction have been produced (GOL, 1996; IPRSP, 2000; UNDP, 2001; GOL, 2001). In all these policy documents, unemployment is ranked as one of the most important causes of poverty in Lesotho.

Government's commitment to tackle poverty has created an enabling environment for poverty in Lesotho to be extensively documented (Sechaba Consultants, 1991, 1993, 2000; World Bank, 1995, UNDP, 1999; GOL, 2001). It is recorded in the same literature that although poverty is predominantly rural, there has also recently been an increase in incidences of serious poverty in urban settlements in the country.

A notable factor that has contributed to the retardation of Government's efforts towards addressing poverty is the lack of proper definition of what "poverty" is. Despite the attention paid to poverty reduction in Lesotho, the definition of poverty remains a subject of debate. Generally, the practised definition is "the ability to attain a minimum standard of living, taking into context the lack of resources with which to attain the type of diet or life-style that is socially acceptable". The absence of a single definition of poverty means that there is no official "absolute poverty line" in Lesotho. In line with general definition, poverty is sub-categorised as:

- (a) **Relatively poor:** a household whose members consume less than half of the mean consumption level. These households need to spend 51% of the total household budget on a basic daily diet of 2,500 calories per person.
- (b) **Very poor:** households that spend less than 25% of the mean consumption level. These households spend the entire household budget on a daily diet of about 2,500 calories per person. The some documents have reported that 50% of all Basotho households are relatively poor; while 25% of all the households are characterised very poor. It is further reiterated that in Lesotho, poverty is currently more pervasive, at a level of about 68 % of the total population; while unemployment is also soaring at a level of 40.5% (GOL, 2001).

As indicated in the previous paragraphs, causes of poverty are listed as: unemployment; environmental disasters (drought, loss of soil fertility); ill health; and lack of adequate agricultural land and inputs. A clear linkage exists between poverty and environmental issues. To illustrate this point further, studies in Lesotho credited improved waste disposal with a 36% reduction in diarrhoea disease in Lesotho (GOL, 2001). This emphasises the point that

improved environmental conditions, especially where infectious diseases account for most illnesses and deaths, could have a bigger impact on health, than improvements in health care services would do (GOL, 2001). To this effect, environmental problems pressing Lesotho are outlined in the following paragraphs.

## 1.5 MAJOR ENVIRONMENTAL PROBLEMS

Environmental issues are linked with poverty. Like many other developing countries Lesotho faces environmental problems in three broad categories: “Green”, “Brown” and “Red”<sup>5</sup>. All three categories have associated linkages with solid waste management problems as illustrated in Diagram 1.1

### 1.5.1 Green Issues (Natural Resources Management)

In Lesotho, major green issues include the following:

- **Soil erosion.** Resulting from poor land use practices, soil erosion is estimated at an annual loss from cropland of 20.4 tonnes/ha, amounting to 15.4 million tonnes/year. The loss from rangelands is put at 18.4 tonnes/ha, amounting to 23.4 million tonnes/year. Soil loss for the whole country is thus in the order of 40 million tonnes/year (GOL, 1989; Damane, 1996). It is very important to note that the indicated soil loss is not proportional to hectarage, but rather to the source. More loss comes from cropland due to heavy gully erosion. The gullies “dongas” become deep and are in turn used as illegal waste dumpsites.

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<sup>5</sup>“Green” issues are associated with environmental degradation such as natural resources depletions; while “Brown” are related to pollution of the environment “Red” deals with the social aspects such as human displacement or poverty (Green Essentials, what You Need to Know about the Environment, Geoffrey Saign, 1994, San Francisco, California).



- **Deforestation/Desertification.** High dependence on trees and wood as the traditional source of fuel for domestic energy supply causes this environmental problem. It is seen however, that in rural and peri-urban areas, people use cow dung as a source of biomass energy while in cities, they use combustible solid wastes as sources of biomass energy. The use of solid waste for energy has an indirect positive impact on solid waste management.
- **Drought/Water Scarcity.** Lack of resources has added to the socio-economic problems of poor rural and some urban households, and with devastating consequences. Women walk long distances to fetch water, wasting much of their valuable productive time.
- **Decline of Food Production.** The issues mentioned in previous paragraphs affect the production of food, especially maize. For example, average production dropped from 1,400 kg/ha in 1976/77 to only 600 kg/ha in 1985/86 (Mvuma, 1997). Low food production has been compounded by unsustainable agricultural practices, resulting in excessive erosion.
- **Loss of Biodiversity.** Most medicinal plants, strong wood and historical paintings have disappeared because of unsustainable utilisation of these resources, yet these have been a source of wealth for many centuries.

### 1.5.2 Brown or Pollution Issues

These include pollution of water, land and air due to several factors:

- **Solid Waste Management.** It has been recorded that urban solid waste management is one of the most intractable environmental problems confronting local authorities, and is listed as one of most pressing environmental problems that Lesotho faces (GOL Pre-UNCED Paper 1991; Tevera, 1996).
- **Industrial and Domestic Effluent Discharge.** Excessive discharge of wastes untreated domestic and industrial wastes from urban and industrial areas, poses a risk to human health in Lesotho.
- **General Water Quality.** The quality of water is high in the highlands (TAMS, 1996; Maro, 1996; CSIR, 1997), whereas in the lowlands, pollution emanates from a number of sources such as industries and settlements. Improve access to safe water and

sanitation is one of the Government's priorities.

- **Pesticides and Agricultural Chemicals.** These agricultural aids pose a danger to human health. Efforts to address these problems in Lesotho are in progress, through the activities of Convention on Persistent Organic Pollutants (POPs) and a newly formed Committee on Chemicals.

### 1.5.3 Red Issues: or Human Social Issues

This category of environmental issues encompasses many problematic areas. Major issues in Lesotho are:

- **Increasing Rural and Urban Poverty.** As indicated in section 1.4.2 of this Chapter, poverty is widespread, with 55%-68% of its inhabitants living below the poverty line of a monthly expenditure less than R80 (UNDP, 1999; GOL, 2001;). This is exacerbated by a relatively high population of 2 million, with a growth rate of between 2.6 % to 2.8% per annum. Yet the labour force market does not expand. For example, by 1993, the unemployment rate was put at 36%; this figure grew to 40.5% levels by 2001 (GOL, 2001).
- **Gender Concerns.** In 1970, the proportion of the population without cropland was 11.4%; by 1987, the figure had risen to 38.5% and is now fast approaching 50%. The greater percentage of these people without cropland are women and children because the law does not give them excess to land (UNDP Human Resource Development Report 1998). This legal restriction reduces productivity and aggravates the poverty problem.
- **Socio-economic Disruption.** The reduction in the number of migrant workers into South Africa worsened the unemployment situation in Lesotho. For example in 1989 there were more than 125,000 Lesotho migrant workers at South Africa gold mines, but this figure dropped to only 69,000 in 1999, indicating a significant reduction (GOL, 2001). Furthermore, the post independence political climate up to the military era caused socio-economic disruptions and institutional conflicts (UNDP, 1998). During this period, skilled labour fled the country and employment opportunities dwindled. Political will towards citizen welfare was low, as leadership, energies were focused on consolidating their power.

The proceeding paragraphs have thrown light on the interrelationship between poverty and environmental issues. These linkages are further illustrated in this Chapter by Table 1.1 (illustrating GDP in relation to the trend in performance of sectors where jobs are created); Table 1.2 (showing the major sources of income); Table 1.3 (indicates the employment status by region and gender); Table 1.4 (showing trends of employment and unemployment in Lesotho); and Diagram 1.1. This data clearly indicates the extent of the poverty problems in Lesotho. Broad-based investment in human capital would be one of most important inputs to create employment, reduce poverty and stimulate growth. Promotion of greater livelihood diversification, including incorporating environmental concerns such as solid waste management activities in employment creation will boost poverty eradication. Table 1.1 illustrates linkages between environment and economic issues specifically poverty.

	1992	1993	1994	1995	1996
<b>Primary Sectors</b>	<b>11.5</b>	<b>13.4</b>	<b>13.0</b>	<b>10.0</b>	<b>13.0</b>
Agriculture	10.7	12.9	19.9	9.5	12.9
Mining and Quarrying	0.8	0.4	0.1	0.5	0.1
<b>Secondary Sector</b>	<b>39.5</b>	<b>37.8</b>	<b>41.4</b>	<b>44.3</b>	<b>44.1</b>
Manufacturing	14.1	14.6	13.8	15.2	15.3
Electricity and Water	2.0	2.2	1.8	1.7	1.7
Building and Construction	23.4	21.1	25.8	27.4	27.2
<b>Tertiary Sector</b>	<b>49.0</b>	<b>48.8</b>	<b>45.6</b>	<b>15.7</b>	<b>42.8</b>
Wholesale and Retail Trade	8.7	8.9	8.8	9.3	9.5
Catering	1.3	1.0	1.2	1.4	1.6
Transport and Communication	4.2	4.7	4.4	4.7	4.6
Finance and Insurance	9.5	8.3	8.3	6.9	5.8
Real Estate and Bus. Service	3.0	2.9	2.6	2.4	2.2
Ownership of Dwellings	5.6	5.5	4.9	4.6	4.2
Public Administration	11.7	11.1	10.0	9.5	8.4
Education	9.9	9.9	9.0	9.1	8.4
Health	2.3	2.5	2.5	2.8	3.1
Other Services	1.5	1.5	1.4	1.3	1.3
<b>GDP at factor cost</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Source: Central Bank of Lesotho Annual Report 1996.

As seen in Table 1.1, agriculture accounts for only a small fraction of economic activity, an average of 12.2% in the last 5 years. Despite this low figure, it remains for now, the major role player in terms of livelihood. For example, Table 1.2 shows that agriculture contributes a major part of the incomes of households in Lesotho.

**Table 1.2. Main Source of Income by region (Households) and Gender (in percent)**

	Total Households	Northern Lowlands	Southern Lowlands	Foothills	Senqu River Valley	Mountains	Male	Female
Agriculture	28.3	22.1	25.1	27.7	32.6	40.0	29.8	28.0
Remittance from relatives	13.4	11.4	16.9	12.5	20.0	12.0	10.7	15.2
Employment in private sector	22.5	25.4	20.3	24.4	20.9	17.4	25.7	21.0
Employment in government	10.0	16.9	9.0	8.2	3.9	4.6	11.3	9.5
Other	23.3	19.8	28.5	26.4	20.4	22.4	21.3	24.9

Source: Human Development Profile Survey, UNDP, 1997.

These factors are enough reason for the government of Lesotho to consider diversifying its economy or finding means of job creation. Agriculture alone cannot reliably sustain jobs. Despite donor support, agricultural production and productivity has been falling (UNDP, 1998). Drought, cultural practices and policy failures have combined to limit land rehabilitation as well as inadvertently promote unsafe exploitation of marginal lands. However, the major reasons for the failure of agriculture to contribute to economic growth, has been the non-existence of competitive land markets. Above all, land continues to be held in trust by the chiefs.

The manufacturing sector consists largely of textile and is complemented by brewing and food processing industries, with the former contributing between 14% -15% of GDP in the five year period 1992-1996 (UNDP, 1998). The other important sector is the Distributive Trades consisting of large wholesale and retail enterprises in Lesotho, managed by South African firms and the state-owned Lesotho National Development Corporation (LNDC), whose contribution to GDP stood at 9.5% in 1996 (UNDP, 1998).

The tourism sector has good potential for growth. Though the sector contributed to no more than 1.5% of GDP over five year period (1992-1996), its potential stands high following development of the Katse Dam. Currently, the two main industrial areas in Lesotho are situated in Leribe (Maputsoe) and Maseru, both of which fall within the Northern Lowlands. More employment opportunities generating activities are possible through creation of tour guides, tour operator training, resort accommodation, etc. Integrated solid waste management in Lesotho would enhance the growth of Tourism sector.

**Table 1.3 Employment Status by Region and Gender (in percent)**

	Total	Northern	Southern		Senqu		Male	Female
	Households	Lowlands	Lowlands	Foothills	River Valley	Mountains		
Self Employed	8.8	12.5	9.5	8.0	7.4	4.1	9.3	9.3
Employee	25.9	35.2	22.4	26.6	15.2	17.7	39.8	19.7
Seeking Work	16.0	13.9	23.0	16.1	15.7	14.1	19.6	15.0
Unpaid Family Worker	43.6	32.8	45.1	43.3	56.6	65.9	30.8	54.6

Source: Human Development Profile Survey, UNDP, 1997.

The base of growth in Lesotho has been the formal sector, which account for 10%-12 % of employment. The estimated potential workforce of Lesotho is about 800,000 of which 225,000 are estimated to have formal employment. New labour market entrants are estimated to be 25,000 per year (UNDP, 1998). The Sixth Development Plan of 1997 indicates that, the domestic formal sector can only absorb limited number of 9,000 new entrants per year into labour market. The increase in employment still falls short of the rate needed to absorb a net increase in the labour force at about 25,000 per year. Hence the need for diversification of the employment opportunities.

The public sector happens to be the largest employer. It provided 33,000 jobs in 1996, while industry provided some 17,000 jobs (UNDP, 1998). Other formal sector jobs are in the other tertiary sectors, though it remains difficult to assess employment changes in these sectors. These facts, supported by evidence in Table 1.4 show trends in employment and underemployment in Lesotho. In this way job, creation efforts in the informal sector should be encouraged, and the solid waste management activities could contribute to the process of job creation.

**Table 1.4 Trends in Employment and Unemployment in Lesotho: 1976/1986/1996**

Labour Force Category	Year 1976		Year 1986		Year 1996	
	Number	% of employable category	Number	% of employable category	Number	% of employable category
<b>Employed Persons</b>						
<b>Males</b>	273,691	95.4	342,163	93.0	297,842	78.1
<b>Females</b>	125,800	92.0	126,510	92.9	140,800	73.4
<b>Total</b>	399,491	94.3	468,673	93.0	438,642	76.5
<b>Unemployed</b>						
<b>Males</b>	13,270	4.6	25,810	7.0	83,456	21.9
<b>Females</b>	10,913	8.0	9,368	7.1	50,966	26.6
<b>Total</b>	24,183	5.7	35,448	7.0	134,422	23.5

Source: Bureau of Statistics: Population Census Analytical Report, Maseru 1999.

As indicated, Lesotho has already put the issue of poverty reduction and job creation as a priority in its National Development Plans. In addition, Lesotho has documented that 68% of the total population fall into poverty definition (Sechaba, 1999; UNDP, 2000; GOL, 2001). More over 70% of poor people are defined as “destitute”, with a monthly income/expenditure of less than M40.

More details on solid waste management in the national context and problem statement are given in Chapter 2.

## **CHAPTER 2: SOLID WASTE MANAGEMENT IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT: LITERATURE REVIEW**

### **2.0 INTRODUCTION**

This study intends to provide much needed data and information concerning solid waste management in Lesotho. This information may also be useful for many countries in the SADC Region. The availability of such information and data will serve the purpose of facilitating of policy and guidelines on this subject, and development of appropriate integrated solid waste management systems in the country. Such integrated systems incorporate all issues on the environment, health and the socio-economic status of the people and ultimately lead to employment generation. The focus of the study is municipal solid waste, excluding medical and bulk waste. <sup>1</sup> Municipal solid waste comprises small and moderately sized solid waste items from houses, businesses, industries and institutions (Liu & Liptak, 2000). (A full definition is given in Section 2.1.1).

Other institutions in some countries have undertaken similar tasks. It is therefore right and proper to review such literature in order to gain in-depth knowledge on the subject. In this chapter, the review of literature includes examining how the theory of environmental issues, specifically in the context of solid waste management, has evolved. In turn, the relationship of evolution of environmental issues to the birth of the concept of sustainable development is examined.

### **2.1 EVOLUTION OF WASTE MANAGEMENT THEORY AND SUSTAINABLE DEVELOPMENT CONCEPT**

The issues of waste management form part of the core components of sustainable development concept. The focus of this study on solid waste management remains aligned with the concept of sustainable development. Before discussing solid waste in detail, a definition of “solid waste” is required. In this case, its full definition is given in the following paragraphs.

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<sup>1</sup> Bulk waste consists of items of solid waste, such as mattresses, furniture and appliances, as well as smaller items generated in large quantities in a short time, such as roofing shingles, demolition bricks/concrete/lumber/plumbing etc, frequently referred to as construction and demolition (C&D) waste. Heeramun, K. (1993). Solid Waste Management in Mauritius -An alternative to Sanitary Landfill, Mauritius.

### 2.1.1 What is Solid Waste? <sup>2</sup>

Snel defines solid waste (or refuse) as any material, apart from gaseous and liquid waste, which the holder discards, intends to discard or is required to be discarded (Snel, 1997). In addition, Liu & Liptak (2000) define solid waste as all waste materials, excluding hazardous waste, liquid waste and atmospheric emissions. According to Witzsch (1990), "solid waste" was not defined in Lesotho's legal system. However, various pieces of legislation do make reference to what constitutes waste, viz "filth", "night soil", rubbish", "refuse" (Sanitary & refuse Regulations 1972). Furthermore, it is stated that "waste is any substance that may be prescribed as a waste or any matter, whether liquid, solid, or radioactive, which is discharged, emitted or disposed of in the environment in such a volume, composition or manner as to cause an alteration to the environment" (WHO, 1990, GOL, 2001).

Taking these definitions into account, then solid wastes should generally include street sweeping (including dead animals); pumped sludge from septic tanks and cesspits (but not waste water treatment plant sludge); refuse collected from residential establishments, commercial enterprises, and institutions; pharmaceutical and surgical wastes from medical clinics and hospitals; and refuse and processing wastes from industrial manufacturing facilities. Whilst this broad definition of solid waste is adopted for the purposes of this study, it is important to mention that waste can be used as a resource through recycling and reuse processes. The composition of solid waste varies from country to country, city to city and from culture to culture. Solid waste can contain putrescible organic matter (e.g. kitchen and market wastes and faecal matter); combustible organic matter (e.g., paper, textile and bone); plastics, metal, glass, oil and grease, and inserts (e.g. soil and ash).

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<sup>2</sup> Note, in this thesis, the term "municipal solid waste" refers primarily to residential solid waste, with some contribution from commercial, institutional and industrial sources. Hazardous wastes are generally managed outside the municipal solid waste stream. Exceptions are the household hazardous wastes and those hazardous wastes generated in very small quantities, which are often placed in the municipal solid waste stream by the generator. This thesis does not attempt to grapple with the pharmaceutical/medical waste.



Solid waste can contain pathogenic microorganisms (e.g. bacteria and parasites) and toxic chemicals (e.g pesticides, heavy metals, volatile organics and solvents) (World Bank, 1991). Table 2.1 shows composition of waste by category for a typical developing country, in this case Lesotho. These figures represent expected maximum percentages of each type of waste in a given area (urban, peri-urban and rural); not exact proportions, hence are not expected to add to 100%.

**Table 2.1 Distribution of household waste in a Typical Developing Country (%)**

Main Waste Item	Urban	Peri-Urban	Rural
Paper	52	51	31
Plastics	24	30	21
Organics/Food Waste	15	2	21
Beverage cans	4	4	10
Glass/bottles	2	-	3
Other	2	14	14
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>

Source: Modified from Mhlanga & Gulilat 1997

### 2.1.2 Evolution of Waste Management Theory

In the past, nature was considered as a perennial spring of survival, renewal which could easily neutralise human impacts (Polizou, 1992). From the days of primitive society, humans and animals have used the resources of the earth to support life and to dispose of wastes. In early times, the disposal of human and other wastes did not pose a significant problem, because the population was small and not concentrated. Furthermore, the amount of land available for the assimilation of wastes was large (Tchobanoglous et al.1977).

Problems regarding the disposal of wastes can be traced from the time when humans first began to congregate in tribes, villages and communities. The accumulation of waste became a consequence of communal life (UNEP/UNESCO/UNDP, 1995). Littering of food and other solid wastes in medieval towns led to the breeding of rats and the outbreak of the plaque epidemic which killed half of the Europeans population in the 14<sup>th</sup> century. The absence of waste disposal preachers caused many subsequent epidemics and high death tolls (Tchobanoglous et al. 1977). Public health was therefore the motivation for removing solid wastes from the human habitat. This approach changed radically during the past thirty years, when environmental pollution and its adverse

effects on mankind became even more apparent (Polizuo, 1992).

Furthermore, as society developed, pollution became one of the major environmental problems. For example, the population increase and migration into cities have created serious environmental problems, including inadequate solid waste management and lack of minimal pollution control (Cotton et al.1999). Improper storage, collection or disposal of solid waste have an impact on public health as well as on ecosystems through the pollution of land, water and air. Meanwhile, one of the branches of the environmental science, “solid waste management” grew out of a need to address these problems. Undeniably, countries: industrialised and developing alike have to deal with similar waste disposal problems. Globally, there is growing importance attached to these issues. Given the importance attached to this issue throughout the world, it is the task of each society to ensure that waste disposal is carried out in such a way that it cannot damage the environment (Suess, 1985).

### 2.1.3 Solid Waste Management Systems/ Concept

In this Chapter, the term “solid waste management system” includes organized programmes and established central facilities for final disposal of waste, and for recycling, reuse, composting and incineration (Liu & Liptak, 2000). In this literature review, it is essential to describe the general concept of solid waste chain and in line with the defined solid waste. Waste management in the world has changed dramatically during the last 20 years. The impetus for this change was catalyzed by a number of unfortunate environmental disasters such as Love Creek Canal in Niagara Falls county in the USA, the Redhill - Surrey cyanide in the UK, and the dioxin fall-out contamination around Serveso in Italy (Lombard, 1993). Debate shifted to issues of waste utilization in the 1970s (Melosi, 1980).

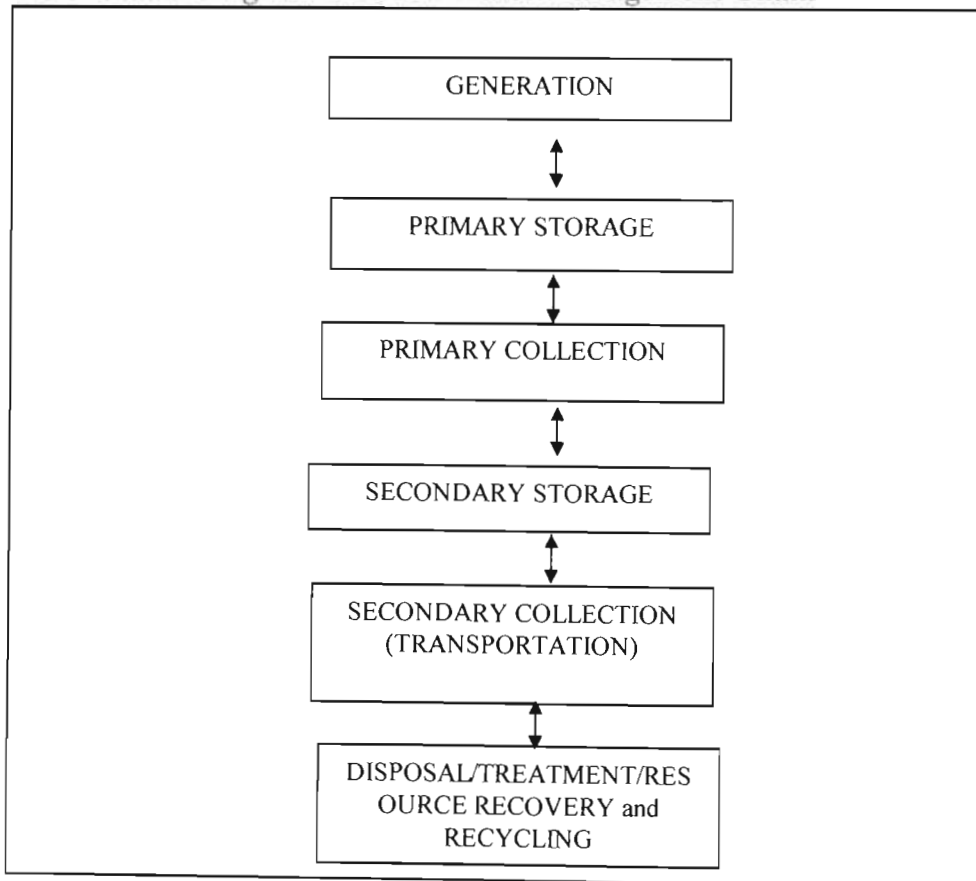
The concept of solid waste management encompasses materials flow streams of waste from generation to ultimate disposal.<sup>3</sup> It comprises generation, storage, collection, transfer or

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<sup>3</sup> Waste generation encompasses those activities in which materials are identified as no longer being of value and are either thrown away or gathered together for disposal. (Pfeiffer, J. T. (1992). Solid Waste management engineering).

transportation, and disposal. Accordingly, solid waste management involves the full range of activities for these streams: from generation of used materials to disposal (Beede & Bloom, 1995; Lardinois, 1996). On the other hand, resource recovery includes all activities of waste segregation, collection and processing, which are carried out taking into account economic viability of materials (Cointreau et al. 1984; Baud & Schenk, 1994; Beede & Bloom, 1995). Diagram 2.1 illustrates the various stages of solid waste management chain .<sup>4</sup>

**Flow Chart: Diagram 2.1 Solid Waste Management Chain**



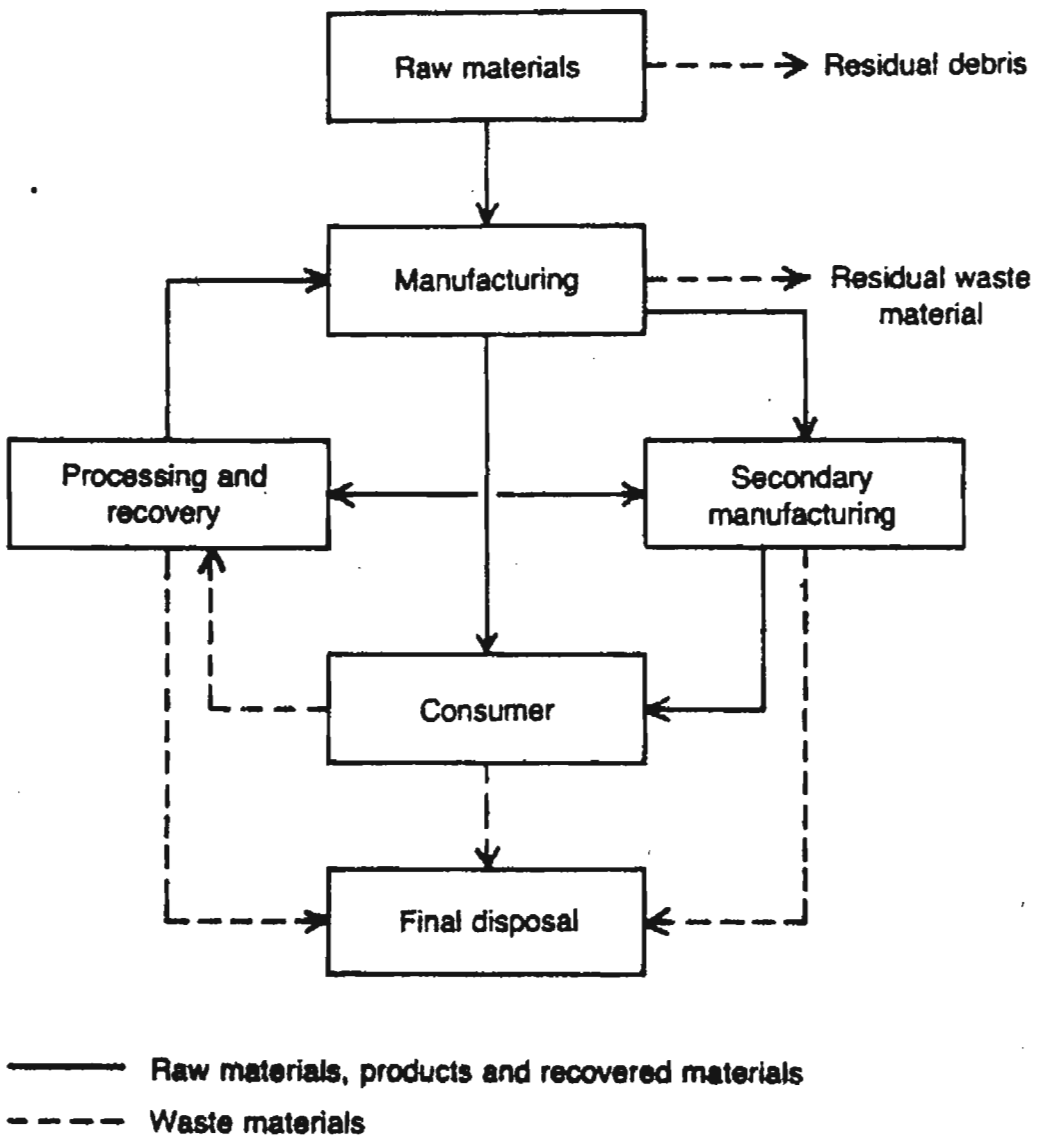
Source: Modified from Cointreau, 1987

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<sup>4</sup> In most cases, it includes all the wastes arising from human and animal activities that are normally solid and are discarded as useless or unwanted. It encompasses the heterogeneous mass of throwaways from residences and commercial activities as well as homogenous accumulations of a single industrial activity (Peavy et al. (1988). Environmental Engineering).

The picture of waste generation has changed dramatically in developed countries. In a typical scenario the amount of solid materials, consumption is reduced and the rate of recovery and re-use of waste materials are increased as illustrated in Diagram 2.2.

**Diagram 2.2 Solid Waste Management System in Industrialised Countries**



Source: UNEP/UNESCO/UNDP, 1995

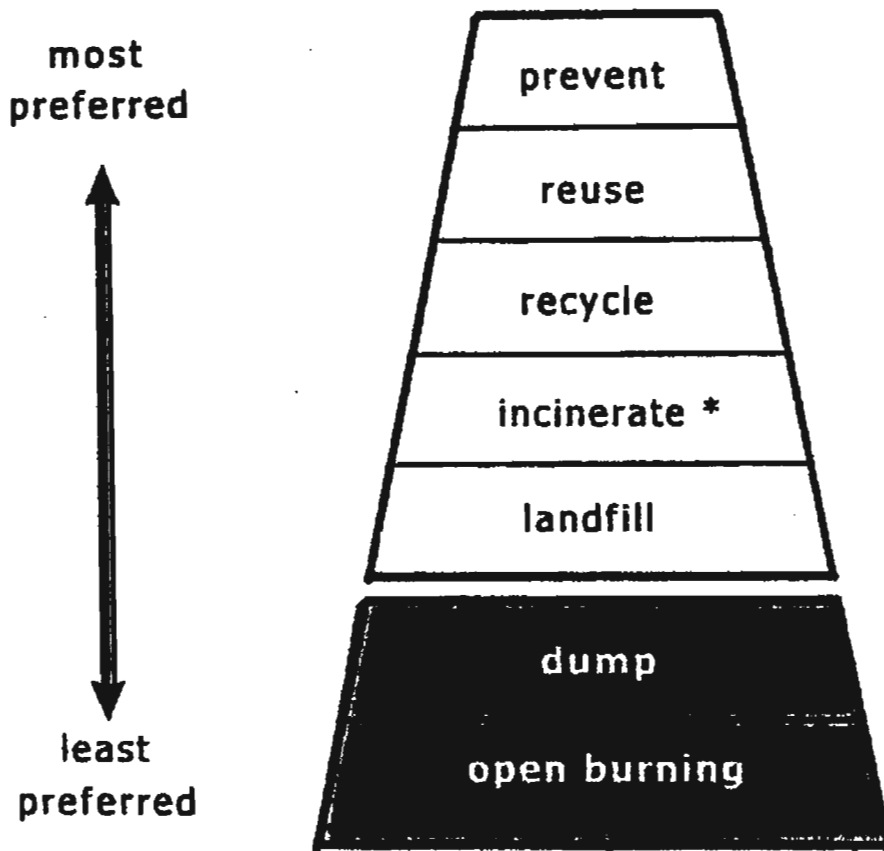
The solid waste management concept has slowly shaped an improved integrated solid waste management system, as indicated in Diagram 2.3.

#### 2.1.4 Integrated Solid Waste Management (ISWM) Concept

Integrated solid waste management has evolved over time. Several examples linked to this concept can be cited. In the 1660s, burial in cotton or linen was banned in Europe to allow more cloth for paper-making (World Resource Foundation, 1997). Similarly, the first combined incineration and electric scheme began operating in East London, UK in the early 18<sup>th</sup> century. In 1894, New York City introduced a “program of source separation of waste” after a long time of dumping waste into the Atlantic Ocean. This practice of separation at source allowed recovery of valuable materials from waste (Gandhy, 1994). The concept of ISWM did not occur only in the Western world, but in Africa as well. In the early 1900s, Zabbaleen in Egyptian was one of the first communities to integrate recovery and recycling of municipal waste (Baaijens, 1994).

The philosophy of a “Waste Management Hierarchy” (prevention/minimisation, materials recovery, incineration and landfill/disposal) has been adopted by most industrialized nations as a means for developing municipal solid waste management strategies (Sakai et al. 1996). Following the environmental movement of the late 1960s, which formally presented integrated solid waste management as a guiding principle for managing societies’ refuse, municipalities began applying the concept. This trend coincided with a period of prosperity in the industrialized world. Ironically, the ISWM concept was further enhanced by the recession period of the early 1980s, when municipalities in developed world had no choice but to adopt the new paradigm shift to integrated solid waste management, subsequently the concept was widely implemented. This philosophy of waste management hierarchy has further been enhanced by Beukering et al. (1996). In his paper, he illustrates integrated nature of the system as a key element in the integrated solid waste management systems of all the industrialized countries (see Diagram 2.3). It is based on the principle, which proposes that waste should be handled by different methods according to its characteristics. For example, prevention of waste could be done by either reducing or re-using the waste. Diagram 2.3 illustrates the general philosophy of a waste management hierarchy.

**Diagram 2.3 Waste Management Hierarchy**



**\* with energy recovery**

Source: CREED<sup>5</sup> Working Paper No. 24, Beukering et al. 1999.

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<sup>5</sup>An initiative between the International Institute for Environment and Development (London) and the Institute for Environmental Studies (Amsterdam).

According to Beukering et al. (1999), the concept of integrated solid waste management is a broad one. It essentially implies that management of the waste should take into account all aspects of concerns, including the following:

- Economic (costs and benefits).
- Environmental issues (global such as ozone depletion; regional such as acid rain, resource depletion, and local problems (such as pollution of ground water etc).
- Social issues such as employment effects of both formal and informal sectors and on human health and ethical issues like child labour.
- Institutional systems that effectively involve main stakeholders.

The integrated nature lies in trade-offs among these four dimensions. For example, in the developed countries, cost of labour and infrastructure for recycling polyethylene outweighs the environmental concerns. This may not be the case in developing countries where labour is cheap. However, financial resources may be a constraining factor. Alternatively defined, “Integrated Waste Management” refers to the complementary use of a variety of waste management practices to safely and effectively handle municipal solid waste streams with the least impact on human health and the environment.<sup>6</sup>

Re-use and recycling provide an appropriate opportunity to capture some of the values from the waste (Cointreau et al. 1984; Beede & Bloom, 1995). Of the two, re-use is a simpler process involving re-utilization of materials in its end-use form, without the processing and value addition necessity (Beukering, 1994). Recycling, on the other hand, involves processing waste through remanufacture and conversion of parts in order to recover the original raw material (Cointreau et al. 1984; Beukering, 1994). Options may differ per country due to factors such as topography, population density, transportation infrastructures, socio-economics and environmental regulations.

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<sup>6</sup> The Solid Waste Dilemma: An Agenda for Action, Final Report of the Solid Waste Task Force, Office of Solid Waste, U.S. Environmental Protection Agency, February 1989.

It would be futile to do a literature review and discuss solid waste management issues without closely linking them with the issues of sustainable development. The importance of sustainable development concept, which has direct bearing on the issues of solid waste management, cannot be overemphasized. Inclusion of a Chapter on Waste Management in Agenda 21 confirms this importance. Hence, it is necessary to examine this concept first, before examining solid waste management issues in depth.

### 2.1.5 Sustainable Development Concept

On one occasion, the former President of the Republic of South Africa, Nelson Mandela said, “*Without knowing where we are from, we would not have the direction to where we are going*”. We have to know the history of the subject matter. In this case, a general knowledge of sustainable development should be given to appreciate the evolution of “sustainable development” concept.

Historically, global concern about environmental deterioration was raised in 1972 at the United Nations Conference on Environment and Development in Stockholm. In 1987, the World Commission on Environment and Development (Brundtland Commission)<sup>7</sup> alerted the world community that urgent steps needed to be taken for concerted action towards a new global framework for development. This was known as “*sustainable development*”: intended to achieve political social and economic development worldwide and to protect the atmosphere, prevent climate change and safeguard natural resources. During the early 1980s, following the review of the State of the Environment and ten years after Stockholm conference, it was universally agreed that both developed and developing countries have a shared responsibility for the protection of the environment and in the concerted action to promote sustainable development. These concerns were addressed by the United Nations Conference on Environment and Development (UNCED), which was held in June 1992 in Rio de Janeiro, Brazil. It was here that the Agenda 21 was conceived. This Conference was the first assembly of world leaders, international organisations, Non Governmental Organisations (NGOs),

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<sup>7</sup> The Brundtland Commission itself concluded that in developing countries, “regulations imposing uniform performance standards” are essential to ensure that industries make the investments necessary to reduce pollution. (World Commission on Environment & Development, “Our Common Future 2020”).



the scientific and technological community, and other major groups who had the opportunity to articulate a vision for the future of the planet. Both developed and developing countries recognized poverty as a major factor in the loss of environmental resources and in land degradation. Equally, economic growth was envisioned as a key factor in fostering job creation and directly benefiting the poor.

It was also recognised that the state of the physical and natural environment is influenced by the pattern of developmental activities of both developed and developing countries. In this regard, all governments committed themselves in 1992 to pursue national and international sustainable development objectives that would protect the atmosphere, prevent climatic change, safeguard natural resources such as land, soil and water, and channel development assistance towards poverty reduction, improvement of economic growth and environment.

As already indicated, in the late 1980s, the concept “sustainable development” was introduced into the environmental debate as an expression of the interdependence between economic development, the natural environment and people. The most widely accepted definition of sustainable development is presented in the report, “*Our Common Future*” (WCED, 1987), where it is described as “*development that meets the needs of current generations without compromising the ability of future generations to meet their needs and aspirations*”. This means improving the quality of life of humans whilst living within the carrying capacity of supporting ecosystems. Unfortunately, to date a lack of common understanding of the term “sustainable development” and its relevance to society exists. Clearly, this could create problems when it is central to the goal and purpose of an organization or a nation or a region.

The developmental goals for sustainable development in the southern African region are underpinned by the sustainable development concept. These goals are to:

- Accelerate economic growth with greater equity and self-reliance.
- Improve the health, income and living conditions of the poor majority.
- Ensure equitable and sustainable use of the environment and natural resources for the benefit of present and future generations.

Diagrams 2.4 and 2.5 provide a pictorial representation of the spheres of sustainable development. Diagram 2.4 shows a model based on the acceptance that the social, economic and natural systems operate independently. This model is frequently used to show the links between the economy, the environment and society, as articulated in the SADC goals above. This model can be useful in showing what and where the interrelationships exist, for example within the biophysical and socio-economic domain.

A better picture of sustainability is given in the Interdependence model (Diagram 2.5). As the model illustrates, the economy exists entirely within society, because all parts of the human economy require interaction among people. However, society is much more than just the economy and is not based entirely on exchanging goods and services. Society, in turn, exists entirely within the environment. Finally, the environment surrounds society. Although human activity is re-shaping the environment at an ever-increasing rate, society can never be larger than the environment.

The ultimate objective of sustainable development is complete integration of social, economic and biophysical systems, as illustrated in Diagram 2.5.

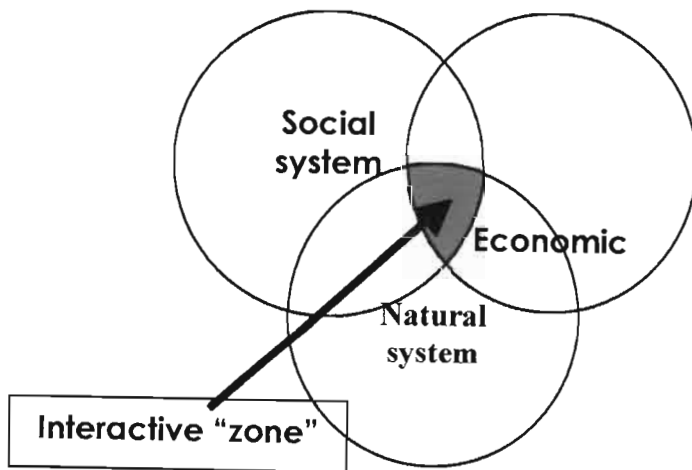


Diagram 2.4 The spheres of sustainability

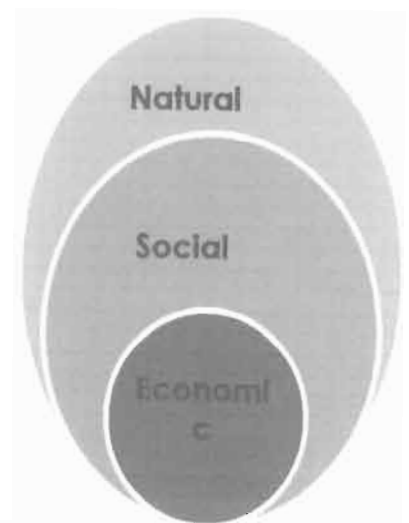


Diagram 2.5 The Interdependence Model of Sustainability

### 2.1.6 Lesotho and Sustainable Development

It is in the context of the issues discussed in Section 2.1.5 that the Government of Lesotho took part in the UNCED conference in 1992, and endorsed the global Agenda 21 on Environment and Sustainable Development. Lesotho's response to Agenda 21 was discussed at a national workshop held in May 1994. The subsequent recommendations were formally incorporated into the National Action Plan to implement Agenda 21 (GOL, 1994). Agenda 21 contains many recommendations for integrating environment and development in all major sectors. It proposes a broad range and mix of regulatory measures and economic initiatives to ensure that national development becomes ecologically and socio-economically sustainable. Agenda 21 encourages the development of international laws in the form of treaties or conventions that would ensure compliance of parties with the provisions of sustainable development as enshrined in relevant conventions or treaty. In addition, Lesotho has ratified the "Basel Convention on the control of trans-boundary movements of hazardous waste and their disposal"<sup>8</sup>. Lesotho is currently engaged in negotiations pertaining to persistent organic pollutants (POPs). This convention is important as it addresses issues of solid waste as well.

The "Bamako convention on ban of the import into Africa and the control of trans-boundary movement and management of hazardous wastes within Africa" has been signed by the Lesotho Government in 1991(GOL, 1997). As a signatory to Agenda 21, Lesotho had assumed the responsibility to ratify and implement International Conventions on Biodiversity, Climate Change, Drought and Desertification, and the Montreal Protocol. It must develop national economic policies and strategies, which would directly benefit the poor and avoid damaging the natural environment, thus helping to meet the needs of the present and future generations, (Phororo, 1998). Of the 40 chapters of Agenda 21 this study focuses on those that deal with issues specifically related to addressing waste management i.e. Chapter 21 "Managing Solid Waste and Sewage" Chapter 20: "Managing Hazardous Waste", Chapter 3: "Combating Poverty" and Chapter 6: "Protecting and Promoting Human Health" (Keating, 1994).

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<sup>8</sup> Principal Environmental. Officer. Per. Comm., (2001). National Environment Secretariat, Maseru, Lesotho.

A general understanding of how the sustainable development concept links with environmental issues of solid waste management issues as part of environmental issues prepares for more detailed information concerning the solid waste management issues in the context of global, regional (Africa) and national (Lesotho) perspective.

**2.2 THE GLOBAL CONTEXT OF THE SOLID WASTE MANAGEMENT CONCEPT**

Global projections of human population growth have been made in many literatures. The projected estimates in Table 2.2 indicate the world trends in population growth.<sup>9</sup> This is to signify the importance of the need for minimizing the use of raw materials to produce new products.

**Table 2.2 World Population Growth Trends**

Year	Population
1930	2.0 billion
1990	5.3 billion
2000	6.3 billion

Source: Lombard, 1993

There is an imbalance between the rate of population growth of human beings and the rate of social and economic development of many developing countries, which leads to a depletion of natural resources. More people are being born, yet the land does not expand. This human population growth rate in developing countries has resulted in more unemployed, hungry, homeless and uneducated people, and inevitably a higher rate of environmental degradation. Morally, it is inhumane and unacceptable to let young and old people die or suffer when their lives can be prolonged and made enjoyable. Measures such as family planning and provision of health services and employment can alleviate problems of this nature to some extent. Indeed, there are more than 6.0 billion people in the world today, increasing by 100 million annually or about 270,000 per day.<sup>10</sup>

<sup>9</sup> “The Challenges of Holistic Waste Management in South Africa, Green Management for the 90’s”, Lombard R, September 1993.

<sup>10</sup> As population continue to increase, society produces more and more waste. Yet, it is becoming increasingly difficult to build new landfills. Finding solutions is not simple; the problem is enormous in size (Tammemagi and Hans (1999). *The Waste Crisis: Landfills, Incinerators, and the Search for Sustainable Future*. Oxford Press).

The point of rapid growth of world's population is confirmed by the United Nations Secretary General (Kofi Annan) December 1999 millennium speech to the World, in which he said: "To my fellow 6 billion human beings in the world. This year's United Nations Day is a special one. The World's population has just passed 6 billion, and we are to enter a new millennium"<sup>11</sup>.

Despite the imbalance stated in the previous paragraph, the world economic activity has also grown by 3% per year since 1950. If this trend continues, the total world output will be five times larger in 2050 than today (O'Riordan, 1997). The two factors of population growth and economic progress imply that the overall generation of waste is also on the increase, in a finite world. It was estimated by Beede and Bloom, (1995) that the global burden of municipal solid waste generated amounted to 1.3 billion metric tonnes in 1990, or 0.67 kilogram of waste per person. In Lesotho, the per capita waste is expected to be less, as will be shown in Chapter 4. Of the (1.3 billion metric tonnes), industrialized countries account for a disproportionately high share of the world's waste relative to their share of world population, while developing countries account for a disproportionately high share of world's waste relative to their share of world income.

Using the material flows methodology; it has been estimated that 195.7 million<sup>12</sup> tonnes of solid waste were generated in United States alone in 1990. Of this total, an estimated 33.4 million tonnes, representing 17.1% of waste were recovered through recycling and composting, leaving 162.3 million tonnes for disposal (Franklin Associates, Ltd. 1992). Similarly, a 1999 study of composition of solid waste in California State showed that 35.6 million tonnes of municipal solid waste were generated. Of this total, 13.5 million tonnes were residential solid waste (California State Waste composition study, 1999). Concerning Europe, studies showed that Denmark generated 12.9 million tonnes of municipal solid waste in 1997, with 1.7 million of this coming from domestic waste; which indicated an increase from the previous year 1996 (Waste 21, 1999).

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<sup>11</sup> UNDP Lesotho, (December 1999). Publication of the United Nations System.

<sup>12</sup> The Annual United States of America generation of 196 million tonnes of municipal solid waste would fill a convoy of 10-tonne garbage trucks, 225,000 kilometers long, thus over half way the length from here on earth to the moon. (The Solid Waste Dilemma: An Agenda for Action, EPA, 1989).

Elsewhere in the world, solid waste generation is also on the increase. In Japan, about 3.2 million tonnes of municipal solid waste were generated in 1997. An increase to 4.4 million tonnes was projected the following year if no corrective measures were put in place (Japanese Government, 1997).

Beede and Bloom further projected that in developing countries, municipal solid waste will increase at an annual rate of 2.7% through the year 2010 (Beede & Bloom 1995). In addition, studies have shown that household solid waste disposal is a problem for many countries around the world (Stone, 1987). The basic difficulty is the volume of domestic waste, and the high costs of disposal. The high disposal cost factor is related to the need to protect the environment, particularly water supplies. Large cities appear to have the most dramatic problems, but the basic problem applies irrespective of town size, country or climate. The United States EPA, (1990) comments as follow on the waste disposal dilemma:

***“We are all responsible for the municipal solid waste dilemma”***. This implies that:

- All levels of government have underestimated the importance of safe and effective waste management.
- Industry has designed, manufactured and packaged products with little regard of how these packages would be disposed of.
- Individuals who consume and waste generators do not pay regard to disposal.
- Disposal facility operators and owners consider environmental issues and human health to be a secondary concern, thus not paying much attention to leachates, dust and disease transmission.

For many countries, disposal of household garbage in crude dumping/landfills<sup>13</sup> is the most common solution. For example, data in percentages for a few countries indicates the amount of solid waste, which is landfilled. USA 85% (NSWMA, 1990), Great Britain 90% (DOE, 1986)

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<sup>13</sup> In many developed countries, “Everybody wants the Authorities to pick it up, and nobody wants the Authorities to put it down”. Many want their trash to disappear quickly and quietly from their backyards and curbs, yet the last thing they want is a landfill, combustor or recycling centre, all which are associated in the public mind with noxious odours, possibly dangerous pollution, and noisy traffic, hence suffer the consequence of public resistance known as the “Not In My Back Yard” (NIMBY) syndrome. (California Integrated Waste Management Board Final Report, December 1999).

and South Africa 95% (CSIR, 1991). In the USA, the situation is changing rapidly with increasing recycling and the establishment of more renewable energy facilities (EPA, 1990). Details appear in Chapter 4.

The rapidly growing quantities of garbage (waste) from cities pose a threat to human health and the environment. It is documented that in many developing countries as many as 5.2 million people, 4 million children inclusive, die annually from diseases caused by the improper disposal of sewage sludge and solid wastes (Keating, 1994). In these developing countries, less than 10% of urban wastes are treated, mostly through land filling and to a small extent incineration. Only a small proportion of this treatment meets acceptable standards. It has also been projected that by the end of the 20<sup>th</sup> century, about half the urban population in developing countries would not have adequate waste disposal facilities (Keating, 1994).

Raven et al. (1995) point out that there are four ways of getting rid of municipal solid waste or trash namely, dump it, bury it, burn it or compost it. As indicated previously, solid waste can contaminate water, soil and air if not managed properly. In many developing countries, a third to a half of urban solid wastes go uncollected, with serious health consequences (UNDP, 1997). Therefore, urban waste in developing countries pollutes the air, land and ground water through leachate over a wide area. Besides polluting, poor disposal practices can also lead to build up of gases, which can cause explosions (Cotton et al. 1997).

Problems of solid waste management exist in the developing countries in the Southern hemisphere. Several examples can be cited in this case. For example, Snel (1997) states that many cities in the southern hemisphere are characterized by overcrowding and lack of solid waste collection, which contribute to the unhealthy urban environment. The improper landfilling systems give rise to symportaneous fires and offensive smells. Thus, communities living near dumping sites suffer the nuisance of smoke and smell and Landfill sites and uncollected waste attract rodents and flies, providing a transmission route for diseases. Diaz (1999) re-iterated these findings. In his paper, he describes management of municipal solid waste as a serious problem in large metros of developing countries due to an ever-increasing influx of immigrants, especially rural-urban. The population increase taxes the ability of municipalities to provide proper basic services (Diaz, 1999). Beukering et al. (1999) adds that increasing amounts of solid waste are being generated

due to the rapid rate of urbanization. This poses difficulties in disposal of waste.

Further examples concerning the problem of solid waste disposal in developing countries can be cited. Coffey (1999) also observed that uncollected solid wastes are rotting in heaps and blocking drains, provide breeding grounds for rodents and insects, thus a transmission route for many diseases endemic in developing countries. Coffey (1999) further states that insufficient solid waste management could be more a serious health hazard than the sanitation wastes from on-site sanitation systems. He proposes a solution that a choice of collection system is the key solution to managing refuse in cities. Coffey challenges that up to now, developing countries have produced very few success stories in this area. Zurbrugg and Ahmed sum up this problem of solid waste management in developing countries. In their paper, they state that in developing countries' rapidly expanding cities, collection of waste is beyond the capacity and financial means of municipal administration, and proposes that the solution to this problem lies in community based management schemes. These are schemes that involve local communities in the proper waste storage, collection, sorting and recycling activities (Zurbrugg & Ahmed, 1999).

According to Gibbs & Miller, (1996), we have been asking the wrong questions about wastes. More often than not, we have asked: "Where do we put all this waste", rather than ask: "Why do we produce so much waste?" "Why do we need products that result in so many toxic by-products?"; "Why can industries not reduce waste?"; etc. These questions would lead to pollution prevention and waste reduction, instead of the current practice of pollution control and end-of-pipe approach.

Bringing this subject closer to the core solid waste management problems is to discuss it in the context of African situation and the SADC Region, of which Lesotho is part.



### 2.3 THE AFRICAN REGIONAL CONTEXT OF SOLID WASTE MANAGEMENT

In periods of rapid urbanization as observed in Africa, the urban populations grow extremely rapidly, often at rates of two to three times those experienced by the developed countries<sup>14</sup>.

The Sub-Saharan Africa experienced an average urban population growth rate of about 5.5% per annum from 1985 to 1990. This makes the Africa continent the world's most rapidly urbanizing region, despite being relatively lower when it comes to the overall urbanization. (Tevera, 1996). This rapid growth has intensified urban poverty, lowered the quality of human life, and has created major environmental and public health problems. Population growth outstrips the capacity of local authorities to provide basic needs<sup>15</sup>. The growth of Dar es Salaam and Johannesburg cities shown in the Table 2.3 indicate how fast the Southern Africa city grows. Kaseva (1998) estimates that in many cities of Africa, 40 %to 85% of inhabitants live in slums and informal settlements, usually with limited or no essential facilities, such as water supply, roads, sanitation and waste management services.<sup>16</sup>

**Table 2.3 Illustrates Population growths of Dar es Salaam and Johannesburg.**

Metropolitan City in the SADC Region	Estimated Population in a given Year	
	Year	Year
	1867	2000
Dar es Salaam	900	3,500,000
Johannesburg (Founded in 1885)	Non existent	4,500,000

Source: Modified from Silbernagl & Thomas, 1999.

<sup>14</sup> Peter Silbernagl and Wolfgang Thomas, (June, 1999). Solid Waste Management in a Developing Urban Community in the Southern Africa Context: the need for a paradigm Shift. Paper Presented at 4<sup>th</sup> International Waste Management Congress, Gaborone, Botswana.

<sup>15</sup> & <sup>16</sup> Kaseva, M.E. (February 1998). The African City in Sustainable Human Settlement development: A Case of Urban Waste Management in Dar-Es-Salaam. SAICHE Journal, 1<sup>st</sup> Quarter.

The main causes of urban environmental <sup>17</sup> problems in the region are:

- Increased population densities coupled with haphazard unplanned settlement.
- Industrialization.
- Poor environmental management policies.
- Lack of stringent environmental monitoring systems.
- Lack of waste removal services and supporting infrastructure.

As a consequence of these problems urban solid waste management is today one of the most intractable environmental problems confronting local authorities in eastern and southern Africa (Tevera, 1996). Insufficient waste collection and its inappropriate disposal now threaten public health and environmental sanitation. Many cities in the region confront acute environmental and health risks due to:

- Uncollected domestic, commercial and industrial solid waste;
- Urban drainage systems that are blocked by indiscriminately dumped refuse and are no longer working; and
- Contamination of water resources near legal and illegal dump sites. <sup>18</sup>

Leachates from dumps pollute soil, groundwater and surface water around dumpsites and thus render the quality of drinking water un acceptable. Inadequate collection and disposal of waste is a combined factor in the spread of gastrointestinal and parasitic diseases through contamination of drinking water and food.

The development of a waste management system for any country cannot proceed in isolation as it is directly related to the country's financial position, resources, the socio-economic level of its people and its potential for industrial growth. The vulnerability of the local environment, the quantity and types of wastes generated and the attitudes of people all increase the complexity of

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<sup>17</sup> Sibanda, H. M. (June, 1997). Environmental Rehabilitation: Doing it Right. Paper presented at a UNDP SADC Workshop on Environment and Development, Maseru, Lesotho.

<sup>18</sup> Ntoampe, Kelello (November, 1998). Influence of Municipal solid waste on Environment and its Management. Report on Lancer's Gap Dumpsite impacts on Environment, Maseru, Lesotho.

the problem through superimposition on basic infrastructure attributes in the above paragraph (Lombard, 1993). The standard of waste disposal throughout Southern Africa is low, particularly in smaller local authorities (Moyo et al. 1993).

### 2.3.1 Resource Recovery and Utilization

The extraction of material from waste stream and its utilization in various ways is commonly termed, “recycling”. Recycling is practiced for many reasons, including financial gain, energy conservation, litter abatement, reduction of waste stream itself, and its potential to pollute and prolong the life span of landfills.

It is often stated that recycling is a waste of time and that goods made of recycled materials are inferior. Inferior products do not necessarily result from the use of recycled materials. In fact, industries recycle on their production lines, as a matter of course. Recycling is an essential part of good housekeeping, which is designed to minimize waste and improve utilization of resources. It costs money to buy in raw materials but it is also expensive to dispose of waste in an environmentally acceptable way. Often, with a little thought, one organization’s waste can be another’s raw material resource. This has an economic benefit because the cost of virgin raw material is, in most cases, generally higher than the recycled one.

Each individual is ultimately responsible for own waste produced. Draconian legislation regarding waste is unhelpful. Waste management must be logical, systematic, disciplined and appropriate. The SADC region needs to start developing a positive attitude towards solid waste management issues because the economies of most of the SADC countries cannot afford the cost of the cleanup due to pollution as a result of inadequate legislation and poor enforcement by the regulatory authorities. Affordable technology should still be imported, as part of the waste generated could still be used as a source of income for scavengers.

Resources recovery, or materials recycling, as currently practised in African cities, provides income to the urban poor who are unable to participate fully in the formal economy, and have to resort to informal sector operations. However, most informal sector resource recovery activities are poorly organized and often operate to the disadvantage of the waste pickers (scavengers) who

are exploited by both the middlemen and recycling companies. Studies conducted in some African countries show that those at the lower ranks of the waste recycling industry are very poor and live in deprived conditions (Tevera, 1996). Waste pickers work in unsanitary conditions at landfills and dump sites where they collect papers, plastics, scrap metal, beverage cans and glass required by recycling companies. They travel long distances by foot to get to the dumpsites and work without protective clothing, which leaves them vulnerable.

### 2.3.2 The Urban Environment and Poverty

The incidence of urban poverty in Africa emanating from unplanned, haphazard urban settlement is evidenced by the multitude of squatters and slum dwellers, who live in sub-human environments plagued by squalor inadequate social amenities such as schools, health facilities, waste disposal facilities and clean water and lack of recreation facilities. The majority of these people operate in the informal economy. For example, as hawkers, petty commodity producers, scavengers, etc and often live a life of constant illegality because most of their activities are not sanctioned by the law (Tevera, 1996). It is common to see Local Authority (LA) officials chasing the vendors in the pretext of enforcing the law. The presence of informal or illegal dumping and the burning of waste have a negative impact on both the environment and humans. The health of the poor is often adversely affected by pathogenic microorganisms in their living environment. Good examples of these problems that commonly affect the poor are the parasitic and infectious diseases transmitted by polluted water used for drinking and bathing <sup>19</sup>. Respiratory diseases are contracted through exposure to indoor air pollution from burning biomass for cooking and heating; and through the inhalation of dust and smokes during scavenging in the landfill or waste dump site.

Poverty has important environmental dimensions. The very poor, struggling at the edge of subsistence levels of consumption and preoccupation, and focused on day-to-day survival, have limited scope to plan ahead. This group, especially women, lack access to formal markets for credit and information that would provide advice on risk-reducing practices. Waste dumpsite

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<sup>19</sup> Otieno, F.O. Kgaogelo P. (June 1999). Management Strategy for Domestic Waste at Informal Settlements - Bester Case Study, Durban, South Africa. Paper presented at 4th International Waste Management Congress, Botswana.

scavenging is an activity that effectively highlights the association between poverty and exposure to survival risks. The poor are compelled by circumstances to over-exploit these resources, even though this jeopardizes their future livelihood and their future generation. Survival becomes the priority for the poor rather than the broader and longer-term issues of national and global environment.

As stated previously, disposal of wastes on land has the potential to cause severe environmental pollution and poses risks to human health (DOE, 1986). The health risks principally result from inadequate protection of collection and disposal workers and scavengers, disposal of solid waste within open dump or illegal dumps and contamination of either surface or sub-surface flow components of the hydrological system which are, or could be, used for drinking water supplies (World Bank, 1991). All domestic and household garbage has the potential to generate toxic leachate (Lee & Jones, 1991). There would therefore, appear to be a fundamental land use incompatibility between storage and disposal of garbage and the provision of drinking water from adjacent aquifers. In addition, uncollected or inadequately disposed solid waste is a public nuisance. It clogs rivers and open drains, encroaches on roadways diminishes landscape aesthetics, and causes unpleasant odours and irritating dusts. In the preceding sub-section, it has been shown that considerations of solid waste management are made on the national context basis. Therefore, these issues should be seriously taken into account.

#### **2.4 SOLID WASTE MANAGEMENT THROUGH ENTREPRENEURSHIP AND MICRO-ENTERPRISE APPROACH**

History, common sense, and the fundamentals of materials handling and processing dictate the importance and relevance of solid waste characterisation in the planning and design of solid waste management systems. Furthermore, knowledge of waste characteristics is required to operate and monitor the performance of the systems. The differentiation of the characteristics into categories and subcategories of generators and by material types provides managers and operators of solid waste systems and generators, with data and information to properly assess, design and implement waste prevention and recycling programmes. Assessments of physical and chemical properties are required to efficiently plan and operate solid waste facilities and monitor their performance. The specific categories and subcategories of properties requiring assessment depend upon the particular systems and conditions under consideration.

The assessment of waste characteristics requires proper and reliable methods and procedures to determine the values of the characteristics. Since solid waste and materials derived from them are in many situations difficult to sample, sub-sample and analyse, special consideration has to be given to the methods and procedures of analysis. The analysis of the waste composition of specific types of generators can be used to identify the types of locations of business and industries and exhibit potential for recycling. The potential in terms of high percentages or substantial quantities of recyclable materials, such as paper, plastic, cans and glass exists.

Basic quantity data is typically represented in unit form, for example, kg/person/day or in the form of daily, weekly, or annual quantities. Unit values allow projection of current waste quantities into the future based on reliable demographic data for future populations, and adjustments of significant influences, such as the future impact of waste prevention programmes can be made. Unit rates of waste generation can be quantified through vehicle weight surveys and collection of basic demographic data for generations.

These important and critical issues relating to solid waste management have been covered in detail in Chapters 3 and 4 of this study. However, should Lesotho and other developing countries opt for the community-based approach to solid waste management, the entrepreneurship and micro-enterprise concepts provide the necessary path in the context of the role of the informal sector in job creation during the solid waste management process.

In some countries where waste management has been successful, collection of waste and its recovery from different waste generating points are carried out by many agents (formal and informal), which represent a variety of organisational structures and relationships (Cointreau 1987). In this, there is a link between the formal and informal recycling or re-use sector through the community-based approach. The common factor is that the primary collection scheme offers potential recycling for the informal sector, provides a livelihood for waste harvesters (pickers) and ensures in-put of waste harvesters in community-based waste disposal schemes.

However, in most developing countries, urban solid waste management comes under the direct auspices of local municipal bodies, which are the main formal stakeholders responsible for collection, removal and disposal of garbage from public places and maintenance of dumping grounds (Hadker, 1995). Hence, the challenge ahead is to move towards privatisation, where Local Government focuses more on community participation and community-based services and recycling for environmental and economic benefits. In some cases, sometimes, private formal sectors (private small and large processing enterprises, Non Governmental organisation (NGO) or Community Based Organisations (CBO) assist the municipal authorities in collection, treating and disposing waste. For those countries in the developing world, which would claim success in this field are those where formal sector, resource recovery and recycling activities are complemented by involvement of the informal sector, comprising waste pickers, Itinerant Waste Buyers (IWB) and wholesalers Aziz, 1984; Harday et al. 1992; Heysman, 1994; Furedy, 1989; Hadroy, 1992; and Huysman, 1994). This informal sector is coined as unpaid family workers and those who collect and treat unregistered materials (World Bank, 1995).

Success stories in the developing world have been documented. Beall (1997) observed in his study that the developing countries have a significant informal sector due to a large number of poor and unskilled under-employed workers. These people could play a pivotal role in community-based waste management activities. It is also documented in ILO (1992) and by Beall (1997) that the urban informal sector absorbs this surplus of estimated labour force of 20%-70% of total the labour force in various cities in the South of equator in which, solid waste management activities play a role. Supporting evidence comes from Indonesia where had 72% of its labour force was in the informal sector in 1998. In 1990, Pakistan informal sector absorbed 79 % of the labour force. Most of these informal activities are in SWM. Activities include resalable waste components through established networks of waste harvesters, dealers, wholesalers and recyclers or waste collection systems through primary waste collection by sweepers which is taken to satellite transfer points, where waste is transferred from small collection vehicles to larger forms of transport. The argument concerning community-based waste management schemes involving local communities as a solution to the problem of MSWM in terms of proper waste storage, collection, sorting, disposal, recycling and job creation activities can be supported by other experiences in the developing world. Furthermore, research study done in an urban slum in Karachi (Pfammatter & Schertenleib, 1996) has shown how such schemes can be implemented under different conditions,

i.e. utilising a community information and education approach to enhance motivation and participation in the establishment of a collection scheme. Producing alternative awareness materials disseminated by informal methods such as community meetings with target groups of different tenders and ethnic background has proved successful.

Therefore, self-help and use of community participation may, in many cases, be the only solution for solving waste collection problems in low-income areas. However, in many community participation projects, donors or government agencies try to motivate communities and beneficiaries but neglect to gain their confidence first, which is a critical element of success for any programme.

The Inform- Educate -Motivate Strategy (IEMS) developed by Ahmed (1992), is a useful tool to gain acceptance and motivate participants:

- **Informing** = Formalises community to hazards of pollution and environmental impacts.
- **Educating** =Videos and hand bills on SWM make people aware of the need to recycle or reuse waste materials and the policies, and of regulatory instruments, such as polluter the pays principle.
- **Motivation** = Follows automatically.

However, it must be noted that it would not be advisable to rush into sole privatisation of waste management services. Privatisation has its own advantages and disadvantages. It can be beneficial when considering rapid urbanisation and the escalating demands for public goods and services. This would mean profit, and bring about low administration expenses for the municipalities. On the other hand, tendency to apply high-tech means may have negative consequences such as to loss of regular municipal jobs, erosion of informal recycling with resultant job losses. It is advisable to follow the route of a slow process into privatisation through the development of recycling as an informal sector where waste is utilised and jobs are created.



#### 2.4.1 Recycling as a Fairly Developed Informal Sector

In this scenario (Diaz, 1999), waste plays a vital role in job creation and can be divided into:

- Waste picking in streets, communities, transfers and diagnosed sites.
- Waste separation at the household and selling to itinerant waste buyers.
- The largest group of people involved in informal recycling is households. In high-income areas, domestic servants first access the resalable components. In this system, the middle dealers usually have permanent plots of land or sharks purchase these wastes from waste buyers or directly from households and shops. Then the middle dealers sale to main dealers or wholesalers, with established businesses.

#### 2.4.2 Entrepreneurship

Waste management entrepreneurship within the informal sector takes the form of private work, which municipal and private sweepers perform in addition to their official waged work (Streefland, 1979). This differentiates itself from waged labour as follows:

- Sweepers market themselves to users.
- They negotiate their wages.
- They manage labour for the work.
- They have full discretion to refuse work and can sub-contract.
- They arrange inputs to produce service outputs.
- There is evidence of private-personal investment such as buying donkeys.

#### 2.4.3 How Jobs can be created

According to Coffey (1999), the sweepers system of primary collection is a set of three verbal agreements:

- Between sweepers and households.
- Between sweepers and their supervisor, if employed by municipal council.
- Between sweepers and fellow sweepers.

Households make agreements with sweepers to collect waste against agreed payments, supplemented by tips, gifts or food. Sweepers may require informal permission from municipal supervisor to perform private work. This directly benefits the poorest of the poor. However, it is

not operational where no market is available or where user does not pay. In this way, private informal activities are important for improved solid waste management, social development and cost effectiveness. The informal sector is an integral part of SWM in developing countries and it must therefore not be overlooked while planning systems.

#### 2.4.4 How SWM can create Jobs and Social Benefits in Low income Countries

Low-income countries can benefit from the solid waste management activities through a community-based approach (Zurbrugg et al. 1999). In this case,

- They fulfil a service gap in the SWM sector in low-income developing countries by providing services, not otherwise provided by the formal sector.
- Income from such activities is a self-off survival strategy for a large number of poor people.
- In the absence of a social security system, informal activities act as a buffer against poverty.
- The activities also create employment for neglected groups, such as women and out-of-school youths.

However, the major challenge is integrating current practices with future system, which may be more regulated and top-controlled, perhaps as consequence of privatisation of SWM. This strategy will cause neglect of the private informal sector. The integration of informal activities into planning must be further explored, i.e. the informal sector can play a vital role as sub-contractor, thus be more socially acceptable and sustainable. As this process progresses, it may lead into the formation of micro-enterprises.

#### 2.4.5 Solid Waste Management Micro-Enterprises

According to Diaz (1999), micro-enterprises can be a viable alternative to conventional approaches for waste management in peri-urban areas. It can provide collection, storage, treatment and disposal of solid waste for settlements in the periphery of metropolitan areas. Therefore, as community-based waste management activities expand, the establishment of micro-enterprises for the provision of services in the periphery of larger cities may be worthwhile considering. A micro-enterprise is a formal entity, comprising of between 3 and 20 employees,

which provides SWM services. Micro-enterprises often operate on profit, but exclusively members are often part of the community they serve, but are not required to be (Diaz, 1999). Micro-enterprises could also deal with recycling, composting and final disposal, besides collection.

The approach for establishing micro-enterprise follows the route:

- Define the area to be serviced and collection of data, such as social, economic, topography and geology.
- Define capacity and willingness to pay by community members using rigorous method, i.e. questionnaires.
- Identify the needs of users.
- Select potential members of micro-enterprises.
- Determine institutional issues to be resolved.

As a caution, collection of information and data from households should be done when the head of house is available. In addition, institutional tasks should include: permission by authorities, co-operation with the public or private, methods of payment (directly from users through municipality, and others). These are critical to the success of micro-enterprise and must be resolved before the investment is made.

#### **2.4.6 The Implementation Process of a Waste Management Micro-Enterprise**

Assuming Sections 2.4.1 to 2.4.5 are successfully addressed, the next phase would be to implement. This requires technical data, which includes:

- Characteristics of waste, quantity, density and composition.
- Type of equipment to be used for collection treatment or final disposal.
- Number of employees (based on standard productivity).
- Frequency of collection.
- Method of storage.

Method of transportation to treatment or final disposal site, if it is for collection programme. Therefore, the choice of a cost-effective collection system is defined by many factors such as socio-economic conditions of the people, density of the waste and volumes of wastes generated in different income areas. When it comes to means of transportation of waste, certain factors should be taken into account. For example, hand carts can be cost-effective over very short distances,

while bicycles would be more efficient over medium distances where there are paved roads and only small gradient, and animal carts can operate over an even ground. Tractors and trailers are efficient at distances up to 5 km. Trucks are efficient over 5 km distances. Therefore, a combination of some of these means would be essential in certain cases. In all, optimum primary collection system will be determined by widths, surfaces and traffic conditions of the roads and streets and the haulage distances.

Since community-based solid waste management promotes the spirit of entrepreneurship, it would be worthwhile to examine some success stories on the continent and in the region.

## **2.5 COMMUNITY – BASED SOLID WASTE MANAGEMENT IN AFRICA: LESSONS LEARNT**

Taking into account that this study would be useful to many other towns and cities in SADC countries, which are currently grappling with similar problems of solid waste management, a link is made to a town and country that has relatively done better and advanced in this field. This is to ensure that we are not re-inventing the wheel. In this case, Durban in South Africa has been selected as a reference point. Other success and failure stories in African cities are also cited as examples; to strengthen the point of the important role informal sector in waste management activities can play.

In the paper by Coffey (1999), it is recorded that choice of collection system is key to managing refuse in cities, and yet the developing world has produced very few success stories in this area. According to Zurbrugg et al. (1999), solution to this problem in solid waste management lies in community-based management schemes – involving local communities. In this study, the cities of Durban in South Africa, Dakar in Senegal, Lagos in Nigeria and Gaborone in Botswana are given as examples of success stories in solid waste management; while Nairobi in Kenya serves as one of those cities still grappling with problems of solid waste management.

Gilbert et al. (1996) recorded that Dakar, the capital of Senegal, with a population of nearly 2 million people (about 21% of Senegal's population), had only less than 65% of city dwellers with access to waste collection services for over decades. This was because of ineffective waste management systems, which were operational during that time. It was estimated that the

inefficient waste management systems and insufficient sanitation and social services were principal causes of the growth of incidence of diseases in the city (Gilbert et al. 1996). However, the situation changed in 1995 when a new comprehensive community participatory waste management system was introduced. This system employed over 1,000 unemployed youths and local communities were involved. In this scenario, the Economic Interest Groups (EIGs) comprising only locals were responsible for street cleaning, garbage bins, gathering garbage from inaccessible areas and community education on waste management. This innovative approach eliminated the waste management monopoly by the Local Authority, and created employment for the low-income residents.

Lagos has been known for its notoriety of images of violent robberies and reeking mounds of rubbish. Streets had mountains of rubbish piled up along pavements (BBC Magazine, 2001). It is an extraordinary transformation to change from heaps of rubbish on the streets to clean streets, especially since cleaning up the litter-strewn streets of Lagos was regarded as an impossible task. Lagos boasts of ten million inhabitants. Faced with catastrophic picture of garbage crisis, it has taken only within a short space of one year (2000-2001) to prove pessimists wrong. Clean-up in this city has added new freshness to the air.

The solution to the problem of waste in Lagos lay in community involvement. The State Government sought the assistance of the private sector to tackle its solid waste management problems. The method followed by this solid management process to score success was as follows: under the auspices of the Lagos State Waste Management Authority, the Government hired the famous private sector participation (PSP) operators. Lagos was divided up into small manageable units and allocated to individual PSP operators who made agreements with communities on how much to pay for services. As its contribution, the State Government handed out free black bags. Waste collection/drop-off satellite stations were introduced. It has further been pointed out that this had another adverse impact on the landfill. It failed to cope with a new scenario of more waste collected. This resulted in air at dumpsites being filled with smoke and a pungent smell of decay. Everyday, except Sunday, there were armies of cleaners across the city dressed in protective clothing insignia the "High-way Managers". This has not only kept the streets of Lagos clean, but also created jobs. Over four thousand people have been employed.

Those employed included graduates from Technikons (Polytechnics) who now serve as supervisors for the waste harvesters.

Closer to home (Lesotho), Botswana in the SADC Region has scored a relative success story by putting in place sustainable solid waste management systems. As reported in the Daily News (8 June 1993), Botswana realized that solid waste management was a serious issue, which was not to be treated lightly. The results of this realization are that through a GTZ project, Botswana has formulated legal instruments (an Act of Parliament) to specifically address waste management problems. In addition, the components of case studies for re-use and recycle have been carried out with a view to create jobs.

Another story that relates to waste management problems caused by lack of integrated waste management systems is about the city of Nairobi, Kenya. It has been reported that the city of Nairobi, once lauded as the “Green City in the Sun”, is now described by columnists as the “Stinking City in the Garbage”. The situation has been caused by garbage from the lower side of the dumpsite flowing into Nairobi’s main river, creating yet another potential environmental disaster. In this case, the major cause of this problem is the Local government’s failure to incorporate garbage disposal into their long- term plans, which overlooked the community-based waste management systems (BBC Magazine, 2001).

These two scenarios set a good platform for this study. They illustrate the point that the issues of community-based solid waste management should not be overlooked. This point should be the central theme in the study and the discussion in relation to the city of Durban in South Africa.

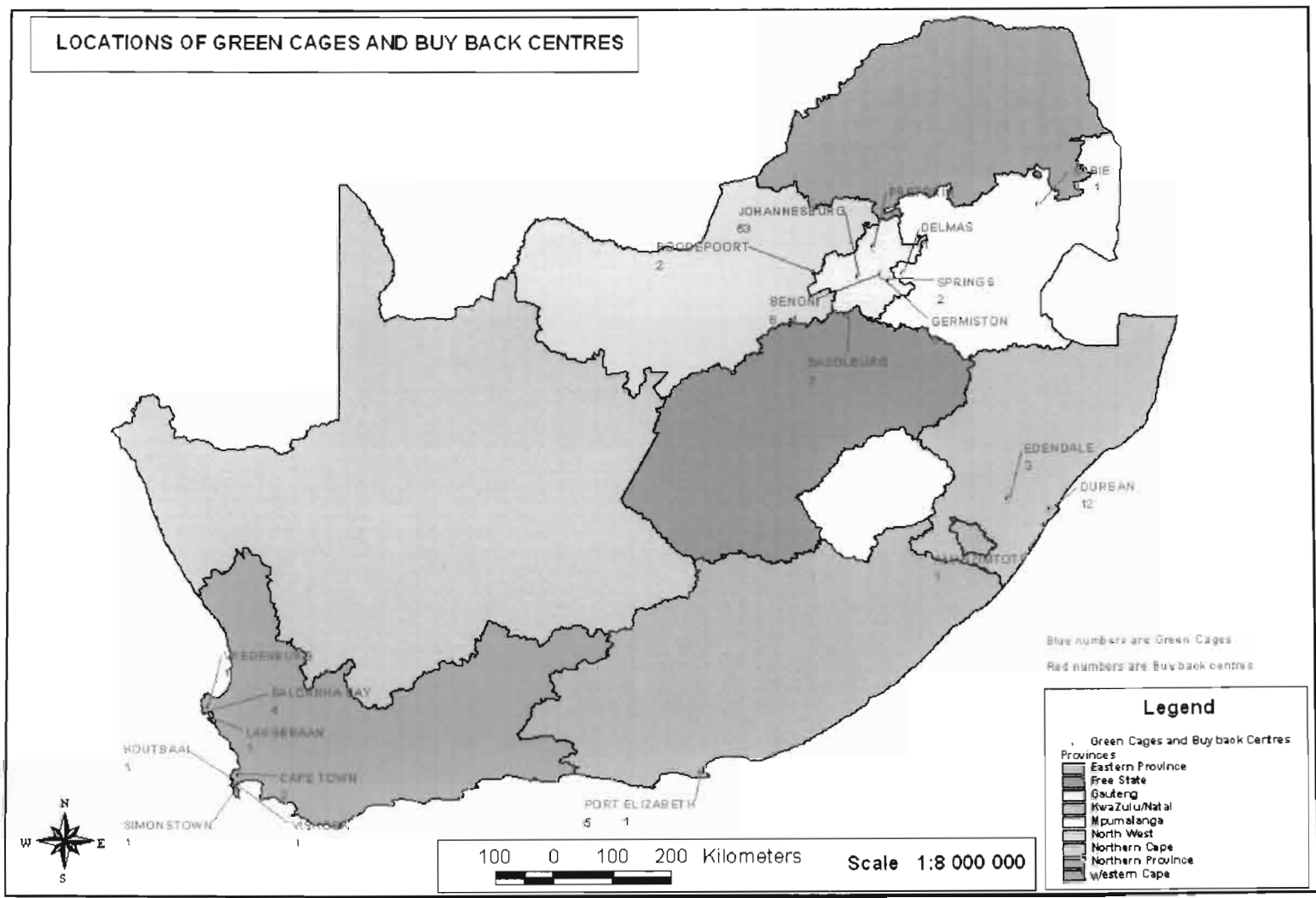
### **2.5.1 Waste Management in South Africa -Community-Based Activities**

Furthermore, in South Africa, there has been a paradigm shift among officials to accept bottom-up approaches. This has resulted in more community -based waste management programmes. For example, the community of Stswetla in Alexandra Township in the out-skirts of Johannesburg, demonstrated this principle. In this project, which was supported by the South African Breweries and Public Works Department, 40 communities nationally, in nine provinces benefited, in which 167,000 families experienced a clean and green environment, and 700 jobs were created. (Mhlanga & Gulilat, 1997). This project is commonly known as Clean and Green Campaign.

South Africa has intensified the activity of waste management with a view to generating jobs. For example, mapping of buy-back centers at national level has been done, as shown in Map 2.1. In addition, mapping is done for the location of waste collectors at national level and of the distribution of recyclers, as shown in Maps 2.2 and 2.3 respectively. In addition, at national level, waste management strategies and guidelines have been developed – a clear demonstration of commitment to the issues of waste management.

The relevance of these points raised is to emphasize the commitment from the Government concerning the issues of integrated waste management, and the role the Government has played as a catalyst to create an environment for the waste harvesters to take part in the waste management activities. Thus, jobs are created. Without the development of these buy-back centers and mapping the location of waste role players, South Africa would not have scored such success, as recorded in this Section 2.5.2 concerning Durban City.

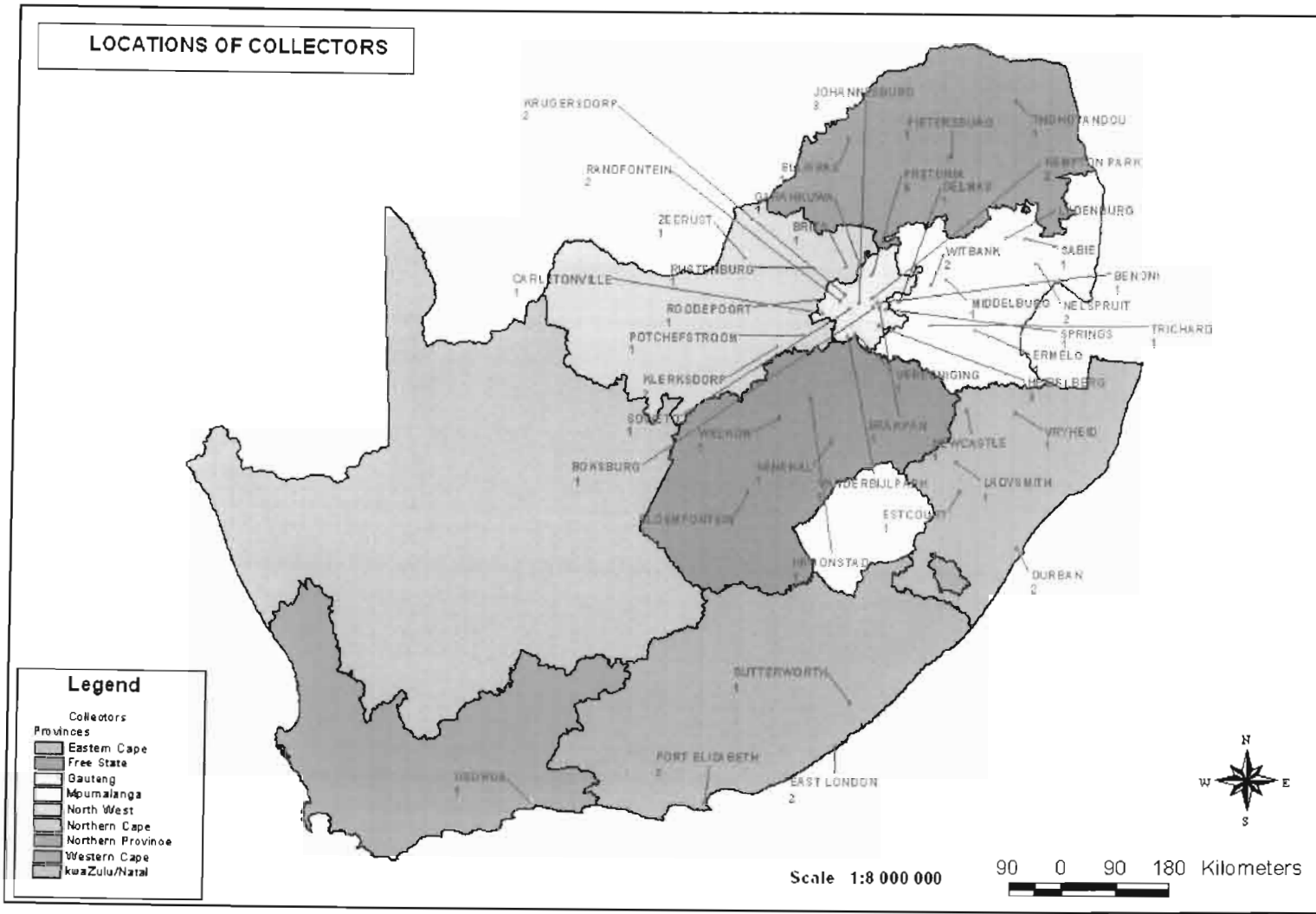
Map 2.1 Location of Green Cages and Buy-back Centres at a National Level



Source: Modified by the Author from the South African Plastics Federation Report, 2000

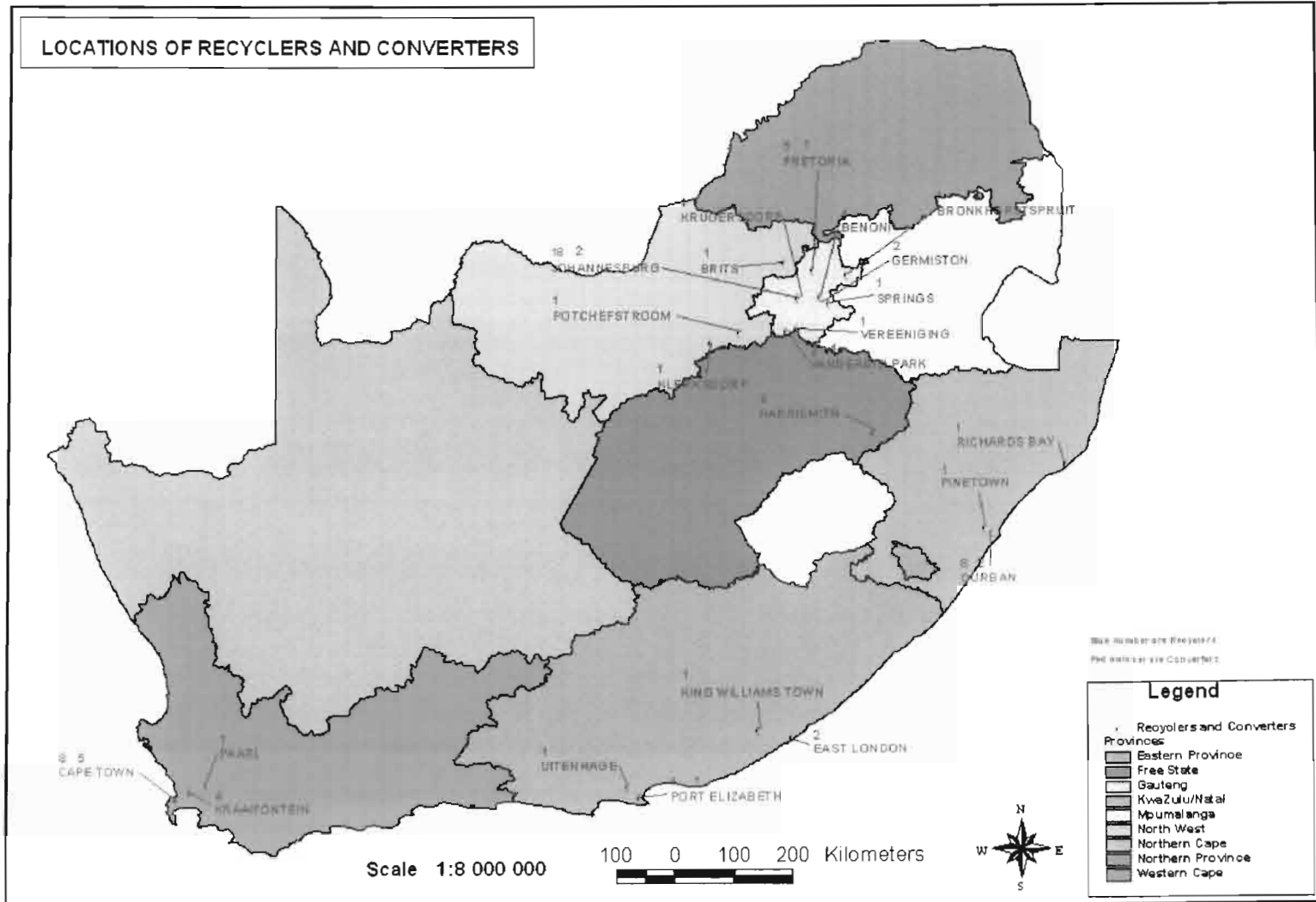


Map 2.2 - Location of Collectors at a National Level



Source: Modified by the Author from the South African Plastics Federation Report, 2000

Map 2.3 - Distribution of Current Recyclers at a National Level



Source: Modified by the Author from the South African Plastics Federation Report, 2000

### 2.5.2 Waste Management in Durban Metropolitan City

Durban Metropolitan City in South Africa has achieved a great deal in the area of solid waste management in relation to job creation as evidenced in the paragraphs that follow below. This does not imply that South Africa has eliminated solid waste management problems. Nevertheless, it is evidence enough that tremendous efforts have been made in the area of community-based waste management, as indicated by examples highlighted in the forthcoming paragraphs.

It has been documented as a report on Trash Culture-South Africa, that: “old habits die hard” (BBC Magazine, 2001). In this issue, it has been re-asserted that people dumped randomly on roadsides and that litter was tossed carelessly onto the streets by pedestrians and motorists. However, the statement was further qualified that the battle against waste littering was not lost. Across South Africa, people have been transforming rubbish into works of art and it has become an increasingly lucrative business. Central to these success stories in South Africa is the City of Durban. The success story starts in the backyard of the Siyanda squatter settlement in Durban and ends up in a metropolitan Museums of Art in New York and London, earning income in foreign exchange, which the country desperately needs. In this example of good waste management practice, the Zulu telephone wire weavers have dipped into their cultural heritage, applied it to discarded telephone wire, and transformed it into high art, i.e. value addition to what would have been meant for the waste dumpsite. In addition, the discarded beverage cans have been turned into lampshade and waste paper into waste paper baskets to sell to tourists in search of something “South African”.

These facts show that Durban, a steamy Indian Ocean port serves as a magnet for the rural poor, who cluster in fragile shacks on the fringes of the more established townships surrounding the City. Siyanda, meaning: “We are moving forward” in Zulu is one of such informal settlements, in which, out of the telephone wire waste art, gave birth to the Bartell Arts Trust shop in Durban which in turn exports the artworks to art galleries and shops in New York and London. Products range from hand-made books, greetings cards and paper, along with all the aluminum and metal products. Thus South Africans, especially Durbanites, are adopting an innovative approach to the debris (waste) that surrounds them in their daily lives. In turn, they help their country to reduce its vast piles of rubbish, and generate foreign exchange and much needed employment for the poor.

The success story for Durban does not only end at Siyanda, it goes on. It has also been documented by Kgaogelo and Otieno (1999) that in South Africa the phenomenon of squatting are prevalent among black people. Of the entire country, Durban has carried the major part of the increase in informal housing and contains the greatest part of freestanding informal settlements (Cross et al.1997). Informal settlement areas are characterized by poor and unhealthy housing, with a low standard of living. Residents also experience poverty and inadequacy or inaccessibility of services such as water, electricity, sewerage, sanitation as well as refuse collection system to meet their basic needs (Muller, 1991; Moyo et al. 1993). Inadequacy in the provision of services or lack of domestic waste management at informal settlements contributes mainly to the accumulation of massive piles of waste. However, despite these hurdles, the Durban Metropolitan City has striven to counter-act the problems of waste management. The success Durban city to generate jobs supersedes the cited inadequacies of informal settlements.

For example, several studies on community-based solid waste management have been carried out in Durban area. Of importance are the studies on “Management Strategies for Domestic waste in Bester Informal Settlement”, by Kgaogelo and Otieno (1999); on “Creating Employment Opportunities through Buyback Centres: a pilot study in Central Durban”, by Mclean, (1999); and “Domestic Recycling in the Greater Durban Metropolitan Area, Durban”, by Mclean, (1999). In the former, the Researchers found that, within a short time, the Bester community of about 9776 inhabitants had established a recycling process with 26 participants. In the latter, the researcher found that the Buyback Centres created job opportunities and that most of the scavengers frequenting this market were earning about M10<sup>20</sup> per day, some even up to M40<sup>21</sup> per day. In addition, the other study by the same researcher on domestic recycling in the greater Durban Metropolitan revealed that there were several reasons why communities preferred recycling activities.

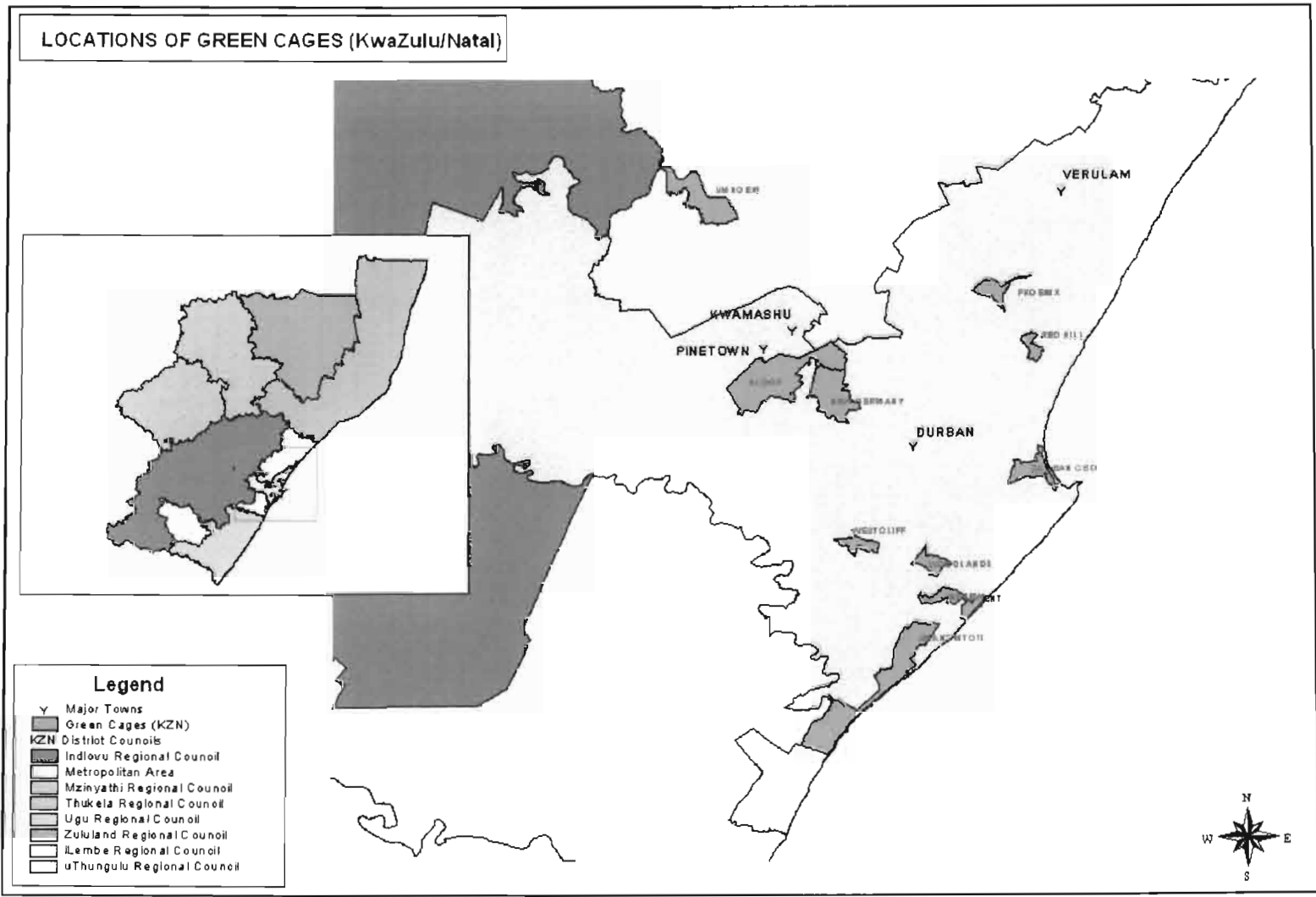
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<sup>20 & 21</sup> In this case, one South African Rand (R) is equal to one Lesotho Maluti (M)

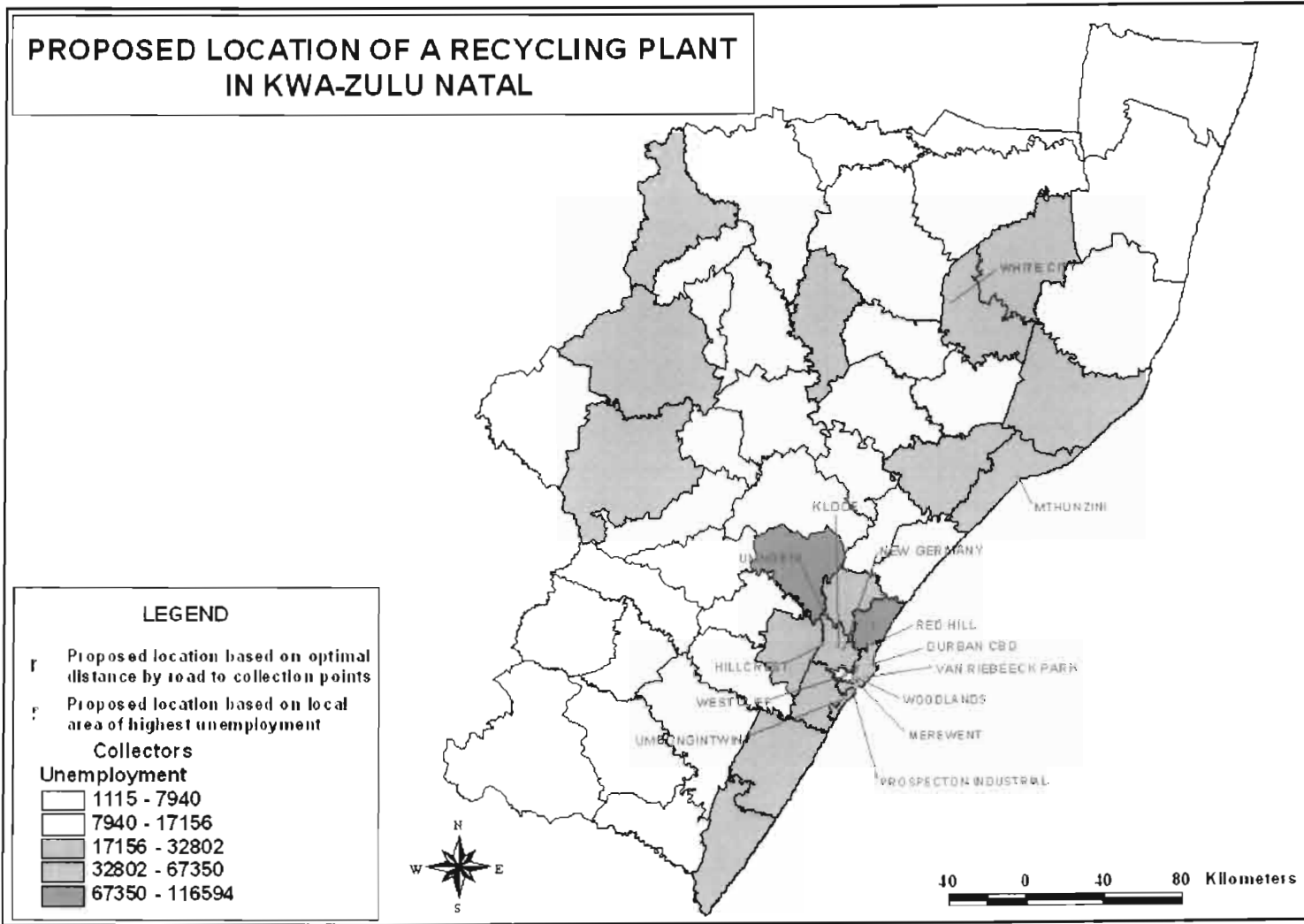
In her study, Mclean found out that the recycling activities in the middle-income households of Glenwood, put forth environmental concerns as a factor for recycling; while the low-income households of Umlazi put forth job creation and income generation as the important consideration. This is evidence enough of how much the Durban area has done in solid waste management through the community-based approach.

To crown it all, Durban is one of the very few cities in Africa, even in the world, which have produced a Local Agenda 21 and the “State of Environment Report’ for the city. In this case, the Local agenda 21 has even reached the pilot study of phase 3. This is not the only achievement: it has also established the location of green cages within local Durban, as shown in Map 2.4. In addition, there is a proposed location for a recycling plant of plastics in an area with highest unemployment in Durban (see Map 2.5).

Map 2.4 -Location of Green Cages within the Local Durban Area



Source: Modified by the Author from the South African Plastics Federation Report, 2000



Map 2.5 - Ideal location of Recycling plant in Durban

## 2.6 NATIONAL CONTEXT OF SOLID WASTE MANAGEMENT IN LESOTHO

Prior to independence in the early 1960s, urban settlement was slow in Lesotho. For example, in 1966 urban dwellers accounted for just 7.4% of the population. By 1976, this level had risen to 11.2%, and to a further 18% by 1993.<sup>22</sup> Comparatively, the period between independence and to date has seen increasing industrial development at a number of areas in Lesotho. These include, but are not restricted to Maseru, Maputsoe, Mafeteng and Masianokeng (Witzsch & Ambrose, 1992).

The main industrial sites in Maseru are located near the railway station and Ha Thetsane areas. In addition, there are some minor industrial enterprises at Sebaboleng and elsewhere in Maseru. Waste is generated by all human congregated communities, and excessive waste generation is an unavoidable result of prosperous, high technology (Raven et al. 1995). All too often, products that could be repaired, reused or recycled are thrown away. Given low environmental awareness amongst industrialists, the tendency is to use cheap waste disposal methods that in most cases are not environmentally friendly. Heaps of waste along the roads and near industries is commonplace due to erratic waste collection service and lack of public awareness. Although there has not been any study to assess the impacts of these illegal practices on the health of the local communities, it can be inferred that these practices impact on human health, as wastes are perfect breeding grounds for vermin like rats and flies. The industries do not take stock of waste emanating from their premises, thus making availability of data very difficult, if not impossible. Therefore, in generating waste management policies, countries should build into these policies and regulatory instruments to enable them to generate the data on the subject.

In Lesotho, waste generation is not only a function of population alone, but also of economic growth or income. A study conducted by Seholoholo (1998) and Mhlanga & Gulilat (1997) showed that the high-income class produces more waste than the low-income households do. This point is supported by the comparison of statistics of other countries at global level concerning solid-waste generation pattern. For example, taking into account the economic status of the countries, the United States of America only 4.7% of the world population - produces 33% of the total world's solid waste (Miller, 1996).

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<sup>22</sup> IUCN. (1997). Environmental Synopsis of Lesotho.



### 2.6.1 Legislative Framework

Clause 36 of 1993 Constitution of Lesotho states that:

*"Lesotho shall adopt policies designed to protect and enhance the natural cultural environment of Lesotho for the benefit of both present and future generations and shall endeavour to assure all citizens a sound and safe environment adequate for their health and well-being".*

In order to fulfil the inter-generational responsibility reflected by the constitutional statement, the Government of Lesotho formulated an umbrella National Environmental Policy in 1996, which has put in place strategies for achieving sustainable development. The Policy addresses environmental issues relating to activities of different sectors of the country's economy. Waste as an important by-product of economic activities has also been included. In this regard, the relevant sections are Sections 4.17 and 4.18, which deal with management of toxic and hazardous waste, and sanitation waste respectively. The policy further proposes the formulation of waste management guidelines. This calls for more data to be gathered to assist with this task. Although solid waste management is covered in this policy, Lesotho still requires specific policy on solid waste management. This signifies the need for more data and information on this subject of waste management, if this subject has to be covered adequately.

Prior to the formulation of the umbrella environmental policy, Witzsch (1990) indicated there was no general anti-litter law in Lesotho. As a result, people were throwing away waste outside their yards or plots, along roads or in illegal dumping sites. Provision for waste management has been made in a number of separate pieces of legislation, regulation and by laws (Witzsch, 1990), e.g. Sanitary Services and Refuse Removal Regulations, 1972 and Public Health Order, 1970, etc. Furthermore, it is assumed that conflicts and inadequacies may exist within these pieces of legislation. These are examined further in Chapter 4.

### 2.6.2 Institutional Framework

In greater Maseru City, the refuse collection section of the Maseru City Council (MCC) serves the wards that fall within its jurisdiction. In order to "effectively" undertake this task, the City is divided into Central Business Development area (CBD) and industrial and residential areas. A skip service is offered to factories on demand<sup>23</sup>. Coming to other Urban Centres in the country, they are being served by the Ministry of Local Government through the offices of Town Clerks. However, even in these other urban Centres, difficulties are experienced with regards to solid waste collection and disposal, such as irregular and inefficient waste collection services and breaking down of waste collection vehicles, etc. One additional problem in solid waste management in Lesotho is the lack of clearly defined roles of responsibility over waste management. There is no a designated Ministry, Department or Institution responsible for waste management. Although NES plays a coordinating role, the other institutions such as WASA, MCC, Department of Water Affairs (DWA), and Department of Environmental Health in the Ministry of Health all have roles in activities of waste management, without specific roles. This leads to lack of focus on waste management issues. The solution lies in an introduction of integrated waste management system.

As stated above, the National Environment Secretariat (NES) co-ordinates the waste management issues through the Committee on Waste Management (COWMAN). The membership of COWMAN (see Appendix A.3) has been drawn from diverse background. Government institutions, parastatals such as National University of Lesotho (NUL), Non-Governmental Organisations, such as LCN, and the private sector, such as Welcome Waste Company. Its mandate is to assist the government in the management and disposal of waste in an environmentally friendly manner and as a forum for exchange of information and experiences relating to waste. The Committee however has no legal status and only plays an advisory role. There is a significant indication, however, that the Government of Lesotho has strived to address these problems. Some of the good examples of government's efforts are indicated Section 2.4.3 of this Chapter.

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<sup>23</sup> The Director *per. Comm.*, (2001). Department of Environmental Health, Maseru City Council, Maseru, Lesotho.

### 2.6.3 Previous Studies on Solid Waste Management in Lesotho

In 1990, it was documented that there had never been a survey done to establish the waste generation rate in Maseru and Maputsoe (WHO, 1990). This report further re-iterated that there was only a small amount of data available on the composition of solid waste in those two towns and recommended a detailed study. Attempt was further made to establish waste generation rates in several towns in Lesotho (NZA Associates, 1987; Otieno, 1995; Mhlanga & Gulilat, 1997). The latter tried to establish trends in solid waste management in Lesotho. However, these studies relied on estimates from population figures and due to the time factor, detailed solid waste characterization classification was not done. Certain participants and stakeholders such as scavengers, institutions, and commercial establishments were either omitted or not fully covered. Another synopsis study of importance on this subject is by Sehlohlo (1998) on waste management in one low-income and one high-income residential area in Maseru.

Having examined waste management at global, regional and local level, a general picture emerges on how waste is managed at different levels of development. In developing countries, community-based approach of solid waste management functions as a useful method of waste management. The concept on how entrepreneurship and micro-enterprises could be developed around solid waste management has already been further elaborated on in Section 2.4.

### 2.6.4 Waste Management in Maseru/ Maputsoe (Lesotho).

According to Mhlanga and Gulilat (1997), the RSA is estimated to generate 466 million tonnes of waste per annum. However, 81% of this comes from mining. The equivalent of what was considered in their study (industrial, domestic and trade sectors, generate 8% or 37 million tonnes per annum. A comparison of waste generation in these two sectors for Lesotho and the RSA is shown on Table 2.4. It can be seen that while Lesotho generates 0.43 tonnes per capita per annum of industrial, trade and domestic waste; the RSA generates 0.88 tonnes per capita per annum. However, while the industrial sector in the RSA is the most important source amongst these three sectors, in Lesotho it is the commercial sector that contributes the largest share, as shown in Section 4.6.1 of this thesis.

**Table 2.4 Comparison of Annual Waste Generation <sup>24</sup>: Lesotho and the RSA**

Item	Lesotho	RSA
Total Waste Generated per year (tonnes)	802,390	37,000,000
Total population (1996) <sup>25</sup>	1,861,225	41,977,904
Annual waste generated per capita (tonnes)	0.43 <sup>#</sup>	0.88 <sup>#</sup>

Sources: Consultants' estimates, Bureau of Statistics, and South African Year book, 1996.

<sup>#</sup> These values include those from households, industrial and commercial establishments. They may seem to be on the higher side when considered only in terms of household level and population of the people.

### 2.6.5 The External Market.

It was also observed by Mhlanga and Gulilat (1997), that the external market absorbs the bulk of waste items that are recovered by the informal sector in Lesotho. This market is dominated by a few refuse collection agents which have established extensive commercial links with giant RSA companies, such as ISCOR, Consol Glass and Metal Box Glass, Rondo Plastics, Mondi /SAPPI Paper Waste Recycling, Durban Steel and Durban Textile industry. The major external markets for waste are located in the Gauteng and KwaZulu/Natal Province of the RSA (in the Johannesburg and Durban Metropolis). This makes the waste industry in Lesotho very transport sensitive. Hence, there is a need to integrate transport services with waste trading in order to maximize the haulage. The need to minimize transport cost also forces the agents to undertake preliminary stages of the recycling process, namely: sorting, shredding, compaction or pressing and bailing. This also helps to increase the value of the waste items. Another external market is Japan, which also gets Lesotho's external market share through the purchase of scrap metal.

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<sup>24</sup> Only industrial, trade and domestic waste was considered, including scrap metal from discarded vehicles.

<sup>25</sup> For Lesotho, estimates based upon preliminary results of the 1996 Population Census, while for RSA, an estimate using a unified growth rate of 2.08%.

## 2.7 PROBLEM STATEMENT ON SOLID WASTE MANAGEMENT AND JUSTIFICATION OF THE STUDY

The problems highlighted in the foregone sections of literature search have given enough evidence that the problems of solid waste management are pertinent to Lesotho. For example, there have been increase in rural-urban migration, especially to Maseru: (the only gazetted city in the country), and to a certain extent, Maputsoe: (the up-coming industrial town of Lesotho), causing a problem competition for few resources in these recipient towns (GOL, 1996). Evidence from Maps 2.6, 2.7 and 2.8, suggest that lack of jobs and non-expansion in economic growth of the country will contribute to more movement into Maseru and Maputsoe in search of jobs and a better life. The tendency will in turn create a problem of more poverty to most of the urban dwellers. Hence, ways have to be found to alleviate their poverty. The problem of lack of jobs is exacerbated by the repatriation of migrant workers from the mines in the Republic of South Africa, as already indicated.

On the other hand, the rapid urbanization of Maseru and Maputsoe and the associated growth of industry and services are key features of economic and demographic development in Lesotho. The population of Maseru has risen from 109,382 in 1986 to an estimate of 190,800 in 1994, 219,250 in 1996 and 240,000 in 1997, showing an increase of 74% and 100% in 8 years and 10 years respectively. The population of Maputsoe was 16,260 in 1986; 28,728 in 1994 and was projected to be 33,000 in 1996. Almost half of the country's urban population live in Maseru<sup>26</sup> thus it can be argued that Maseru, and to a lesser extent, Maputsoe, are the main catalysts of economic growth in Lesotho (Otieno, 1995).

Furthermore, recent information indicates that the population growth within the capital Maseru is between 7.0% and 11% per annum, while other urban centers growth has proceeded at a rate of 4.3% (Mvuma in UNDP, 1998).

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<sup>26</sup> State of Environment, World Bank, 1986, Lesotho Country Economic memorandum. Report No. 6671. LSO. Washington, D.C., USA.

Such rapid population growth, coupled with unregulated and unplanned settlements, can seriously degrade the urban environment, placing enormous strain on the natural resources and sustainable development. A very important environmental consequence of the process of urbanization in Maseru is “the immense and ever growing amounts of solid waste, most of which remain uncollected and are dumped on vacant land or into river beds and dongas, resulting in a negative impact on the environment and human health”(Otieno, 1995). What is generally observed is growth without essential services such as good roads, clean water, sewerage systems and proper and timely solid waste removal.

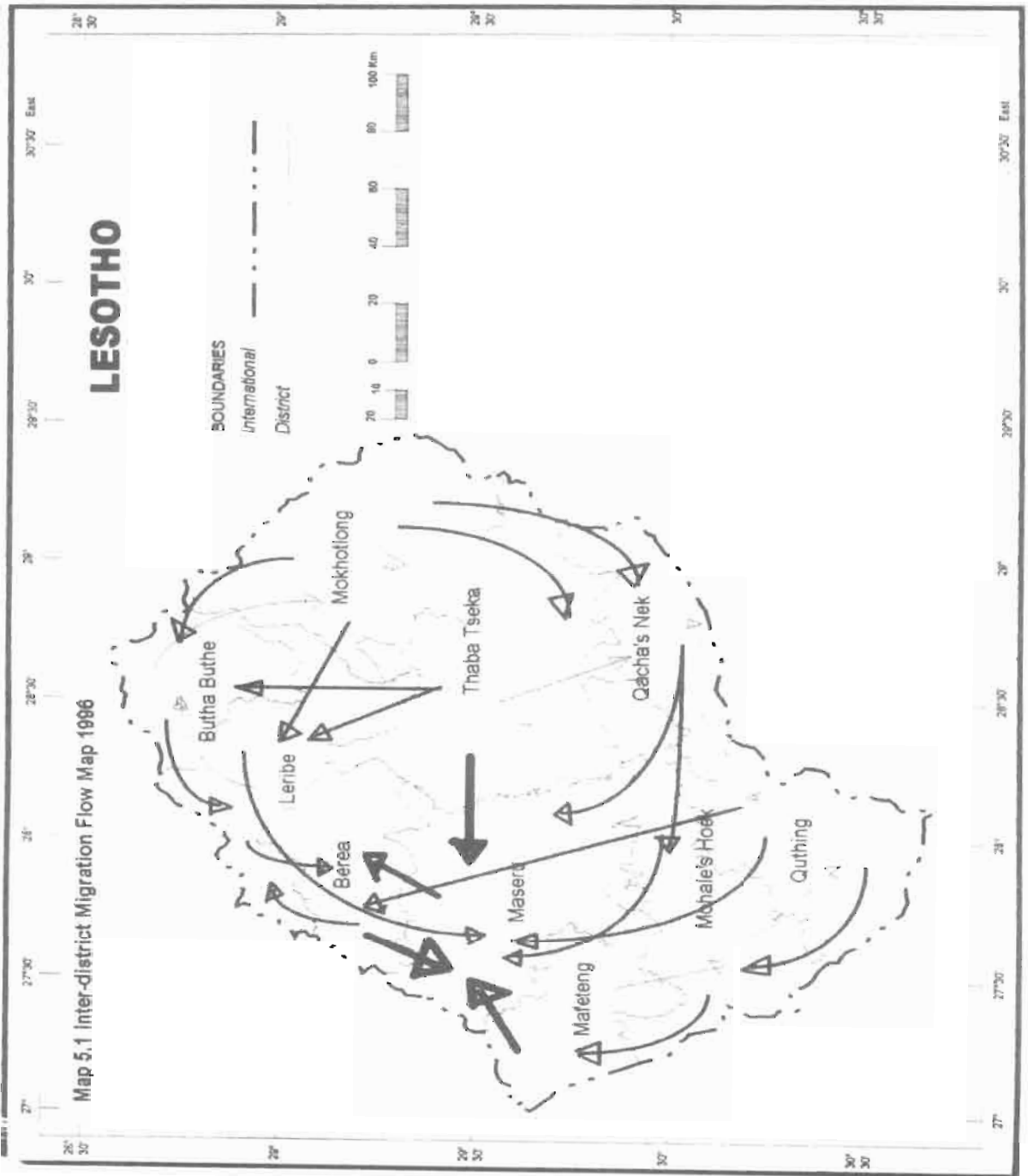
The quality of water is severely compromised by poor disposal of waste. For example, Khalema & Moteetee, (1997) showed that poor disposal of solid waste at Ha Tšosane dumpsite is affecting the water quality of a stream that discharges into Maqalika Dam. Molapo (1999) showed that high density of settlements and poor disposal of domestic waste are contributing to high pollution level in Sebaboleng Dam and to certain extent Maqalika Dam. Poor quality and the low levels of solid waste collection and environmental protection services is an issue of concern in Maseru and Maputsoe. The Maqalika Dam is the main source of drinking water for residents of Maseru, yet it is located below the slope of the dumpsite in Maseru (Plate 2.1). This slope indicates that when it rains, the run-off and the leachate drain into the dam, thus posing a problem to the water quality of Maseru, if the dumpsite is not properly managed.

The goal of the umbrella National policy on Environment is to ensure the protection and conservation of the environment with a view to achieving sustainable development for Lesotho. Hence, one of its key objectives is to “secure for all Basothos a high quality of environment to enhance their health and well-being”.<sup>27</sup> Therefore, the concept of proper solid waste management is a critical component of this objective. However, for a long time many contradictions and conflicts have abounded among sectoral policies concerning institutional roles on solid waste management in the country.

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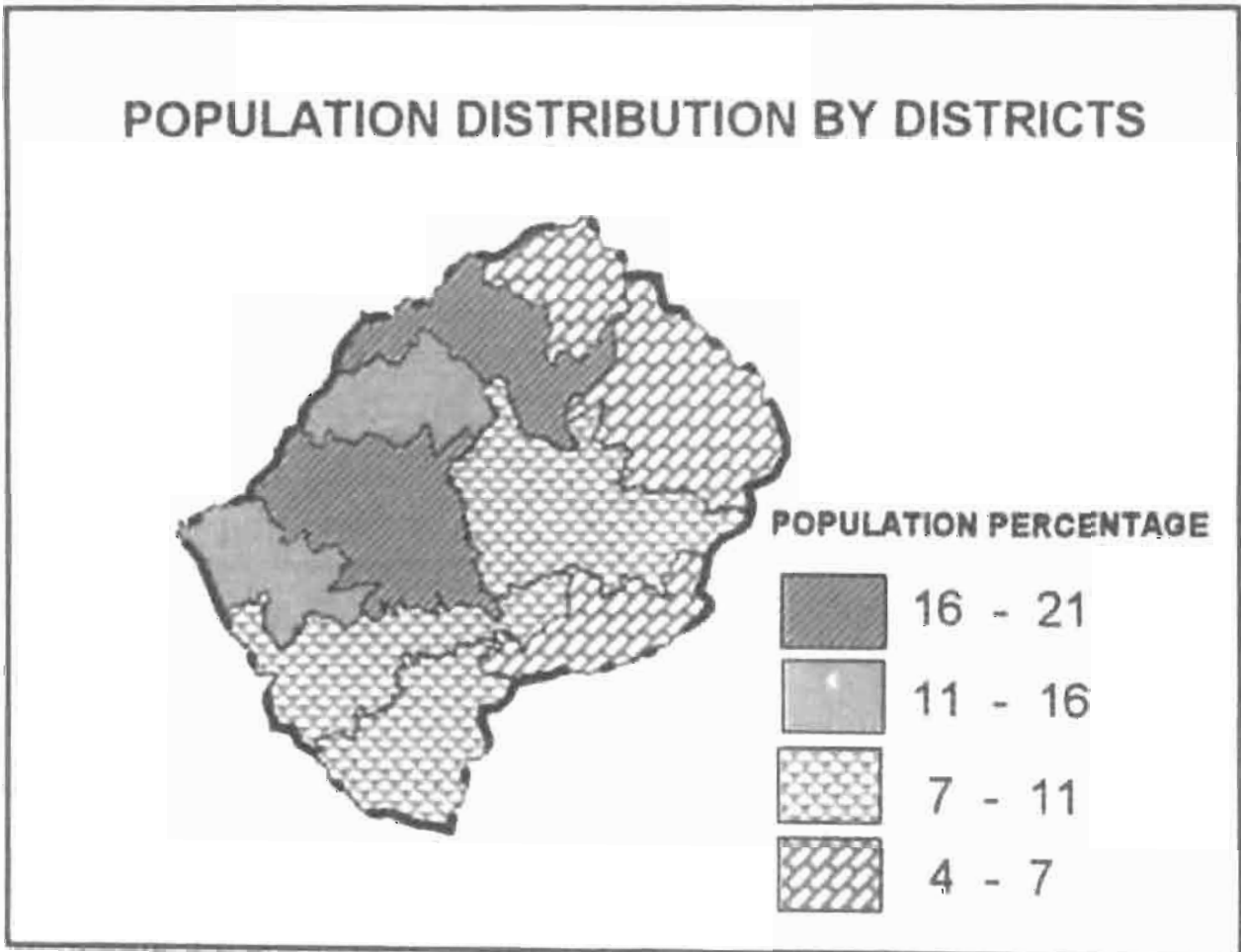
<sup>27</sup> The Clause 36 of 1993 Constitution of Lesotho

Map 2.6 Illustrating Rural – Urban migration in Lesotho (signifying why there is a concentration of more people in Maseru and Maputsoe).



Source: Population Analytical Report, 1996. Lesotho Bureau of Statistics

Map 2.7: Population Distribution by District



Source: Population Census Analytical Report 1996. Lesotho Bureau of Statistics.



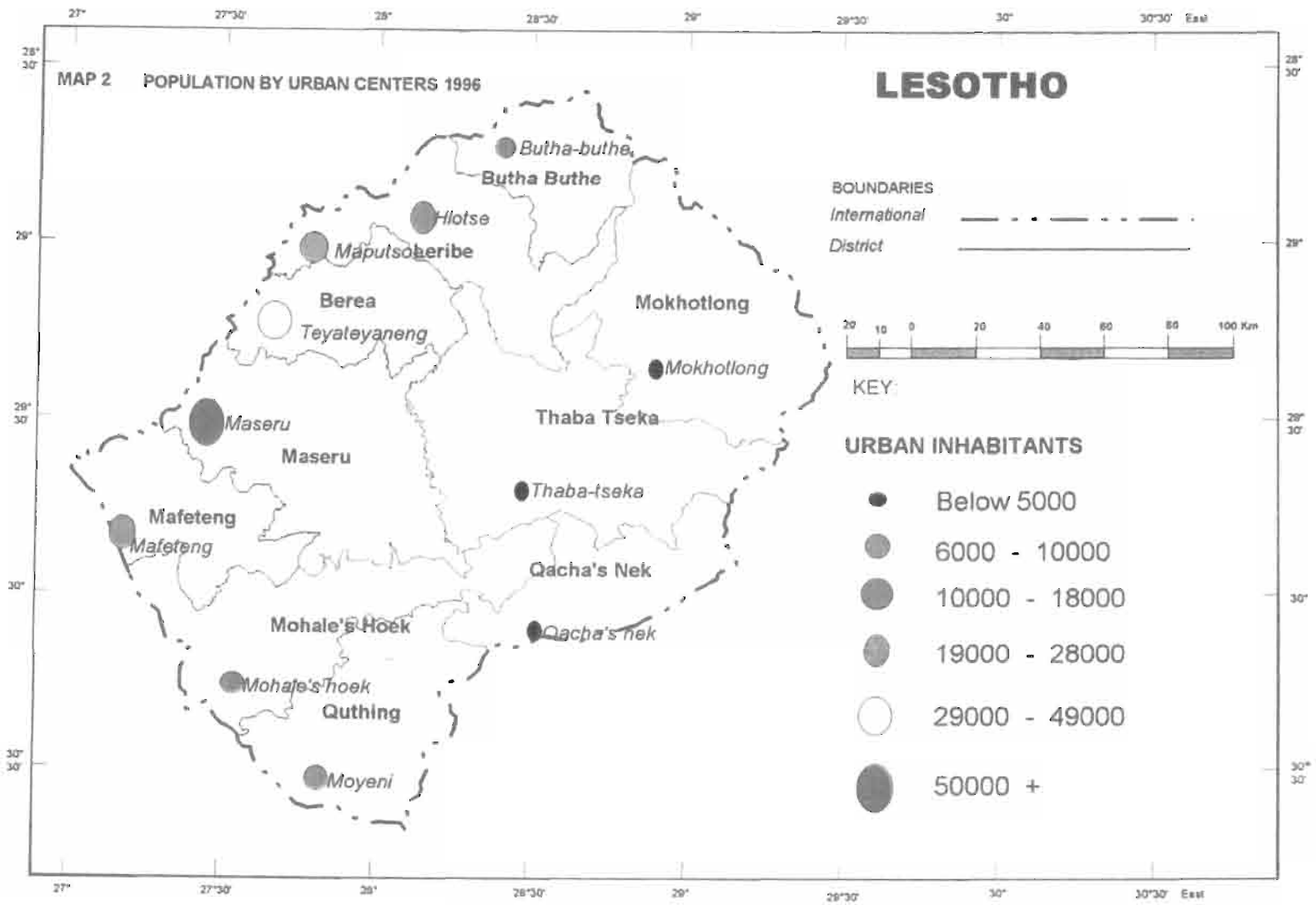
**Table 2.5: Projected Population and Labour Force in Lesotho 1991 – 2000 (In 000's)**

Year	Population			Working Age*			Labour Force*		
	Males	Females	Total	Males	Females	Total	Males	Females	Total
1991	900.7	933.4	1834.1	524.7	561.4	1086.1	446.0	421.1	867.1
%	49.1	50.9	100.0	48.3	57.7	100.0	51.4	48.6	100.0
2000	1040.5	1071.9	2112.4	601.6	636.4	1238.0	511.4	477.3	988.7
%	49.3	50.7	100.0	48.6	51.4	100.0	51.7	48.3	100.0
Absolute Increase	139.8	138.5	278.3	76.9	75.0	151.9	65.4	56.2	121.6
Percent Increase	15.5	14.8	15.2	14.7	13.4	14.0	14.7	13.3	14.0
Average Annual Increase	3.1	3.0	3.0	2.9	2.7	2.8	2.9	2.7	2.8

Source: Mlosy Christopher, December 2000

Note: \* Age group 15 years and above assumes average participation rates of 85% for males and 75% for females.

Map 2.8 Populations by Urban Centres in Lesotho in 1996



Source: Lesotho Bureau of Statistics 1998

**Plate 2.1: Showing Slope of Ha T'sosane Dumpsite Draining into Maqalika Dam**



Source: Photos <sup>28</sup> taken during data collection exercise.

Attempts to improve on the deficiency in environmental issues were made in 1998 when Lesotho published a National Environmental Action Plan with the assistance of the World Bank (GOL, 1989), and the umbrella Environmental Policy.<sup>29</sup> Even though this policy does not go into details on solid waste management, it does spell out in its objectives the promotion of safe collection, hauling and disposal of wastes based on established guidelines to reduce environmental pollution and the spread of diseases. This strengthens the need for more data and information on the subject in order to develop guidelines.

This study will therefore go a long way in the provision of data and information which is necessary and useful for policy makers to develop guidelines and specific policy on solid waste

<sup>28</sup> The photo in page 23 depicting the Scavenger, three Research Assistants and the Principal Researcher.

<sup>29</sup> Lesotho National Environmental Policy, April 1998, National Environment Secretariat, Maseru, Lesotho.

management. As already indicated, the availability of labour in both Maseru and Maputsoe has increased dramatically due to high urban population growth of these two towns, but has not been matched by economic development. Therefore, if properly coordinated with strong community involvement, recycling being a high labour-intensive activity and so should contribute substantially to employment generation. To this effect, Maseru and Maputsoe, where adult unemployment is currently placed at 44.8% (GOL, 1992), should be able to provide the required labour. And more especially, it has been estimated that if waste recycling and reprocessing is fully developed, the sector could employ about 2% of the urban population (Habitat, 1994). Waste collection, recycling and re-use could also alleviate poverty and create jobs in Lesotho, especially in the targeted areas namely Maseru and Maputsoe.

A need may arise to assess the preference of the community for certain collection and recycling schemes since its success will depend on their involvement. However, such an assessment will aim at securing the largest possible net gain to the community as a whole. Efficiency criteria should not be restricted to net economic gains but should incorporate an assessment of wider and sometimes less tangible external costs and benefits associated with collection, recycling and waste disposal in general.

As indicated in this chapter, it is re-emphasized here that, in developing countries, including Lesotho, disposal of municipal solid waste is often combined with ash, human waste (where sewerage systems do not reach substantial portion of the population), medical waste (Bartone and Bernstein, 1990), and industrial waste (Benavides, 1992). For this reason, municipal solid waste in developing countries is in most cases more harmful to humans and the ecological health than in industrialized countries, yet in these countries, municipal solid waste is often a resource to the poor. The findings of this study have implication for the handling of this type of waste and their recycling and re-use activities.

Most of the studies concerning informal sector tend to concentrate only on the socially acceptable and more visible activities of this sector, such as petty commodity production and hawking (Tevera, 1993). Few studies focus on the stigmatized informal-sector occupations such as waste harvesting (scavenging), prostitution and begging. This study assesses the benefits of waste harvesting, linkage between scavenging activities and hardships faced by these scavengers, and the

indicative occurrences of diseases amongst the scavengers in Lesotho, which may relate to these activities.

Lesotho's population in general and in particular those poor people in urban areas, experience serious fuel shortage through lack of biomass as a source of domestic fuel for energy (Mvuma, 2001). Some people, especially those in Maseru, urban poor residential areas are seen using textile off-cuts as a source of biomass energy for domestic cooking (Mvuma, 1997). This study will attempt to generate information useful for biomass energy fuel providers who would make briquettes. Notably, the data and information of importance would be the estimated proximate, ultimate and heat values generated in given amounts of waste in the study.

In summary, from the literature search and pre-leminary survey, solid waste management in Lesotho has a number of problems that require attention, including, but not limited to:

- Limited legal and institutional framework to manage waste, and absence of solid waste policy.
- High littering, particularly within major sites.
- Lack of a co-ordinating agency/WCA on recycling and inefficient collection system.
- Haphazard dumping of waste at inappropriate dumpsites that are sometimes unmanaged and situated in places that easily allow leachates and run-offs to go into drinking water courses. See the photo Plate 2.1 in this Chapter and Map 4.1 in Chapter 4 concerning the Ha T'sosane Dumpsite located in residential area).
- Lack of waste classification system, which leads to co-disposal of both hazardous and non hazardous wastes together.
- Localised air pollution of waste at dumpsites caused by burning of waste at dumpsites threatens the health of local communities.
- Limited awareness of waste management by the waste generators, what local and community level.
- Lack of financial resources.
- Lack of incentives for private sectors dealing with waste management.

- Lack of commitment by decision makers on the management of municipal waste<sup>30</sup>

The problem of waste management is further compounded by the fact that the generation of waste has, according to Mhlanga and Gulilat (1997) exceeded by far its collection services in every urban area in the country. The response to the above-mentioned problems led to the formulation of the objective of this research. These objectives are given in Section 2.8 of this Chapter.

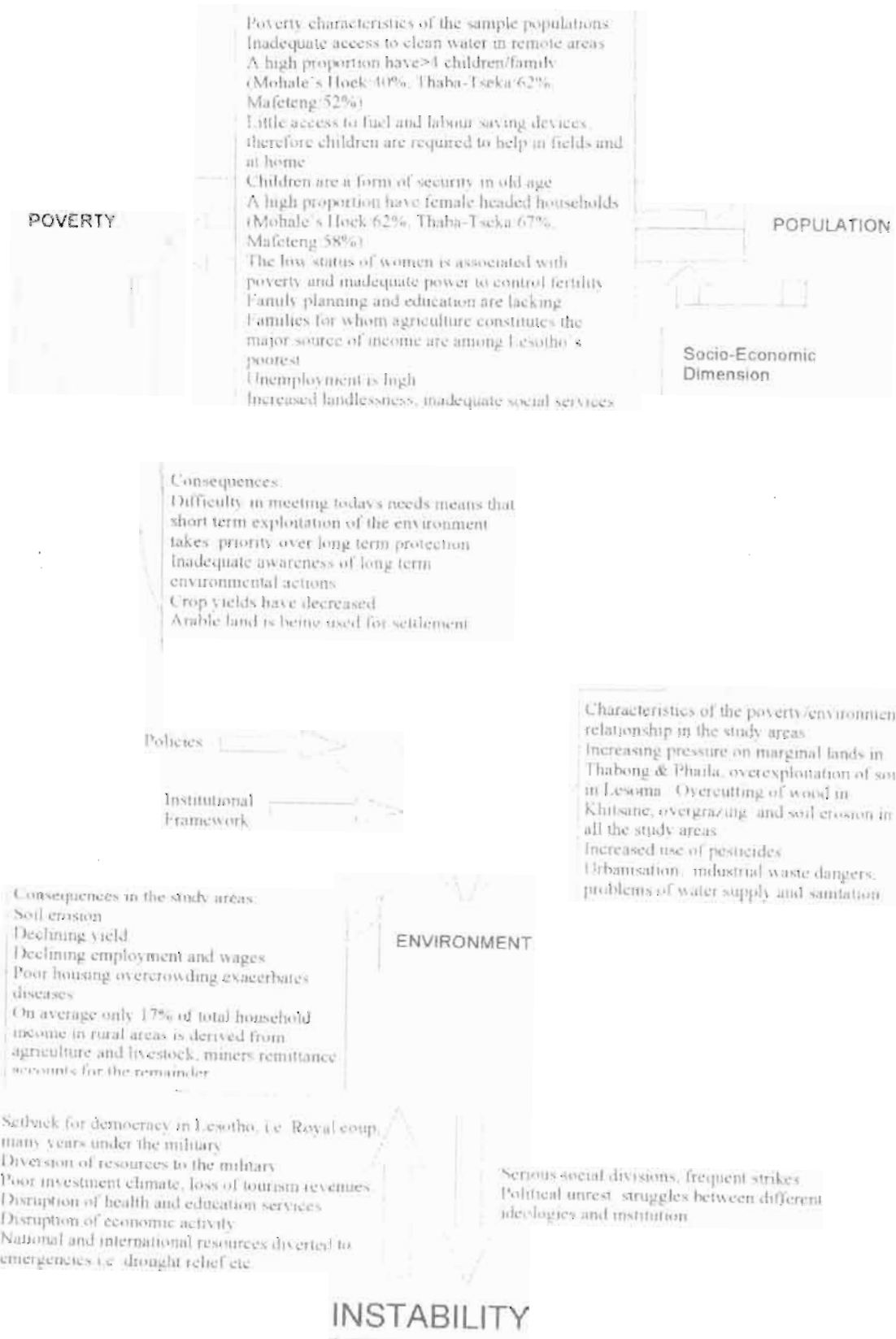
There is also a vicious circle of poverty that is linked to environmental issues, viz-a-viz solid waste problems as indicated in Diagram 2.6. Urbanisation results in more waste generated from households, rendering Local Authorities incapable of effectively handling the waste generated. This factor, combined with waste from the industries and commercial establishments pose dangers and problems to the human health and pollution to the environment.

To combat the dangers in the poverty circle may require attacking various points of the poverty circle as found in Diagram 2.6 The environment, in the form of waste management activities provides a point of entry in this process as long as these activities generate sustainable jobs. Since waste management can play a role in breaking the vicious circle of poverty, it calls for all the Basothos (and in this case, even all the SADC citizenry) to take note that waste management is a priority for everyone and that action is urgently required to address the problem. Community-based waste management, in which waste management systems contribute to sustainable development and improve the quality of life, would provide the route of solution to the problem. As already, indicated, recycling and solid waste management through entrepreneurship and the formation of micro-enterprises would seal the success of the programme. Indicative processes involved in this route are given in this chapter. This process would also be useful for those intending to start waste management practices that would benefit the community.

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<sup>30</sup> “Report on UNIDO Waste Management Training Workshop in Mozambique”. T’seliso Mabeli, NES, Lesotho, December 1998.

**Diagram 2.6 Poverty- Environment Cycle Linkages**



Modified from: UNDP/GOL 1995

### 2.7.1 Solid Waste Management as an Informal Sector: what is it worth in Lesotho?

It is stated by Mlosy (2000) that the poor depend mainly on income from labour to meet their daily needs. Any national strategy to increase employment opportunities and poverty alleviation must promote not only micro-economic stability and rapid economic growth, but also more productive use of labour. The waste management activities through recycling, reuse and composting are labour-intensive and hence could provide an avenue for utility of poor people's labour. In addition, cost recovery problems are a major cause of concern for Local Authority (LA) run solid waste management systems. The urban environment must receive both fiscal and political will. However, raising the political profile of this issue may prove to be a challenge. For many municipal types of council, waste management services have been operated at a budget between 3%-6%, with this service still tending to be the Cinderella (low profile) department. The challenge, therefore, is for the local Government officials to recognise the importance of alternative waste management services, which can produce a clean doorstep environment: a community-based waste management system, where a community is an active member and a partner. The sole running of waste collection services by LA always brings about an economic recovery problem. In Lesotho 137,837 households in Maseru urban and peri-urban, have only 8,000 on the list for receiving waste collection services and not all of these households receive waste collection services. The problem for this small coverage has been due to lack of capacity in terms of the haul trucks which mostly break down, a lack of integrated waste management system in which communities could be involved and general inefficiency.

The picture concerning these problems could be different if a community-based waste management system was put in place. For example, in some cases where the infrastructure such as roads would be a hindrance to access by vehicles, the hand or animal drawn carts or horses would have been useful means of transport. Worse still, the revenue incomes from refuse collection for 2000/2001 faced the problem of inefficiency and underperformance. The Maseru City Council projected revenue target from waste service in Maseru for the 2000/2001 financial year at M7.12 million. Yet the actual amount collected from this service during this period was only M1.2 million (MCC Annual Report, 2000/2001). The revenue collected represents only 17% of the targeted revenue. This is a gross underperformance. The MCC attributed this underperformance of revenue collection to poor methods of revenue collection and the payment apathy by the recipients of the service. This apathy to paying for the service could have come about due to poor



service provided. Concomitant to the low level of revenue collection from the waste service are annual expenses incurred from running costs, as shown in Table 2.6.

**Table 2.6 Annual Running costs for Health & Environment Dept (MCC 2000/2001)**

<b>Expenditure Item</b>	<b>Maluti</b>
Street cleaners	458,988
Refuse collectors	566,090
Professional staff	200,000
Repairs of trucks & tractors	340,525
Fuel for trucks	34,066
Fuel for trucks	15,344
<b>Total Expenditure</b>	<b>1,615,013</b>

Source: Computed by the Author from the Survey Data

From Table 2.6 it is shown that the running costs for the department responsible for waste collection is approximately M1.6 million. This represented a deficit of M 415,013, i.e. negative cost recovery of about - 35%. This therefore calls for a better-designed solid waste management system, to incorporate the principles of recycling and re-use and the aspects of community-based waste management components, in addition to proper revenue collection system. The essence of waste recycling and re-use is driven by a number of economic reasons, including:

- Cost reduction of waste management.
- Reduction of use of natural resources and energy consumption by industry.
- Generation of employment.
- Improve urban environment.
- Improvement of human health.

The availability of labour in both Maseru and Maputsoe sets pace for the promotion of recycling and reuse activities. If this labour is properly managed, following the principles of community-based approach, recycling as a labour-intensive activity has the potential for employment generation.

The problems highlighted in Section 2.7 and Sections 1.5.1, 1.5.2 and 1.5.3 of Chapter 1, coupled with the opportunity arising from the abundant labour available in Maseru and Maputsoe pose a challenge of linking the two issues and to find means that would turn these problems into opportunities. In addition, solid waste management, besides soil erosion and poverty are cited as the overriding problems in Lesotho (GOL, 1997; GOL, 2001; UNDP, 1997; Sechaba, 2001). Furthermore, through official meetings, while in Lesotho, the researcher was confronted with the sentiments expressing these major problems. Thus was prompted to carry out this study as a way of contribution to numerous solutions offered in response to these problems. To carry out this study required formulation of objectives. These are indicated in Section 2.8.

## **2.8 OBJECTIVES OF THE STUDY**

This study was formulated as a way of benchmarking the waste management problems and is the first such of its kind of magnitude and type in Lesotho, and most likely in the SADC Region. The study has encompassed gathering data and information from residential, industrial, commercial establishments, institutional settings, recyclers and waste harvesters in order to set pace in meeting the major objective of the umbrella environmental policy<sup>31</sup> of Lesotho: “To secure for all Basotho a high quality of environment to enhance their health and well-being”.<sup>32</sup> This in turn would help Lesotho to meet its goals for achieving the ethics of sustainable development as defined in Section 2.1.5. The overall and specific objectives of this study are therefore outlined in subsequent Sections 2.8.1 and 2.8.2 respectively.

### **2.8.1 The Overall Objective of the Study**

The overall objective of the research is to generate data and information that would be useful for designing appropriate and sustainable solid waste management systems in Lesotho. The systems that would improve the delivery of solid waste management services and geared towards community participation, job creation, and thus contributing to the economic growth and environmental and health benefits of the people in Lesotho.

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<sup>31</sup> Defined as a set of rules influencing how resources are allocated and who benefits from resource allocation; in other words, a set of governmental actions and statements made aiming at the improvements of the environment in order to meet sustainability objectives (ILO, 1992); or defined as a course of action adopted to correct a behaviour or bring about a desired change (UNIDO/UNEP, 1998).

<sup>32</sup> National Environmental Policy (1998). National Environment Secretariat, Maseru, Lesotho.

### 2.8.2 Specific Research Objectives

The specific objectives are:

- To investigate the appropriateness and relevance of existing environmentally related policies and regulations in addressing real problems of solid waste management.
- To assess people's understanding of the polluter pays principle.
- To assess the community's perceived level of existing solid waste management services and their preferences and attitudes towards these services.
- To establish people's willingness to pay for the waste services and levels of affordability.
- To determine the solid waste generation rates (per capita per person for households) and establish the types and quantities from selected generators at dustbin level.
- To investigate whether waste generators separate waste at source.
- To evaluate the economic benefits of the solid waste harvesting activities and to establish the profit of incomes made by recycling companies per annum, income generated by waste harvesters (scavengers) per month, and the number of jobs created in the solid waste management activities as an informal sector.
- To establish the demographic characteristics of the waste harvesters (scavengers), their families, and activities at the dumpsite.
- To investigate the hardships faced by waste harvesters (scavengers) in their day-to-day waste collection activities and the likelihood of adverse impacts on the human health of handling the wastes and their by-products.

## 2.9 ORGANISATION OF THE THESIS

**Chapter 1** gives a background on the socio-economic status of Lesotho, its general environmental and solid waste management problems in the country

**Chapter 2** superficially defines, through a partial review of existing knowledge the general problem of solid waste management at international, regional and local (specifically) Lesotho, within the context of sustainable development principles. In addition, it presents problem statement, justification of the study and its motivation in the unique area of solid waste management. The chapter also outlines the potential of solid waste management to contribute to employment creation in Lesotho. Finally, the chapter puts forth the objectives of the study.

**Chapter 3** examines the approach to best practices in obtaining data and information in solid waste management studies and presents the methodologies on how this study was executed.

**Chapter 4** is a consolidation of results on the status quo of the legal and policy framework concerning waste management in Lesotho, waste generation and disposal (from households, industry and commercial establishments) in Maseru and Maputsoe. In addition, the chapter describes the socio-economic benefits of the waste generated in terms of waste recycling and the potential to create jobs through waste harvesting, and the hardships the waste harvesters undergo in this informal sector. The chapter also presents the possible pollutants that may result from the waste if used as source of energy or disposed through incineration process.

**Chapter 5** discusses the results, identifies the gaps, concludes and presents relevant recommendations resulting from the study.

## CHAPTER 3: STUDY METHODOLOGY AND EXPERIMENTAL WORK

### 3.0 BACKGROUND

Although this study is country-specific, Lesotho, it is envisaged that many countries, especially those in the SADC region would find this information very useful for designing their waste management strategies and plans. The study heavily relied upon questionnaire responses and the outcome of personal interviews. In this case, therefore, it has become very necessary that the approach to the methodology of collecting data and information for the development of solid waste management systems should have some descriptive analysis of steps to be taken. A review of what others have done in the process of developing similar solid waste management systems is also included.

The examination of literature cited in Chapter 2 indicates that the essential first step in developing a sound municipal solid waste management system is the accurate determination of quantities in terms of generation rates and composition of the waste, and their location. This rationale is critical to the management of solid waste and many specialists buy in with this idea. For example, in Savage's paper <sup>1</sup> on solid waste management planning, it is strongly emphasized that waste characterization is a critical phase in the development of solid waste management systems and in their operation and performance. Savage (1996) distinguishes between operational requirements and performance requirements. Performance in this case includes meeting of acceptable standards for health and safety of waste handlers, and the environmental impacts. Performance also includes technical benchmarks such as costs and efficiency of collection and disposal. The operational aspect is the quantification of wastes, which includes description of amounts and properties of the solid waste, composition of materials and the location of these wastes. Indeed, characterization of solid waste is a fundamental aspect of solid waste management since it includes the performance of the process used for handling, processing and conversion of materials, thus bringing into play the physical and chemical properties of the waste. In turn, quantities of waste are important in the design of storage, collection, processing and disposal systems.

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<sup>1</sup> Savage, G. (May, 1996). Assessing waste quantities and properties: a vital requirement for successful solid waste management planning. Warmer Bulletin No. 49.

Furthermore, literature (Coffey et al. 1999; Beukering, 1999; Cotton, 1997) shows that during the last two decades there has been an increase in household studies based on community participation. However, the concern has mainly been in water and sanitation sector

On the other hand, when it comes to the solid waste sector, it is hard to find concepts based on a participatory approach. If the target population does not participate in the planning stage, this results into them not willing to pay for solid waste services, because a solid waste system differs markedly in many ways from those of water and sanitation (Anschutz, 1996). For example, it is not easily possible to exclude parts of target population from receiving the solid waste collection services, even if they have indicated, not willing to pay for, or cannot afford to pay for the services.

Moreover, this problem is exacerbated by an important factor of solid waste collection service, which is not in line with the expectations of the inhabitants. It then becomes very hard to find base for a regular payment of the service (Anschutz, 1996; Cointreau, 1987; UNCHS/Habitat, 1994). In this way, these two aspects become very important when handling municipal solid waste management issues. This is because these aspects aim at creating a community-based support for the sustainability of a solid waste service. That is to ensure the service is in line with local community's preference and needs (Anschutz, 1996).

The principal component of this research is intended to elicit critical pieces of information, on solid waste management issues to meet the requirements of objectives stated in Section 2.8. The critical pieces and types of information required were, namely:

- The appropriateness of existing environmentally related policies and regulations regarding addressing really problems of solid waste management.
- The perceived level of existing solid waste services and suggest the possible improved service alternatives;
- Preferences and attitudes of community regarding these services, with a view to proposing better options;
- The willingness of the people to pay for the improved services and the affordability of the options;

- The possibility of increased recycling activities and job creation through municipal solid waste management activities; and
- The hardships experience by the waste harvesters and the possibility of negative human health impacts resulting from waste handling.

In this case, these key issues are spelt out in the methodology and the approach to the methodology of this study. They are also the core issues upon which this study is based.

### **3.1 STUDY METHODOLOGY AND APPROACH**

Inherent in the concept of quantities and composition of solid waste is the need for methods and procedures of determining these components. The methods and procedures must be structured to produce reliable and accurate results. Perhaps worth mentioning is that the research methodology in municipal solid waste management is not carved in a stone. Several approaches have been suggested by different authors on this subject (Martin et al. 1995; UNCHS, 1995; Whittington, 1998; Woodyard & Klee, 1978). In this study, the research methodology only adopted approaches relevant to the realization of the objectives of this study as highlighted in Section 2.8. Hence, the approach to the study required adopting certain steps as suggested by other literature surveys. In this case, the steps adopted were as follows:

1. Desktop study of the existing policies and regulations on environment, which relate to solid waste management and assessment their appropriateness.
2. Survey statement and objectives-a clear understanding of the research objectives.
3. Survey delineation with a comprehensive description of the area for the survey and research.
4. Development of survey questions and techniques to ensure the questions are clear and understood by the intended stakeholders.
5. Determine survey layout and sample size to assist in the design of the questionnaire and estimate sample size.
6. Selecting and offering of simple training to the enumerators.
7. Piloting and revision of the questionnaire before implementing it in the field.
8. Implementation of research questionnaire and sample collection, sorting and weighing.

### 3.2 STEP 1 SURVEY STATEMENT

Why this research and survey was initiated is focused on the main objective 1 of the study as outlined in Chapter 1. “the generation of data and information necessary for designing appropriate and sustainable solid waste management systems in the country”. In the end, it would be difficult to achieve this overall objective, without appropriate policies and regulatory guidelines in place. This strengthens the point that existence of appropriate policy and regulations on solid waste does create an enabling environment for proper solid waste management, which leads to job creation, good quality of life and improved health of the people.

The major objective of the study arose from the general concern expressed in several environmental meetings the researcher attended. In these meetings, it was mostly remarked that solid waste management and soil erosion<sup>2</sup> (as a symptom) were major environmental problems confronting the great Kingdom of Lesotho.

### 3.3 STEP 2 SURVEY DELINEATION

The second step of the methodology involved delineation of the scope of the research and description of all terms used as per Appendix A 1. This helped to determine where the study was going to take place and defined the parameters to be determined. In this case, the survey delineation of this study took into account the growth of industrial sector activities and the population growth of the country as shown in Map 2.8 and Table 2.5 of Chapter 2.

The other factors taken into account included the observed presence of illegal dumpsites and the increased in numbers of scavengers in these areas. In addition, solid wastes from households (in terms of high, middle and low income),<sup>3</sup> industries and commercial establishments were other factors of delineation. However, the Construction and Demolition (C &D) and the Medical Waste were excluded from this study. Hence, these two types of waste were not taken as a factor

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<sup>2</sup> Soil erosion is usually cited as an environmental problem, yet it is a symptom of poor land use practices.

<sup>3</sup> High, middle and low-income households were determined by the nature of the house and sometimes the area where they were located.



. In addition, the waste from institutions such as Governments offices, hotels and schools were not included in this study because of their coverage in Mhlanga/Gulilat study of 1997. The lowland towns of Maseru and Maputsoe also met the criteria. (See Maps 1.1 and 1.2 of Chapter 1; 2.6 and 2.7 of Chapter 2).

As already indicated, Ha Ts'osane and maputsoe were categorized as low-income, Katlehong as a middle-income, Hillside and Maseru West as high-income areas. Middle-income households were difficult to characterize. The initial assumption of deciding the criteria was the location: high-income houses were those in well-planned areas and villas, with servants quarters; while middle-income houses were those in semi-planned; and the low-income were houses in low-cost unplanned areas. This was later checked and verified by the results of the answers from households in the study. In the end, the percentage of each category was as follows:

- High income 35.46% (with a monthly income above M3,000, and average of M5,600).
- Middle income 18.32% (with monthly income M600-3,000, and average of M1,020).
- Low-income 46.22% (with monthly income below M600, and average of M240).

### **3.4 SURVEY QUESTIONS AND TECHNIQUES**

The formulated questions constituted the questionnaire. Questionnaires were designed with an opening statement according to UNCHS (1995), which addressed the whys, whats and hows of the study and the assurance of confidentiality. This was important because it gave flexibility in formulation of questions to obtain certain type of required information. However, in most of the published literature, hardly any attention was paid to the detailed formulation of the several forms of contingent valuation questions.<sup>4</sup> This would have led to missing out of many necessary pieces of information required. In this study, this problem was avoided by narrowing down to specific important areas. Questions were formulated to cover four areas of importance in the formulation of sustainable solid waste management systems, as outlined in the introduction section of this Chapter.

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<sup>4</sup> WASTE, (September 1998). Marketing of Solid Waste Services in Tingloy, Philippines.

These areas were:

- The policy – legal related institutional issues.
- The waste generating entities, which in this case comprised three types of agents, namely: households, commercial and industrial establishments.
- The recycling activities.
- Waste harvesting (Scavenging) activities.

These questions focused on the existence and appropriateness of policies and regulations on solid waste management taking into account conflicts, performance of waste collection services, economic benefits and job creation of solid waste activities, community involvement, affordability and willingness to pay for services and general human health impacts of solid waste handling. The questions were formulated to cover specific issues as highlighted below.

- Establishment of the demographic characteristics of scavengers, their families, and activities at the dumpsite and hardship experienced, including getting the indicative human health impacts of waste harvesting activities by finding out the frequency of occurrences of certain ailments they suffered from before engaging in waste harvesting activities and after engaging in these activities.
- Determination of solid waste generation rates and establishment of the types and means of disposal for such wastes from selected households, industrial and commercial establishments of the two towns, by means of actual measurements, survey questionnaires and personal interviews.
- Investigation into whether collectors separated recyclables from non-recyclable and the means of transportation of these solid wastes. This was done through questionnaires and personal interviews of people in selected areas in order to establish the possibility of involving the communities to transport the wastes to designated satellite waste collection/drop-off points. This was carried out with a view to sourcing information on how these activities could generate incomes and jobs, and in addition, to set new partnership with the communities.
- Establishment of the willingness of people to pay for the waste removal services and the affordability to pay for such services.

- Evaluation of the economic benefits of these solid wastes, especially paper, plastics, beer and soft drinks cans, organic matter and textile materials, for the purpose of income generation, and job creation in terms of re-using, recycling and composting for organic manure and as a source of biomass energy.
- Investigation of the relevance and existence of policies and regulations concerning solid waste management, and assessment of their conflicts and the general understanding of polluter-pays principles by generators and policy makers. This was done by means of questionnaire administration and literature reviews on the subject matter, including personal interviews of Government officials and other stakeholders.
- Investigation of the likelihood of adverse impacts on the human health resulting from handling of these wastes and their by-products, with a view to provide advice to the government, waste collectors and handlers through the results of this study. This was also based on the questionnaire responses by the responsible people and in this case, the waste harvesters, generators and policy makers.

The designed questionnaires were then sent to Prof. Fredric Otieno of the University of Durban~Westville. In addition, the questionnaires were also sent to other solid waste management experts with vast experience in this area, such as Prof. Sosten Chiotha of Leadership for Environment and Development in Zimbabwe and Dr Henry Sibanda, Chief Technical Advisor of NEYC/UNDP Project in Lesotho. The comments from these people were incorporated into the questionnaires.

A pre-testing of time taken to answer each questionnaire was also done and the time taken to answer ranged between 35-60 minutes depending on the set of questionnaire.<sup>5</sup> i.e. waste generator, or waste recyclers or waste harvesters.

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<sup>5</sup> For a detailed description and application of contingent valuation questions, Alfa and Deshazo (1996), and Whittington et al. (1990) provide interesting insights.

### **3.5 SELECTING AND TRAINING THE ENUMERATORS**

The total number of enumerators needed to carry out the survey depended on the total number of respondents to be interviewed and on budgetary and time limitations. This study required administration of questionnaires, actual sample collection and sorting out and weighing of these samples. To meet this formidable task, six enumerators were selected. Several criteria used when selecting enumerators to carry out such research were considered. In this study, the enumerators were selected according to the following criteria (Tejam & Ross 1997):

- Proficiency in language or dialect of the area coverage;
- Persons with experience in doing surveys and research;
- Persons coming from or living in the survey area; and
- Persons with enthusiasm and a certain intention to learn.

All the enumerators met these criteria. The enumerators then received background information about the objectives of this research and the need to observe a set of procedures to encourage honest responses and eliminate biases. Finally, the enumerators were instructed on how to conduct the survey and what to do in case of problems. Mr. Molapo of NES played a major role in this part because of his previous experience in his Masters project. The procedure guidelines for instructing the enumerators were simple (UNCHS, 1995; Whittington, 1998):

- Be honesty in your work;
- Be completely objective in your manner;
- Be accurate and neutral in asking and recording answers;
- Be reliable and conscientious;
- Be understanding and patient;
- Be presentable; and
- Be confidential.

### **3.6 PILOT TESTING THE QUESTIONNAIRE**

Minor problems were experienced in this task because of the intensive nature of ensuring that right questions were formulated and well constructed. Checks and balances on the questionnaires focused on fluency of the questionnaire, i.e. smooth transitions from one section to another; total time taken needed for the whole questionnaire to be implement; and the design and layout.

From the few tests conducted on the scavengers, waste generators and policy makers, necessitated some minor changes to be made to questionnaires, and these were done.

### 3.7 SURVEY LAYOUTS AND SAMPLE SIZE

Time was spent on the aspects of questionnaire presentation. In this study, the various stakeholders in the solid waste management process in Lesotho were grouped broadly as:

- Waste generators (household, commercial<sup>6</sup> establishments, such as markets and shops, and industrial establishments);
- Waste collectors/processors (waste harvesters or pickers) including the Itinerant Waste Buyers [(IWB) and the recycling units); and
- Policy makers (Government and parastatals).

The selected areas of this study are as stated in Section 3.3: Maseru and Maputsoe towns in Lesotho. However, it must be reiterated that since the socio-economic level of population affects the quantities and the nature of waste generated (Vesilind & Rimer, 1981), it was expedient that a stratified random sampling procedure (Walpole, 1982) was applied. In this case, sampling sites were allocated as high, middle or low- income socio-economic categories, according the criteria indicated in Section 3.3. Socio-economic level of families was determined based on the housing type of each family (Van der Broek & Kirov, 1972): those families with a high-income level live in houses in well-planned areas; those of middle-income live in flats and houses in semi-planned areas; while the low income live in low-cost houses in unplanned areas.

In accordance with the stated conditions, Maseru and Maputsoe were decided as follows:

**Maseru:** Hillsvieiw and Maseru West were selected as high-income residential areas. Katlehong was selected as middle income while Ha T'sosane was chosen as low-income area.

**Maputsoe:** The households in this town displayed a typical set of an unplanned town. There was no specific demarcation of locations in terms of low and high-income areas in this town due to its unplanned nature. Although few of these households physically

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<sup>6</sup> The waste generating category on commercial excludes Hotels; while that of institutions excludes educational institutions and hospitals.

appeared to be of the middle-income category, it was difficult to ascertain their status because they were in a typical unplanned area. Hence, due to the difficulty of easily identifying the class into which these few households fell, the status of all these households in Maputo was generally grouped into low-income categories. This was verified to be correct from the results of socio-economic responses, as indicated in Chapter 4.

The other stakeholders taken into account for the questionnaire administration were Waste harvesters (scavengers) and selected industrialist in some industrial establishments, shop owners in commercial areas, public officials in Government, those of parastatals, NGOs, and the recycling companies in Maseru. Though questionnaires were pre-tested for between, 35 to 60 minutes to fulfill, the respondents were given as take-home questionnaire and were given an opportunity to think the questions over. However, this was with an exception of those submitted to waste harvesters (scavengers) at dumpsite, the questionnaires were completed by enumerators and collected on the spot.

Ideally, the required sample size depended on two key factors: the degree of accuracy and the extent to which there was variation in the population in regard to the key characteristics of the study. In this study, for the purpose of data collection, a limited sample survey was considered for some stakeholders, mainly due to their being limited in nature. Such limited stakeholders included the recycling companies, industries, commercial settings, institutions and waste harvesters/pickers. Therefore, the major survey was confined to the waste-generating category, especially households, and to a certain extent, to industries and commercial settings. The study was designed to at least randomly cover more than 30 households from each selected residential area. Usually 50 households or above were covered. However, problems were encountered where occupants of some houses were not readily available. Even in this circumstance, efforts were made to ensure that at least 20 households were randomly covered. The principal researcher accompanied by at least one research assistant visited the household late in the evening.

### **3.8 SAMPLE WEIGHT OR ABUNDANCE**

In addition to questionnaire administration, as stated in item 3.7, solid waste samples were also collected and classified. The normal practice would have been that when sampling for quantity or composition of solid waste, the weight or abundance of individual samples should be sufficient to

overcome the variability in the amounts and components produced. Woodyard and Klee (1978) have developed curves for selecting the proper sample size for a desired level of precision for number of components. For example, using samples of 90 kg, a precision of + or - 10% and confidence interval 90% is obtained through the following number of samples for each component:

- Organic (10 samples);
- News print, ferrous, glass, aluminum (80 samples); and
- Corrugated paper (500 samples).

According to a recent study by Martin *et al.* (1995) conducted in Mongolia County, West Virginia, (U.S.A), in which a sampling protocol for composting, recycling and re-use of MSW was developed, the number of samples of 90 kg weight required to have a 95% confidence interval (with 1% sampling error) would be as follows:

- Putrescibles (92 samples);
- Paper (87 samples);
- Metals (35 samples);
- Glass (19 samples); and
- Plastics (13 samples).

However, the 90kg sample weight refers to samples taken from collection vehicles at transfer stations or landfill sites. Lesotho has no such facilities. Therefore, in this study, it was impossible to get samples of 90 kg weight, as the samples were taken directly from households, commercial and industrial establishments. It was observed in the study that the resultant average sample weight was about 3 kg. It was also assumed that the large number of samples collected would overcome the limitation of sample weight.

### **3.9 PHYSICAL AND CHEMICAL COMPOSITION**

The physical and chemical analysis part of the data processing was intended to assist those who would use the data for purposes of determining the use of solid waste as a source of biomass energy, composting of these wastes for manure and biogas, and the designing and choice of waste disposal facilities (especially incineration). The physical and chemical data was obtained through desktop study of the values of proximate, ultimate and heat values, derived from literature. This was then related to indicative amounts of energy, which could be obtained if used as briquettes of

paper or any other combustible waste, and what emissions could be expected from combusting such waste. Therefore, the chemical component, which was designed to assess the usefulness of the solid waste as source of biomass energy and other uses as mentioned in this section was narrowed only to proximate, ultimate and heat values. Details of these are given in Chapter 4.

### **3.10 ACTUAL IMPLEMENTATION OF THE RESEARCH STUDY: QUESTIONNAIRE ADMINISTRATION AND WASTE CHARACTERISATION.**

In order to obtain meaningful data and correct information, the study was focused on issues highlighted in item 3.4. The researcher, with the assistance of NES staff (Mr. Molapo and Mr. Phakisi) and six enumerators (Mampoi Kabi, Teboho Makara, Liepollo Monaheng, Litsoanelo Ranthamane, Rahaba Ntsalla and Pusetso Maitin) undertook several activities to obtain data and information from both primary and secondary sources using structured questionnaires and personal interviews. The persons interviewed were among some heads of Government institutions and parastatal organizations, industrialists, commercial business owners, recyclers and waste harvesters.

#### **3.10.1 Dissemination of Questionnaires**

After the required number of samples for each category in terms of generators, policy makers, recyclers and waste harvesters had been decided, the main sampling survey started in March 1999. The questionnaire survey took over a period of six months during which 325 questionnaires were administered. Out of which, 251 were for households, 11 for industries and 13 for commercial settings, 10 for institutions (public offices), four for recycling companies and 36 for waste harvesters.

#### **3.10.2 Sample Collection, Sorting and Characterization**

Based on the selected required number of samples stated in item 3.10.1. There were 251 households selected. Of these households, 89 were residences with high income, 46 residence with middle income and 116 residences with low income. The residents of each house were supplied with two sets of plastic bags and asked to segregate kitchen organic waste in separate bags according to the waste categories shown in the questionnaire.



At the end of 7 days (one week)<sup>7</sup> the bags were collected from households and were taken to a central sorting station at the Ministry of Environment building. Here, samples were aggregated, hand sorted and characterized according to categories: paper, plastics, organics, cans, textile, glass and the potential hazardous waste (PHHW).<sup>8</sup> As similar process was undertaken for the industries and commercial establishments. The results of the weighed samples were recorded in the notebooks and have been tabulated and analysed in Chapter 4 of this thesis.

### 3.10.3 Personal Interviews and Desktop Research

The researcher undertook personal interviews of some Government, municipal and personnel of other concerned institutions on the solid waste management policies and legal framework in order to assess their sufficiency and investigate conflicts and appropriateness to addressing the issues. This process took over a period of three years and six months. The results have also been given in Chapter 4.

### 3.10.4 Physical and Chemical Composition of Solid Waste

Section 3.9 of this Chapter indicated the need for knowledge of the physical and chemical composition of the solid waste for purposes of planning the solid waste management systems, including the use of the waste as a source of biomass energy, composting and disposal by incineration etc. According to Savage (1996), physical properties relevant to solid waste characterization are based on proximate, while the chemical properties include ultimate analysis (i.e. carbon, hydrogen, oxygen, nitrogen, sulphur and to a certain extent chlorine), metals analysis and other toxic compounds.<sup>9</sup> In Lesotho, some of the solid wastes collected by waste harvesters at dumpsites and other sources are used as biomass fuel. A need may also arise to use incineration as an option for disposal of the waste.

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<sup>7</sup> The Maseru City Council waste collection service is offered once weekly. The exercise had to emulate this.

<sup>8</sup> The Potential Hazardous Waste comprises the small batteries, small amounts of chemicals and sweepings at the household level, while at industry level it includes brick making clay fall-offs and sweepings

<sup>9</sup> Taking into account the low industrialization nature of Lesotho, it was assumed that the analysis for toxic metals and other compounds, which could be very expensive and sophisticated, would not be necessary in this study. To this effect, the values of proximate, ultimate and heat have been obtained from the literature.

In addition, some of the waste would be composted for manure and biogas. Hence, estimates of energy content through proximate, ultimate and heat values may be essential in case there would be intentions to make waste briquettes and plans for waste management systems. This would be necessary in order to estimate what and the quantities of resultant pollutants from these wastes, when any option of a process was chosen. As stated in Section 3.9, these values have been determined from literature,<sup>10</sup> which was readily available in Liu & Liptak (2000). The results from this section have also been tabulated in Chapter 4.

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<sup>10</sup> Hazardous Waste and Solid Waste, David Liu and Bella Liptak, 2000, Lewis Publishers, New York, USA

## CHAPTER 4: RESULTS, ANALYSIS AND DISCUSSIONS

The analysis of data is split into several sections. The first, Section 4.1, addresses the legal framework analysis from desktop study and policy analysis to the responses of questionnaires in the survey of institutional establishments. The next Section 4.2 addresses the issues of households waste generation and their factors, such as generation rates, quantities and frequency. Section 4.3 is about the analysis of responses to the questionnaire in the surveyed households. Section 4.4 concerns the waste generation from industrial and commercial establishment. Section 4.5 is about analysis of the frequency of waste generated by establishments. and their questionnaire responses. Section 4.6 addresses issues of waste composition comparison by countries. Section 4.7 is about questionnaire responses on resource recovery, reuse and recycling activities. Section 4.8 considers the questionnaire responses from waste harvesters (scavengers). Section 4.9 describes the physical chemical properties of solid waste generated in Lesotho.

### 4.1 SOLID WASTE MANAGEMENT LEGAL FRAMEWORK AND POLICY REVIEW.

#### 4.1.1 Legal Framework Review

The current constitution of Lesotho, as indicated in Section 2.4.1 of Chapter 2 of this thesis, requires that policies that the country adopts should ensure the highest attainable standard of physical and mental health of its citizens: those that are geared to environmental and industrial hygiene, including the improvement of public health.<sup>1</sup> Legislation and regulation addressing solid waste issues in Lesotho can be summarised as follows:

The Local Government - Model Sanitary and Public Health By-Law 1963 (GN No 45 of 1963)	States the general provisions for sanitary services to be applied and implemented with the objective of securing public health.
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<sup>1</sup> Section 27 paragraph. (1) (b) & (e)

<p>The Local Administration Act 1969 (Act No 13 of 1969)</p>	<p>Authorises the Ministry of Local Government to issue regulations regarding public services to be implemented at local level.</p>
<p>Sanitary Services and Refuse Removal Regulations 1972 (LN No 36 of 1972)</p>	<p>Regulations which contain rules for the storage and removal of waste from private premises, the Local Administration Act (1969)</p>
<p>The Public Health Order 1970 (Order No 12 of 1970)</p>	<p>Addresses the issue of nuisance problems arising from waste deposits at private premises.</p>
<p>The Urban Government Act 1983 (Act No 3 of 1983) The Act has to date only been partially implemented</p>	<p>Provides for the establishment of local executing authorities in the form of municipal and urban councils. So far, only Maseru City Council has been established, following local elections.</p>
<p>The Land Act 1979 (Act No 17 of 1979)</p>	<p>Mandates the inclusion of statutory conditions for leases other than agricultural leases, i.e. waste treatment facilities other than disposal sites to be established outside urban areas.</p>
<p>The Town and Country Planning Act 1980 (Act No 11 of 1980)</p>	<p>Provision for the establishment of waste disposal sites are governed by this Act.</p>

The Environmental Act 2001  
Parts II & VI

Provision of the right to a clean and healthy environment and the prescription of waste standards for segregation and disposal

In the subsequent paragraphs, a more detailed description of these listed legislation and regulations will be made, also highlighting major discrepancies and omissions in the present legislative framework regarding solid waste management.

**The pre independence Local Government - Model Sanitary and Public Health By-Law (1963)** in section 17, under the heading, “Sanitary Services Regulation”, provides, besides requirements to individual waste receptacles at private premises, a definition on unauthorised waste disposal:

*In any area where a sanitary service has been established in pursuance to paragraph (1) of section sixteen, the following regulations shall apply:*

*(h) no person by himself or by any member of his family or by his servant shall throw or deposit, or allow to be passed into or upon any street or open space any refuse or waste matter of any description;*

*(i) no person by himself or by any member of his family or by his servant shall throw or deposit upon any land or premises any refuse or waste matter likely to cause nuisance, offence or annoyance.*

A violation of these provisions, carries on conviction a fine not exceeding M50, or in default of payment thereof to, imprisonment not exceeding three months (section 33(1)). The By-Law was amended in 1968, but the above-mentioned provisions were not among those repealed or amended (cf. GN 88/1968). In addition, the wording of these sections shows that they do not address the main issues of health and safety and environmental protection, but they are only clinical in nature. For example, three month’s imprisonment is not enough, yet the impact on the environment and human health of such behaviour is major.

It is difficult to draw a clear line between the term “open space” and “any land” used in subsections (h) and (i); the comportment of “open space” includes in ordinary parlance also “land”. The distinction makes only sense if the word “land” is set against the term “premises” in subsection (i); “premises” is defined in section 2 as meaning “any land or building room, structure, tent, van, vehicle or place covered or enclosed, whether built or not and whether public or private”.

Waste deposited in covered or enclosed places is usually less conspicuous and therefore requires resources to dispose them, presumably because their storage may be safer. Therefore, the legal element is added that they are *“likely to cause a nuisance, offence or annoyance”*. The distinction to be drawn between subsections (h) and (i) appears to be the following: the former deals with waste deposited in an open area, the latter wastes deposited in an enclosed or covered area. The word “land” in subsection (i) must, therefore, be given a very narrow meaning.

At first glance, the two subsections appear to prohibit unauthorised waste disposal in rather broad terms. However, the scope of application in reality is limited. Firstly, they apply only in so-called Government reserves (see section 3), i.e. in towns in Lesotho designated as urban areas (cf. section 3 (1) of Local Administration Act 1969), and secondly, only to those Government reserves which have actually established sanitary services for the removal of waste (cf. sections 17 and 16 (1) of the By-Law). It was apparently felt that anti-litter regulations could be enforced only in those areas of Lesotho, where corresponding public removal services exist. In this case, to persecute someone knowledge is needed in order to convict, and capacity to monitor and enforce to bring people to book. Currently, capacity is one major issue to be considered together with awareness.

**The Local Administration Act (1969)** in section 4(1), authorises the Minister responsible for local administration to make regulations, i.e.:

*(d) to establish, install, build and maintain drains, latrines and public lavatories and to establish, maintain and carry out services for the removal and disposal of refuse and night soil and other effluents;*

*(j) to control the depositing in streets, public places and unoccupied land of refuse, derelict vehicle and rubbish of whatever nature.*

In exercising the power vested in him by the above-mentioned section 4, the Minister passed the **Sanitary Services and Refuse Removal Regulations (1972)**.

Regulation 12 places a duty on every occupier of premises to provide a sufficient number of receptacles on his premises and to deposit any refuse into them. Such an obligation, however, exists only where the municipalities establish services for the removal of such refuse.

**Regulation 12 states:**

*(1) Whenever a service for the removal of refuse has been established for a particular area, every occupier of premises within that area shall provide on his premises a sufficient number of receptacles for the reception therein of refuse as the health officer may direct, and he shall thereafter maintain and replace them as the health officer may deem necessary.*

*(2) Every receptacle provided in pursuance of subparagraph (1) hereof shall be:*

*(a) of a capacity not exceeding three cubic feet;*

*(b) of galvanised metal or of other material approved by the health officer;*

*(c) cylindrical in shape, and*

*(d) fitted with an effective cover.*

*(3) Every occupier shall cause all refuse from his premises to be placed within the receptacle provided in accordance with these regulations and not elsewhere.*

*(4) Every occupier shall cause all refuse receptacles upon his premises to be covered continuously safe when refuse is being deposited therein and removed there from.*

*(5) No occupier shall deposit, or allow to be deposited any refuse upon the land or premises which he occupies.*

*(6) No occupier shall deposit or cause to be deposited in any receptacle provided for the reception of refuse any un-extinguished ashes or other material likely to cause a fire, or any liquid matter whatsoever.*

The above paragraph (5) of regulation 12 apparently cannot be used as a legal basis to prohibit the deposition of refuse on any land or premises. As paragraph (1) of regulation 12 and also the margin next to it indicate, such prohibition is restricted to areas where refuse removal services have been established.

Regulation 12 overlaps more or less with section 17, subsections (a), (c) to (i), and (k) of the Local Government Model Sanitary and Public Health By-Law (1963). The Adaptation of the By-Law Order 1968 (GN 88/1968) essentially only changed the names of Government bodies or official responsible for implementing the By-Law, but left the content of the By-Law intact. The provisions contained in section 17 of the By-Law are therefore still applicable, in theory.

As the later law, the Regulations may have implied that the corresponding provisions of the 1963 By-Law were repealed. Yet, this still leaves the question unresolved whether the other stipulations are still in force, namely section 17(f), requiring it to keep refuse receptacles and the covers thereof clean and in good condition, and section 17(g) requiring keeping of receptacles in an “approved position”. Since these provisions are not inconsistent with the later Regulations, they appear to be still in force.

***Regulation 14 stipulates that no person shall:***

*(a) keep or deposit, or cause or allow to be kept or deposited on any premises (including vacant land) whether he is the occupier of such land or not, any accumulation of filth, night soil, rubbish, refuse, manure or other offensive matter so as to be a nuisance to others or injurious or dangerous to health;*

*(b) occupy or cause or allow to be occupied any dwelling or other premises not provided with proper and sufficient sanitary conveniences;*



*(c) deposit or store within the public view upon premises, whether fenced or not, any disused vehicle or machinery or parts thereof or second-hand or unsightly building materials or unsightly materials, used or to be used for trade or manufacturing purposes, or any rubbish or refuse, and the District Administrator may serve a written order on the occupier or owner of such land or premises requiring him within a period prescribed in the order to remove any such material or thing from the public view or to enclose and screen it within a fence, hedge or wall to the satisfaction of the District Administrator, and any occupier or owner who wilfully disregards such an order shall be guilty of an offence;*

*(d) the occupier or owner of any land or premises shall keep them clean and free from filth, debris, rubbish, scrap, metal, lumber, or any vegetable growth which is likely to become a public nuisance or cause annoyance to the inhabitants of the neighbourhood. Any such occupier or owner who contravenes the provisions of this paragraph shall be guilty of an offence.*

The language used in subparagraph (d) does not correspond to the introductory words in regulation 14 “No person shall”. The second sentence in subparagraph (d) also appears to be superfluous, when regulation 16 specifies that non-compliance with any of the provisions of the Regulations, (i.e. also subparagraph (d)), shall be guilty of an offence).

***Regulation 16 states that any person who refuses, fails or neglects to comply with any of the provisions of these regulations or with a direction by a health officer lawfully given under these regulations, shall be guilty of an offence and shall be liable upon conviction to a fine not exceeding M50 or to imprisonment for a period not exceeding 6 months or to both such fine and imprisonment.***

It should first be noted that regulation 16 does not exactly correspond to the authority given under section 12 of the Local Administration Act 1969: section 12 allows also imprisonment in case of default of payment of fine. Moreover, the scope of application of the above provision, to some extent, is even more limited than of the stipulation made under section 17 (h) and (I) of the 1963 By-Law.

Regulation 14 makes littering of “*offensive matters*” unlawful to the extent only that it is “*a nuisance to others or injurious or dangerous to health*”.

Regulation 14 (c) restricts the illegality of the deposition of “*rubbish or refuse*” to those waste matters “*within the public view upon premises*”. Furthermore, violation of this provision leads to criminal sanctions only in the case of non-compliance a written order served by the District Administrator to remove such material from public view.

The duties imposed by regulation 14 (d) can only be violated if the matters mentioned therein (not necessarily waste matters) “*are likely to become a public nuisance or cause annoyance to the inhabitants of the neighbourhood*”.

Regulation 14 (d) partly overlaps with regulation 14 (a), which both deal with “filth” and “rubbish”. While in regulation 14 (a) the test is the actual existence of a nuisance or the danger to health, in regulation 14 (d) the proof of only the likelihood of a nuisance or a mere annoyance to the neighbourhood is required. Regulation 14 (d) therefore imposes a heavier burden on the occupier or owner of any land or premises than regulation 14 (a); the two provisions are therefore partly irreconcilable, and poses the questions whether regulation 14 (d) has, in part, impliedly repealed regulation 14 (a) or the other way around.

The territorial application of the Regulations is restricted to certain urban areas of Lesotho as designated in the Third Schedule (Regulation 3).

***The Public Health Order (1970)*** also deals with waste matters. In chapter VII, under the heading of Sanitation and Housing, section 53 says:

*No person shall cause a nuisance or allow a nuisance to continue on any land or premises owned or occupied by him or of which he is in charge which is likely to be injurious or dangerous to health.*

What constitutes such nuisance is stated in section 56 (1), which says:

*(h) any accumulation or deposit of refuse, offal, manure or any other matter whatsoever which is offensive or which is injurious or dangerous to health.*

*(r) any act, omission or thing which is or may be offensive, dangerous to life or injurious to health.*

Section 56 (2) says:

*The author of a nuisance means any person by whose act, default or sufferance nuisance is caused, exists or is continued, whether he be the owner or occupier or both or any person.*

Section 56 is enforced firstly by the Health Officer who serves a notice, as a rule, on the author of the nuisance, to remove the nuisance (section 56), in case of non-compliance with such notice, by a Magistrate's court order (section 58 (2)); the court may by such order also impose a fine not exceeding M25 (section 58 (3)).

It appears that the above-mentioned section 56 (1)(h) has replaced the almost identical provision in the Local Government-Model Sanitary and Public Health By-Law (see section 8 (e) of that By-Law), though section 8 has neither been formally amended nor repealed. However, since the Public Health Order of 1970 equals an act of parliament and as such, takes precedence over any By-Laws, the above provision in the 1963 By-Law may be deemed impliedly repealed. According to the rule "*lex posterior lege priore*" section 56 (1) (h) has impliedly repealed the corresponding provision of the 1963 By-Law (section 8 (e)).

The same cannot be said about section 9 of the 1963 By-Law since it does not exactly correspond with the procedure laid down by the Public Health Order. Under both the By-Law and the Order, as the first step is that an abatement order or notice has to be served on the author of the nuisance or the occupier of the premises on which the nuisance exists (the By-Law, however refers to the "occupier" only). But afterwards, in case of non-compliance with the order or notice, the procedure diverges.

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While under the By-Law, default of compliance as such constitutes an offence punishable with a fine not exceeding M100, or in default of payment thereafter imprisonment not exceeding six months, or both such fine and imprisonment (see section 33 (2)); under the Order a criminal sanction lies within the discretion of the magistrate and he may impose only a fine not exceeding M25 (see Section 58 (3)).

The situation becomes even more complicated, for section 56 (1) (h) appears to overlap also with regulation 14 (a) of the Sanitary Services Refuse Removal Regulations of 1972. Both deal with “refuse” and “manure” or other offensive matter which is “*injurious or dangerous to health*”. Non-compliance with regulation 14 (a) as such constitutes an offence carrying a fine not exceeding M50 or to imprisonment not exceeding 6 months or both such fine or imprisonment (regulation 16).

The authorities therefore appear to have a choice of three alternative actions against the culprit: institute criminal proceedings against him because of the very act of depositing refuse, or because of non-compliance with an abatement order by the responsible officer, or a non-criminal proceeding because of non-compliance with an abatement notice. This jungle of legal overlaps ideally requires clarification by parliament.

In the absence of this step, the following solution may be tendered: the Public Health Order of 1970 establishes a procedural system dealing with nuisances, which is different to that in the By-Law, but the Order equals an act of parliament, and as such takes precedence over any By-law. Section 9 of the By-Law may therefore be deemed to have been impliedly repealed. The same cannot be said about the status of regulation 16, because it derives its authority from an act of parliament, namely section 12 of the Local Administration Act (1969).

The authorities may therefore institute criminal proceedings against the author of the nuisance under regulation 16 or serve a notice under section 56 of the Public Health Order. It appears, that if they choose the second course of action, they waive their right to criminal prosecution under regulations 14 and 15, and in the case of non-compliance with a court order, the author is liable only to the penalties stipulated under section 59 of the Public

Health Order (1970). In actual government practice, the procedure described in the Public Health Order is being followed.

**The Urban Government Act (1983)** provides for the establishment of municipal and urban councils. The council shall, i.e. “*generally promote the public, health, welfare and convenience and the development, sanitation and amenities of the municipalities*”. The Minister may, by regulation, impose on any council any of the duties contained in schedule I of the Act.

In schedule I of the council duties listed, specifically mention the administration and enforcement of the Sanitary Service and Refuse Removal Regulations (1972). The disposal of carcasses of dead animals and of condemned foodstuffs is also a mandate given to the councils.

*Section 49 empowers the councils to make by-laws for:*

- (a) the maintenance of the health, well being and safety of the inhabitants of the municipality;*
- (b) the good order and government of the municipality, or;*
- (c) the prevention and suppression of nuisance in the municipality.*

The Maseru City Council has used this authority and adopted a by-law, which in its 248 sections covers a wide range of urban government subjects, i.e., in its part II, a detailed display of matters pertaining to health and sanitation also covering waste collection services.

Two other acts shall be mentioned, which also impact on to waste management. **The Land Act (1979)**, in its first schedule (section 2), mandates the inclusion of statutory conditions for leases other than agricultural leases. One of the conditions is number 12 of the schedule:

*No act, matter or thing, whatever, shall be done or permitted to be done on the land or any part of such land which may cause or lead to pollution of the environment or results in the creation of any hazard to the health of other persons or become a nuisance or annoyance to or damage or in any way interfere with the peace and comfort of the adjoining lease or the occupiers of adjoining or other land in the neighbourhood.*

This is a rather broad and far-reaching statement of law to prevent pollution emanating from any land leased for non-agricultural purposes. Non-compliance with or breach of the above statutory condition of lease may lead to termination of the lease by the Minister by giving at least one month written notice to the lessee (section 42 (1) of the Land Act. This powerful tool has, however, not been used for the purpose of waste control nor, for that matter, for any other environmental purposes. It is apparently also not meant to introduce a right which aggrieved neighbour may claim to institute any court action.

Provision for the establishment of waste disposal and dumping sites is made under the ***Town and Country Planning Act (1980)***. The Act applies to any area designated by the Minister by notice in the Gazette (section 2). The Commissioner of Lands is entrusted with the task to prepare a development plan indicating the manner in which the area in question shall be used and developed (section 5). “*Development*” means “*the making of any material changes in the use of land*” and accordingly section 9 (2), and section 9 (3)(c) states:

*.... the deposit of refuse or waste materials on land involves a material change of the area, notwithstanding that the land is comprised in a site already used for that purpose, if the superficial area of the deposit is thereby extended and if the height of the deposit is extended and exceeds the level of the land adjoining the site.*

The establishment of new waste disposal sites is therefore governed by this act. It will be subjected to the conditions laid out in a development plan. The plan is to be published, and the public may lodge objections (section 7). The ultimate decision to the plan, however, rests with the Minister.

As part of the planning process, environmental considerations as to the situation and technical standards of the disposal site may therefore be taken into account. There is, however, a big “but”: though the Act was officially commenced in 1984, it has not been put into operation because of difficulties encountered in meeting financial implications and manpower requirements. In addition, in this case, it will be very generic, and not directional because it requires professional input, needs clear legal depth of how the waste dumps shall be constructed and maintained, and raises the issue of manpower.

In summary, with an exception of the Environmental Act 2001, the other existing legislation on waste management is obsolete and has not adequately covered the developments in this area. Furthermore, the Environmental Act 2001 mainly addresses all the other issues of the environment but does not lay much emphasis on solid waste management issues. The only point of reference to it is Part VI section 38 (a) which stipulates that the Authority shall, in consultation with the relevant line Ministry, prescribe standards for waste in terms of classification and disposal methods. It does not mention the depth of health and environmental inter-relationships. The analysis of deficiencies and conflicts in the existing legal and regulatory framework given in the foregone paragraphs underscore the importance paying considerable attention to these issues when developing solid waste management systems in Lesotho. The legal instruments should not depend on “command and control”, but promote public understanding and participation.

#### 4.1.2 Waste Management Policy Review

The point of departure for appropriate waste management policy is the way in which this policy is formulated in order to focus on the preference for waste disposal.<sup>2</sup> The main elements required to achieve the formulation of such an appropriate policy are:

- Development and application of a set of instruments to promote prevention and reuse;
- Establishment of environmental and policy parameters (guidelines) for the disposal of waste;
- Setting up a structure for planning disposal at national level;
- Working out the sole and co-responsibilities of producers for disposal of their products at the waste stage, and
- Regulation of imports and exports of waste.

To achieve the aims of a waste policy, a number of radical measures are required, such as the compulsory separation of waste at source or producers recycling back their products after they have reached waste stage. However, in developing countries, policies on waste management generally tend to focus mainly on the down-wards trend of waste hierarchy due to limited municipal budgets that pose difficulties on integration. See Diagram 2.3.

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<sup>2</sup> “Waste in the Netherlands”. Ministry of Housing, Directorate of Waste Management Policy, the Netherlands, August 1998.

In the case of Lesotho, although the current umbrella Environmental Policy provides a framework for the formulation of waste management programmes, there is still no coherent overall waste management policy upon which waste management guidelines and standards could be based and drawn from. Thus, in the absence of a waste management policy, it would be a difficult task to formulate guidelines and standards, let alone trying to rally public behind the government's efforts to developing policies and strategies, which will address specific actions in the environment sector, especially waste management issues.

#### 4.1.3 Institutional Establishment Policy Questionnaire Responses

The analysis of questionnaire responses from institutional establishments on policy and regulatory instruments, provide more information on the problems confronting the government concerning solid waste management. The analysis of these issues is given in this section and their results are highlighted in Table 4.1 and Figures 4.1 and 4.2.

On Government and company policies pertaining to:

- **Imposition of levies:** Only 33.3% were aware, yet 66.7% were not aware.
- **On waste collection services:** Only 33.3% were aware, unlike the 67.7% who were not aware. The 33% awareness is as a result of specification under contracts for waste management, such as the UNDP National Environment Youth Corps Project.
- **Consumer to leave packaging materials to the shopkeepers:** The majority (83%) were not aware, except for the 17% who were, able to link with the refunds of mineral drinks bottles as an incentive for consumers, to return packaging material.
- **Separation of waste at source and classification:** Similarly, 83 % responded that they were not aware of this, except for the 17% who associated with separation of beverage cans from other solid wastes in their establishments.
- **Establishment of waste satellite collection points:** This issue encompassed the appropriate means of transport, involvement of communities and NGOs in waste management activities. It also included the establishment of actual waste satellite collection/drop-off stations. The same was the case in this situation as in the case of separation at source, the majority (83%) were not aware, except for the 17%, who



cited the National Environment Youth Corps Project as an example that had some satellite collection points.

- **Willingness to pay for waste collection services:** The result of the responses was a 50%-50%. In this case, half gave support to the paying for the services, while the other half said no.

The high rate of unawareness of the regulatory instruments and policy issues on solid waste management among senior officials in the government and other institutions raises serious concern about the lack of general environmental awareness campaigns in Lesotho. This does not auger well with the principles of sustainable development. Perhaps the major contribution to such a state of affairs is that currently there is neither specific policy nor legal instrument on solid waste management. Regulations for waste collection and disposal are mostly embodied in the waste Management Act. In this case, Lesotho has no such specific Act on solid waste. The Act that draws closer to the issues of solid waste management is the Environment Act 2001. To address such a serious flaw requires that Lesotho should formulate specific regulations, policy and guidelines on solid waste management.

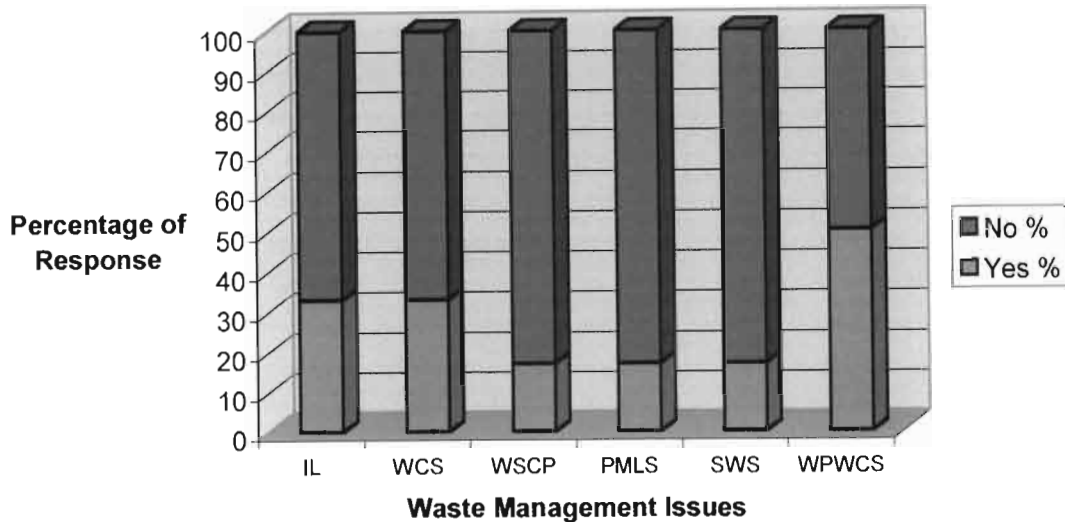
**Table 4.1 Institutional Awareness on Policy Issues**

Waste Management issues	Yes	No
	%	%
Imposition of Levies	33	67
Waste Collection Services	33	67
Waste Satellite Collection /Drop off Points	17	83
Packaging Materials Left to Shopkeepers	17	83
Separation of Waste at Source	17	83
Willingness to pay for Waste Collection Services	50	50

Source: Computed by the Author from the Survey data.

These results in Table 4.1 and Fig.4.1 reveal the low level of awareness of important policy and regulatory instruments among key government and parastatl policy makers. This could be as a result of absence of specific solid waste management policy and legal instruments in Lesotho. This therefore poses a challenge to the government of Lesotho to ensure that these are formulated. Without these instruments in place, it would be futile to implement sound solid waste management system in the coutry.

## Institutional Awareness on Policy Issues



**IL**= imposition of Levies      **WCS**= Waste Collection Services  
**WSCP**= Waste Satellite Collection Points      **PMLS**= Packaging Material Left to Shopkeepers  
**SWS**= Separation of Waste at Source      **WPWCS** = Willingness to Pay for Waste Collection Services

Figure 4.1 Waste Management Strategies in Companies and Government Institutions

Regarding affordability for payment of these services, the highest percentage of institutions (50%) indicated they could afford between M21 – 50 per month, while 42% indicated the range of M6-20 and 5 % between M1-5, and 3 % in the M51-100 range and none above these ranges. The sustainability suggested by values indicated is questionable. It would have been more reliable if the majority of the respondents had indicated the M 50-100 and above ranges. It must be noted that in the case of institutions, the values of monthly income for these entities were not obtained due to lack of readily available figures. For more details, see Section 4.3.

In Section 4.7, it has been shown that the Maseru City Council experienced low cost recovery of its waste collection services. Government institutions are part of the recipient for this service. Taking into account that current charges are at M100 per month, the affordability indicated is therefore unsustainable for the efficient supply of these services. With M100 being levied currently, the city of Maseru still experiences difficulties in offering good

quality waste collection service. Though lack of delivery has been attributed to many factors such as lack of capacity and breakdown of waste hauling vehicles, it would also be important to examine the fees for waste collection. It may be necessary to look into the possibility of raising this fee. This should also be marched with an improved revenue collection system.

**Amount per month (M) % Institutions**

1 to 5	5
6 to 20	42
21 to 50	50
51 to 100	3

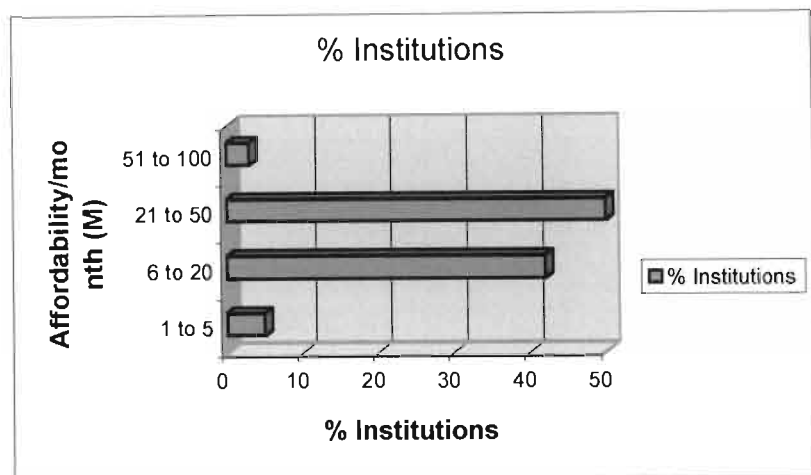


Figure 4.2 Companies & Govt Institutions: Responses to Affordability of Waste Collection Services

**4.2 WASTE GENERATION AND THEIR FACTORS**

Waste generation encompasses those activities in which materials are identified as no longer of value and are either thrown away or gathered together for disposal. An indication of how and where solid wastes are generated is shown in the simplified materials flow diagram in Diagram 2.2 of Chapter 2. Solid waste is generated at the start of the process, beginning with the mining of the raw material. Thereafter, solid waste is generated at every step in the process as raw materials are converted into goods for consumption.

It is apparent from Diagrams 2.2 and 2.3 of Chapter 2 that one of the best ways to reduce the amount of solid waste is to limit the consumption of raw materials and to increase the rate of recovery and reuse of waste materials. Although the concept is simple, effecting this change in a modern technology society has proved extremely difficult.

Factors that influence the quantity of municipal waste generation include:

- geographic location;
- season of the year;
- collection frequency (affects amount collected);
- characteristics of populace (life style of people);
- use of kitchen waste grinders;
- extent of salvaging and recycling;
- public attitudes; and
- legislation.

The existence of salvage and recycling operations within a community definitely affects quantities of waste collected for disposal.

As indicated in Chapter 2, Section 2.6, Lesotho's population is currently estimated to be growing at a rate of 2.2% leading to a 1996 census of 2,112,400 people. With per capita incomes of around US\$540, the country ranks amongst the world's lowest income countries, with 80% -85% of the population classified as rural. However, the progressive decline of rural agriculture is compelling large numbers of Basotho to look more and more to the modern sector for livelihood, leading to a mushrooming of urban sprawls in the perimeters of many large lowland settlements on land that was originally devoted to agriculture (see Maps 2.6, 2.7 and 2.8 in Chapter 2). Due to these population shifts, the rate of urbanization has been increasing rapidly from 14% in 1986 to an estimated 18% to date. The absence of physical infrastructure and street layouts in these newly established places makes the provision of services exceeding difficult. On the other hand, both the industrial and commercial sectors are too small to absorb the economy's surplus labour, leading to increased levels of poverty and squalor (Mhlanga & Gulilat, 1997).

In this study, the data on waste generation has been classified and analysed according to source as well as according to composition. Three major sources were identified: households, industrial and commercial establishments. The former was further classified into three: low-income (high-density areas), middle-income and high-income (low-density areas). In the case of composition, the primary classification consisted of seven components on MSW, which were evaluated in the sampling survey, namely paper, plastic, organic, beverage cans and

foils, textiles and fabric, glass and potentially hazardous household waste (PHHW)<sup>3</sup>. These components are the major constituents of the dustbin solid waste in Lesotho. The breakdown of the components of solid waste for different socio-economic categories and overall averages for Maseru and Maputsoe are given in Section 4.2.1 of this Chapter. Likewise, the data collected from the recycling companies and scavengers has also been tabulated in this Chapter under Sections 4.3 and 4.4 respectively. Detailed information on the methodology for sample collection, sorting and characterization is given in Chapter 3, Section 3.10.2 of the methodologies.

#### 4.2.1 Households Waste Generation

The composition of solid waste and quantities generated by a community is a function of factors such as the socio-economic levels of households and development of the country, the consumption patterns the level of social services infrastructure, technological advancement and cultural patterns.

To this effect, households were further sub-classified into sample size constituting of low-income 46.22% (Ha-Tsosane and Maputsoe), middle-income 18.32% (Katlhong) and high-income 35.46% (Maseru West and Hillsvie). This classification criterion was made based on the socio-economic appearance of the house, as detailed in Chapter 3 of the methodology. It was initially assumed that high-income households are villas with servant quarters in a well-planned area; middle-income households are those in semi-planned areas; while low-income are households in low-cost unplanned areas. This was later checked and verified by the results of the answers from households in the study. Under this section, the socio-economic analysis of households is given. In order to obtain a clear picture of the characteristics of waste generation from households, the results of quantities of waste generated have been presented in terms of the actual households sampled, actual area surveyed, the per capita and the frequency of generation.

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<sup>3</sup> Potential hazardous waste included small batteries and dust sweepings in household clay fall-offs in brick making factory and dust sweepings in industrial establishments.

#### 4.2.2 Socio-economic Status of Households:

The socio-economic status of households in the sampled areas is depicted in Table 4.2. Since matters concerning income are as sensitive, it is difficult for people to reveal their exact income, an option was given to the respondents to indicate their average monthly income in four income brackets and supply an exact figure, if possible. The aim was to get a more meaningful and simplified overview of their incomes.

**Table 4.2 Socio-Economic Average Data for HHs in the main Sampling Survey**

Area of surveyed HHs	Number of HHs surveyed	Average number of inhabitants per HH	Average number of inhabitants working per HH	% HH in Income Range per Month			
				Less than M600	Between M600 and 1,500	Between M1,500 and M3,000	Above M3,000
<b>Ha Ts'osane (Low-income)</b>	N = 53	4.7	1.4	86.8	11.3	1.9	0
<b>Katlehong (Middle-income)</b>	N = 46	4.3	1.3	0	32.6	67.4	0
<b>Hillsview (High-income)</b>	N = 35	2.7	1.4	2.9	0	0	97.1
<b>Maseru West (High-income)</b>	N = 54	3.3	2.0	0	0	0	100
<b>Maputsoe (Low-income)</b>	N = 63	5.0	1.1	95.2	3.2	1.6	0
Average of exact income per month				# M220	# M1,020	# M1,020	# M5,600

Source: Computed by the Author from the Survey Data

# The average value was calculated from the figures of those respondents who indicated their actual income per month. From the results, the average of incomes for the 25 respondents in the low-income households gave the value of M220, while, 12 respondents of the middle-income households gave the value of M1,020 and the high-income households gave the value of M5,600.

In this study, the main approach to establish household income was by using income ranges. The exact amount of household income was recorded optionally. The income ranges used were: less than M600; between M600 and M1500; between M1,500 and M3,000, and above M3,000. These income range categories were based on values indicated in the households population census as indicated in the Bureau of Statistics (1996). According to the results in Table 4.2, the average number of inhabitants was higher for low-income households (4.7 in Ha-Tsosane and 5.0 in Maputsoe) compared to high-income household (2.7 in Hillsview and 3.3 in Maseru West). The average number of those working was highest in high-income of

Maseru-West at 2.0 inhabitants and lowest in low-income Maputsoe at 1.1. Interestingly, the low-income Ha-Tsosane had some overall number of working inhabitants same with the high-income Hillsview at 1.4, more than middle-income Katlehong at 1.3. Ha-Tsosane's advantage of a good number of working inhabitants is severely compromised by the low-level of household income with 86.6% earning below M600 per month and with non-earning above M3000. Yet Hillsview has only 2.9% earnings below M600, with 97.1% earning above M3000. Katlehong, a middle-income area, gains advantage in income over Ha-Tsosane, with most of the households 67.4% earning between M1,500 and M3,000 none are below the M600 bracket. The high-income Maseru West area displays typical expensive household with 100% in the above M3,000 per month bracket. Results show that Maputsoe has the lowest socio-economic development. It has the least number of working inhabitants per household, and 95.2% of the households are in the below M600 per month bracket, with 0% in the above M3,000 bracket.

This information is useful in trying to gauge the affordability of waste services. As already indicated in Section 4.1.3, there may be a need to establish the affordability of waste services using the income expenditure data to supplement the average monthly household income bracket data obtained in this study. This would assist in making a decision as whether to have a blanket fee for all households or to apportion the fee according to the average household monthly income in the area. The factor of waste generation as a function of the socio-economic status of a household would, in this case, play a major role. This in turn would mean the waste services fee has to be in relation to the quantity of solid waste generated, collected and disposed off. A flat-rate fee would lead to a failure in relating the price of waste collection and disposal to the marginal private cost and external costs of waste disposal. The implication would be the encouragement of the households, commercial and industrial establishments to generate more waste, rather than aiming at the incentive of waste minimisation. This is simply because there is no cost for extra marginal increase in waste generated, and hence this would eventually lead to low - cost recovery.

### 4.2.3 Household Waste Generation

It has already been emphasized that the amount of waste a community generates is a function of the socio-economic and technological advancement of that community (Vesilind & Rimer, 1981). In this study, the results in Table 4.3 and Fig. 4.3 indicate that the quantities of waste generated and the nature of composition are a function of the socio-economic levels of household. In terms of quantity, the low-income households are expected to generate the least quantities of waste per household per week. For example, Maputsoe, with the least socio-economic development of 95.2% households falling in the below M600 income bracket generate a mean quantity of 1.37/hh/week, followed by Ha-Tsosane with 86.8% households in the same income bracket generating 1.95 kg/hh/week. The middle-income households of Katlehong generated waste quantities higher than the low-income at 2.98kg/hh/week, but less than the high-income households of Maseru-West, with 100 % of households in the above M3,000 bracket; and Hillsview, with 97.1% of households also above M3,000 bracket. In terms of composition of waste at household level, the high-income households generated more quantities of plastics than middle and low-income households.

**Table 4.3 Weekly Average Solid Waste Generation per HH (kg/hh/week)**

Category of Waste		Paper	Plastic	Organic wastes	Beverage Cans/ Foils	Textiles/ Fabric	Glass	PHH W	
<b>Area of surveyed HHs</b>	Number of HHs surveyed								<b>Waste generated Kg/hh/week</b>
<b>Ha Ts'osane (Low-income)</b>	N = 53	0.38	0.34	0.58	0.30	0.01	0.15	0.19	<b>1.95</b>
<b>Katlehong (Middle-income)</b>	N = 46	0.58	0.39	1.28	0.44	-	0.24	0.05	<b>2.98</b>
<b>Hillsview (High-income)</b>	N = 35	0.43	0.50	0.50	1.27	-	0.47	0.05	<b>3.22</b>
<b>Maseru West (High-income)</b>	N = 54	0.62	0.81	1.10	0.45	-	0.21	0.04	<b>3.23</b>
<b>Maputsoe (Low-income)</b>	N = 63	0.31	0.25	0.25	0.26	0.01	0.25	0.04	<b>1.37</b>
<b>Total</b>	<b>251</b>	<b>2.32</b>	<b>2.29</b>	<b>3.71</b>	<b>2.72</b>	<b>0.02</b>	<b>1.32</b>	<b>0.37</b>	<b>12.75</b>

Source: Computed by the Author from the Survey Data



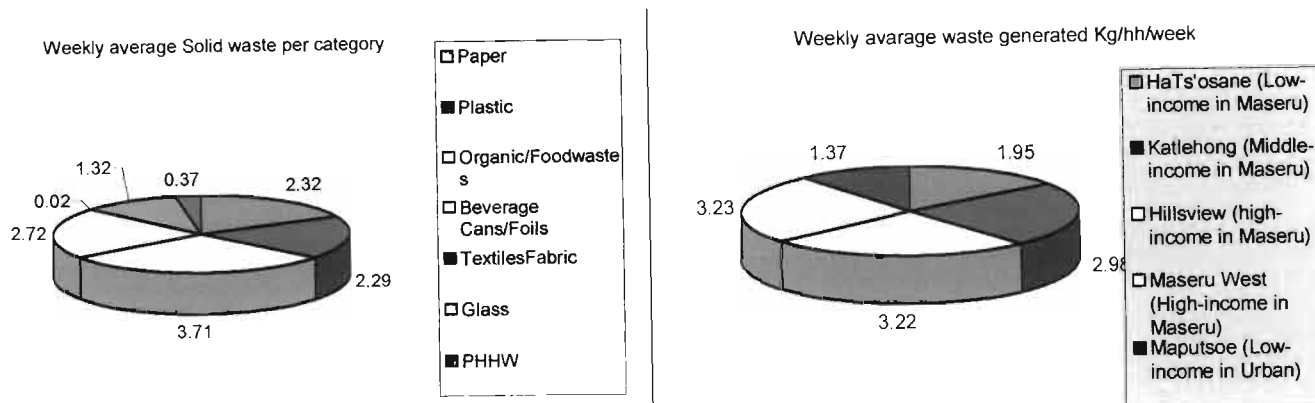


Figure 4.3 Weekly average generation per household and composition

Similarly, in the case of organic waste, high-income households generated more than the middle-income and low-income, indicating that high-income households have higher amounts of food left-over than the middle and low-income ones. However, the low value of organic waste in Hillsview (0.5kg/hh/week) was attributed to households using part of this type of waste for feeding the chickens and dogs. In Maputsoe, the abnormally low quantity of organic waste (0.25kg/hh/week) was also attributed to a farmer collecting this type of waste to feed animals. In general, textile materials were almost absent in all households. On the overall, a combination of high, middle and low-income generated more organic waste per household than paper and plastics, as indicated in Table 4.3 and Figure 4.3. This point becomes critical when deciding on the utilization of the waste. According to Mvuma (2001), poor households in Lesotho are faced with a serious problem of finding an appropriate source of energy. At the same time, Lesotho faces problems in meeting its food supply, including vegetables, which are mostly imported from South Africa. Therefore, the way this waste would be utilized becomes critical. The food organic waste, which would not be ideal for converting into briquettes as a source of biomass energy, would be considered for either composting to be used as manure for urban agriculture or alternatively as a source of biogas energy.

#### 4.2.4 Household Waste Generation Rate (per Capita)

In this study, the per capita income has been considered as a function of socio-economic status of households. The results of the sampling exercise are shown in Table 4.4 and Figure 4.4. It has been found that the average generation rates of household solid waste for different economic categories are a function of the socio-economic levels of those households. For example, the low-income households displayed low per capita income (Maputsoe 0.27 kg/cap/week and Ha-Tsosane 0.40 kg/cap/week) followed by the middle-income (Katlehong 0.69 kg/cap/week). The per capita income was highest in high-income households (Hillsview 1.20kg/cap/week and Maseru West 1.00kg/cap/week).

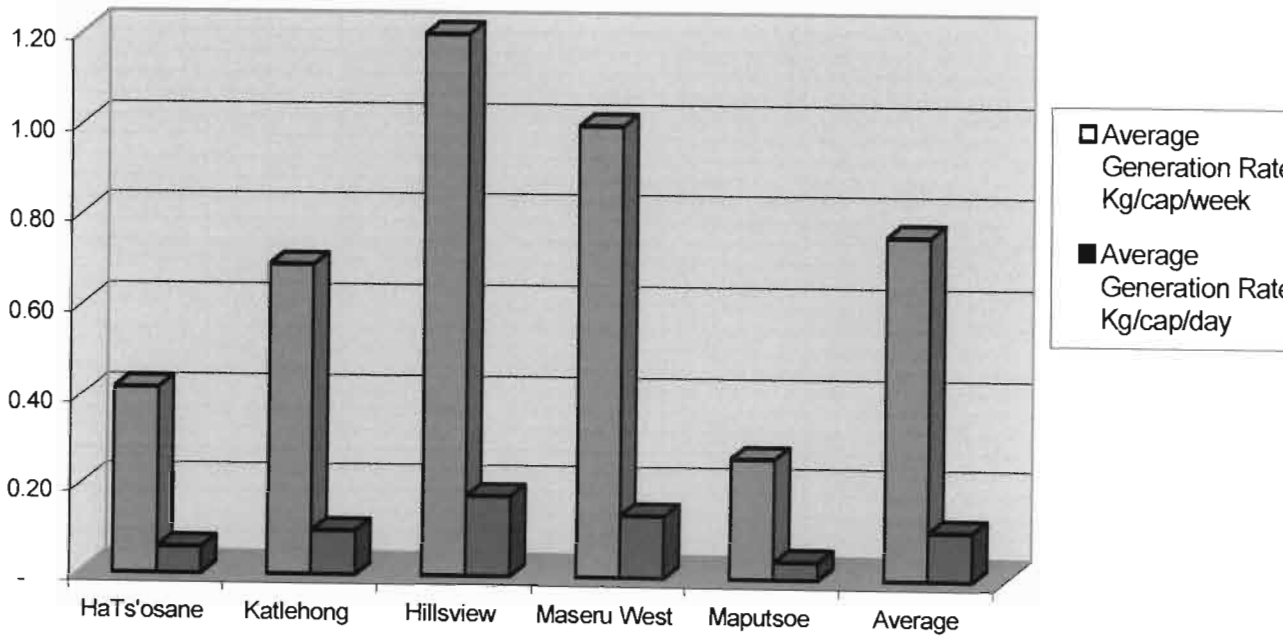
These results confirm what was reported in Chapter 1, Section 1.4.2, in which Lesotho is classified by the World Bank as one of the poorest countries in the world. By comparing these generation rates in Lesotho, with those rates reported for other developed countries, it can be seen that Lesotho is indeed, among the countries with the lowest generation rates in the world. For example, per capita per week is 10.57 for Kuwait, 8.05 for Germany, 5.6 for United Kingdom, 2.87 for India, 3.15 for Yemen, and 11.06 for USA (Ward, 1993).

It must be borne in mind that the per capita values are site specific. In this case, these results refer to the towns of Maseru and Maputsoe towns in Lesotho. However, Maseru and Maputsoe are the main sources of waste generation in Lesotho. Therefore, an estimate of per capita for Lesotho would not diverge so much from the values indicated. The information on Lesotho ranking as one of the poorest countries is useful input for development of integrated solid waste management systems for the country. As an under-developed country, the solid waste management systems should not opt for big Electra-Haul trucks that would drain financial resources for maintenance, but for appropriate systems, in which communities become involved and derive benefit.

**Table 4.4 Solid Waste Generation Rate (Kg/cap/week or /day)**

Area of Surveyed HHs	Weekly Average waste generated per HH	Daily Average waste generated per HH	Average Number of Inhabitants per HH	Average Generation Rate	
				Kg/cap/week	Kg/cap/day
<b>Ha Ts'osane (Low-income)</b>	1.95	0.28	4.7	<b>0.42</b>	<b>0.06</b>
<b>Katlehong (Middle-Income)</b>	2.98	0.43	4.3	<b>0.69</b>	<b>0.10</b>
<b>Hillsview (High-Income)</b>	3.25	0.47	2.7	<b>1.20</b>	<b>0.18</b>
<b>Maseru West (High-Income)</b>	3.23	0.46	3.3	<b>1.00</b>	<b>0.14</b>
<b>Maputsoe Urban (Low-Income)</b>	1.37	0.20	5.0	<b>0.27</b>	<b>0.04</b>
<b>Total Maseru Urban Estimate</b>	2.85	0.41	3.75	<b>0.76</b>	<b>0.11</b>

Source: Computed by the Author from the Survey Data



**Figure 4.4 Average waste generation rates per capita per week and per day by source**

#### 4.2.5 Influence of Socio-economic Factors

The results of socio-economic status of households in the surveyed areas as shown in Section 4.2.2 can be summarized as follows: most low-income households have an average monthly income of below M600; while the middle-income households have between M1,500 and M3,000; the high-income households have above M3,000.

The influence of socio-economic factors on solid waste generation was evaluated by the average generation rate of solid waste for every income bracket levels (Fig. 4.5), the linear regression between the average monthly household income per site (Fig. 4.6) and the average number of persons living in the property (Fig. 4.7) against the average monthly generation of solid waste for every household.

Fig 4.5 indicates that there is a strong relationship between waste generation rate and the monthly household income bracket: the higher the income bracket, the higher the rate of waste generation. From this figure, it is seen that the average generation rates of household solid waste for different socio-economic categories are as follows:

High-income: 0.16 Kg per capita day<sup>-1</sup>

Middle-income: 0.10 Kg per capita day<sup>-1</sup>

Low-income: 0.05Kg per capita day<sup>-1</sup>

**The weighted average generation rate for all the households in the surveyed areas is:**

$$(0.16 \times 52\%) + (0.10 \times 32\%) + (0.05 \times 16\%) / 100\% = 0.13 \text{ Kg per capita day}^{-1}$$

Although households do not feature as major contributors to waste generation in Lesotho in comparison with waste generated by commercial establishment, as indicated in Section 4.2.3, it would be useful to know how the socio-economic factors influence change in waste generation following the economic development. It may also be useful to establish a clear relationship between the income levels and kg per capita per month. This relationship, shown in Figure 4.5, illustrates the correlation between the household average income per month and waste generation per household per day.

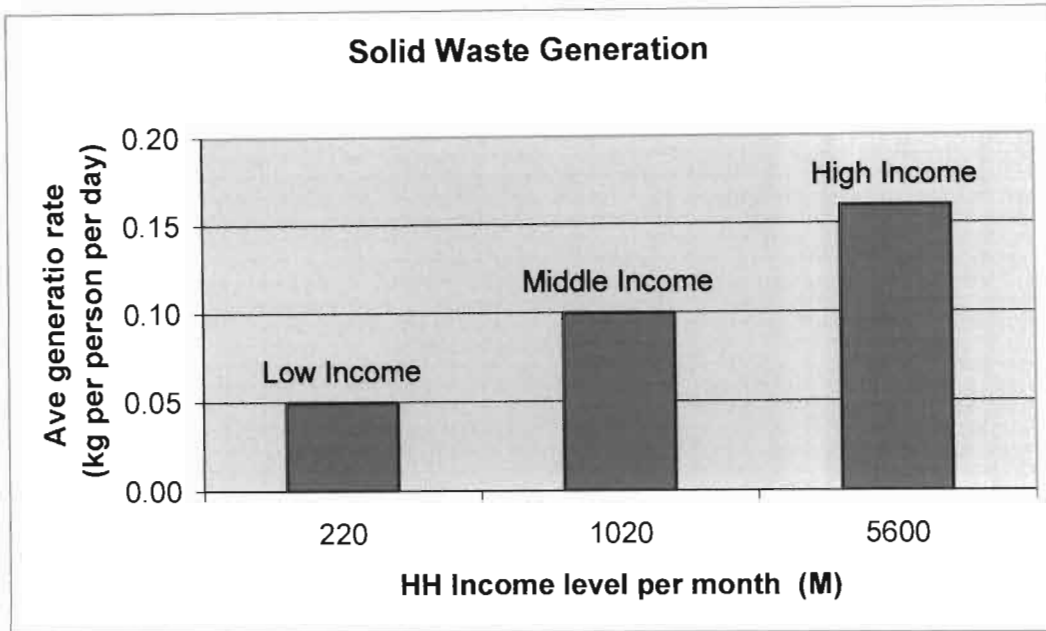


Figure 4.5 Monthly household income versus per capita waste generation rate of solid waste

Fig. 4.5 clearly shows the positive relationship between monthly income levels and waste generation rate at household level. Similarly, as shown in Fig 4.6, the significant correlation between per capita income and the monthly waste generation rate is  $r = 0.670$ . This demonstrates the influence of income level on the generation of solid waste. On the other hand, the relationship between the number of persons living on property and the generation of waste generation, as shown in Fig. 4.7, displays a poor relationship and hence less influence as shown by a correlation of  $r = 0.442$ .

It must be borne in mind that the poor in relationship between the number of persons in a household and waste generation rate, as shown in Fig. 4.7, does not imply that the number of people in a household has no bearing on the amount of waste generated. An explanation to this result could be that samples were insufficient for this factor to be significant.

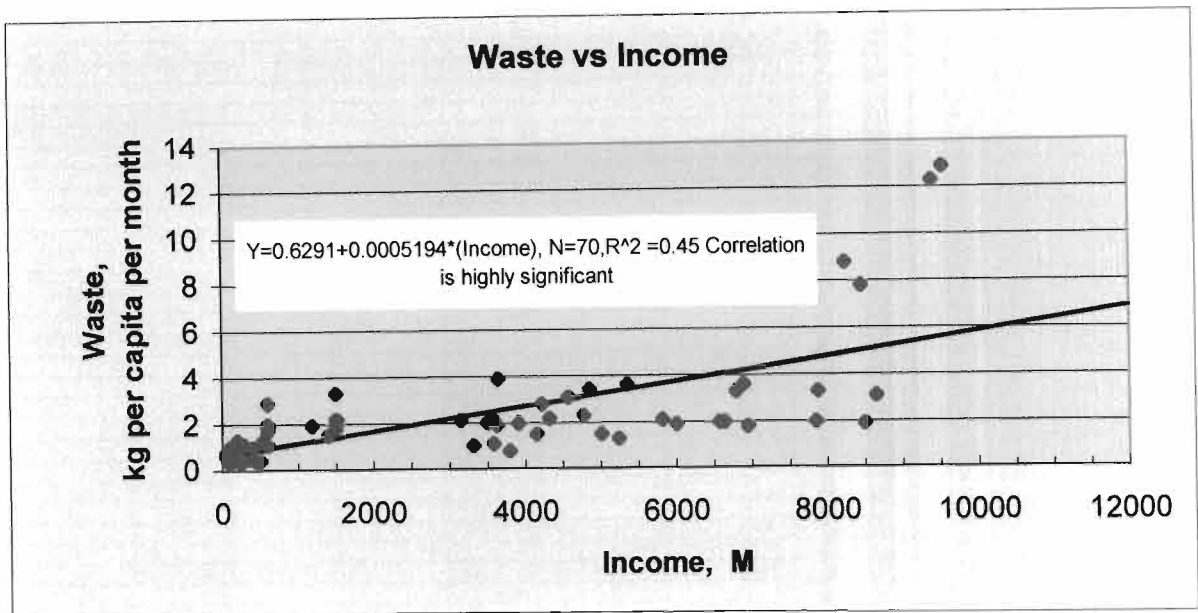


Fig 4.6

Correlation between Waste generation Rate and Monthly Household Income Levels

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.67062217
R Square	0.4497341
Adjusted R Square	0.44164195
Standard Error	1.7266134
Observations	70

ANOVA

	Df	SS	MS	F	Significance F
Regression	1	165.7	165.7	55.58	2.13691E-10
Residual	68	202.7	2.981		
Total	69	368.4			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.6291	0.29127	2.160	0.03432	0.04786	1.2103
X Variable 1	0.0005194	6.96719E-05	7.455	2.13691E-10	0.0003804	84

Waste (kg per capita per month) = 0.6291 + 0.0005194 \*(Income)

The correlation is significant

This relationship explains 44% of the variation

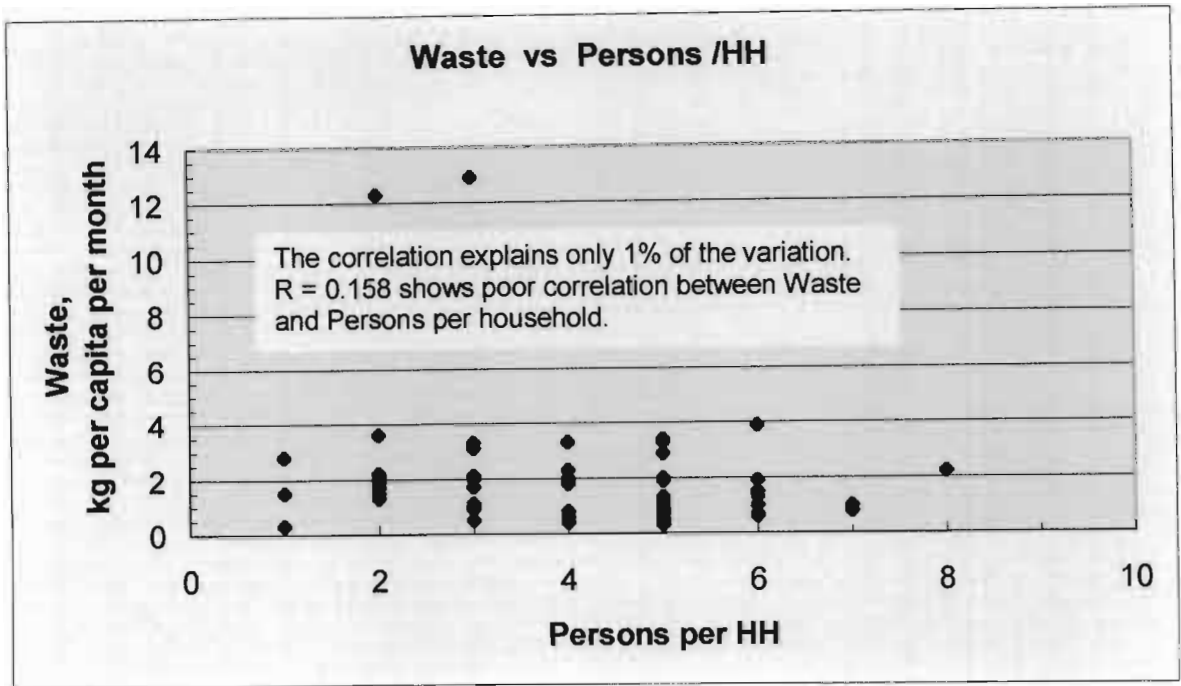


Figure 4.7 Correlation between average monthly waste per capita and average persons per household .

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.157784
R Square	0.024896
Adjusted R Square	0.010556
Standard Error	2.298446
Observations	70

There is poor correlation between waste generated and persons per household

It has generally been seen from Figures 4.4, 4.5 and 4.6 that the generation rate of solid waste increases with an increase in income. It is also seen that the quantities of waste generated increased by 0.5 kg for each increase of M2000 per month. From Fig. 4.6, it is seen that there is a relation between waste generation and the monthly income bracket ( $r = 0.67$ ), which demonstrates the influence of income level on the generation of solid waste. A further relationship was investigated between the average waste generation rate and the number of persons per household, as shown in Fig. 4.7. The results show that there is a poor relationship between the average number of persons in the households and the rate of waste generation ( $r = 0.442$ ).

#### 4.2.6 Weekly and Daily Solid Waste Generation per Surveyed Area and per Town.

The results in Table 4.5 and Fig. 4.8 give indicative quantities of solid waste generated by all households in the study areas. This is important for planning purposes of solid waste service both on a weekly and daily basis. From the results in Table 4.5, it is shown that the total number of households waste quantities per a given surveyed area is an important factor when considering the quantity of waste generated in that area.

**Table 4.5 Weekly and Daily Total HH Waste Quantities per Surveyed Areas (kg/area/week or /day)**

Area Surveyed (Location)	Total No. of HHs <sup>4</sup> per Location	Weekly Average waste generated per HH	Daily Average generated per HH	Total waste generated per Area per week	Total waste generated per area per day
<b>Ha Tsosane</b>	1713	1.95	0.28	<b>3340.35</b>	<b>479.64</b>
<b>Katlehong</b>	490	2.98	0.43	<b>1460.20</b>	<b>210.70</b>
<b>Hillsview</b>	474	3.25	0.47	<b>1540.50</b>	<b>222.78</b>
<b>Maseru West</b>	1948	3.23	0.46	<b>6292</b>	<b>896.08</b>
<b>Maputsoe</b>	2927	1.37	0.02	<b>4010.00</b>	<b>585.40</b>
<b>Total</b>	7552	2.85	0.41	<b>16643.09</b>	<b>2394.60</b>

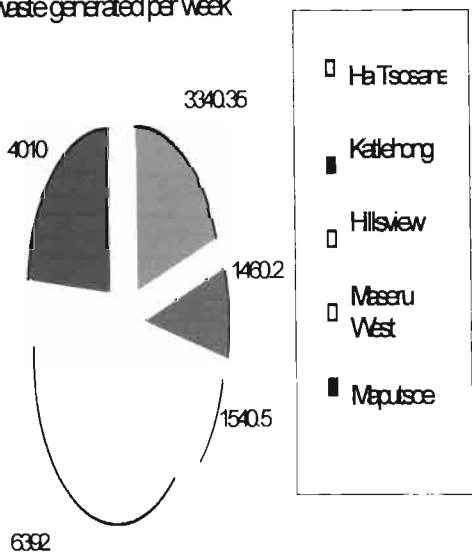
Source: Computed by the Author from the Survey Data

To highlight this point, an example can be drawn from the results in this table. Although Ha-Tsosane and Maputsoe have low socio-economic level of development and low per capita, they generated more waste per week (Ha-Tsosane 3340.35kg/week, Maputsoe 4010.00kg/week) than middle-income Katlehong (1460.20kg/week) and even high-income Hillsview (1540.50kg/week). Therefore, the number of households in the area to receive solid waste collection service becomes an important factor to consider. This also verifies the point made in Section 4.2.5 concerning the relationship between the number of people per household and generation rate. Even though this relationship was poor, it still has a bearing on the amounts generated and the number of persons in a household. As stated, the logic is that the number of households or persons generating waste is an important factor to consider when planning the solid waste management systems in a city.

<sup>4</sup> Information on number of household was extracted from Households Population, 1996, Vol. IIID (a), Bureau of Statistics, Maseru, Lesotho



Weekly waste generated per week



Total H's waste generated per day

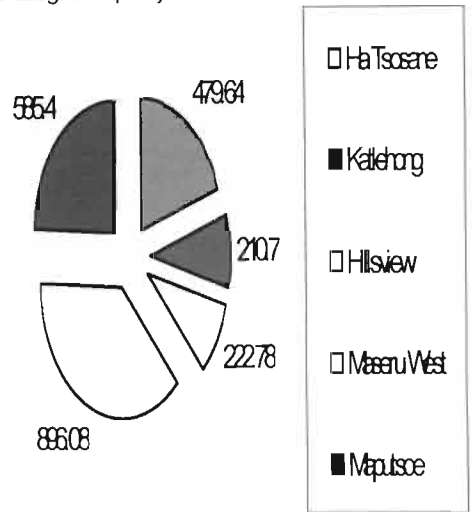


Figure 4.8 Waste generation per week and per day

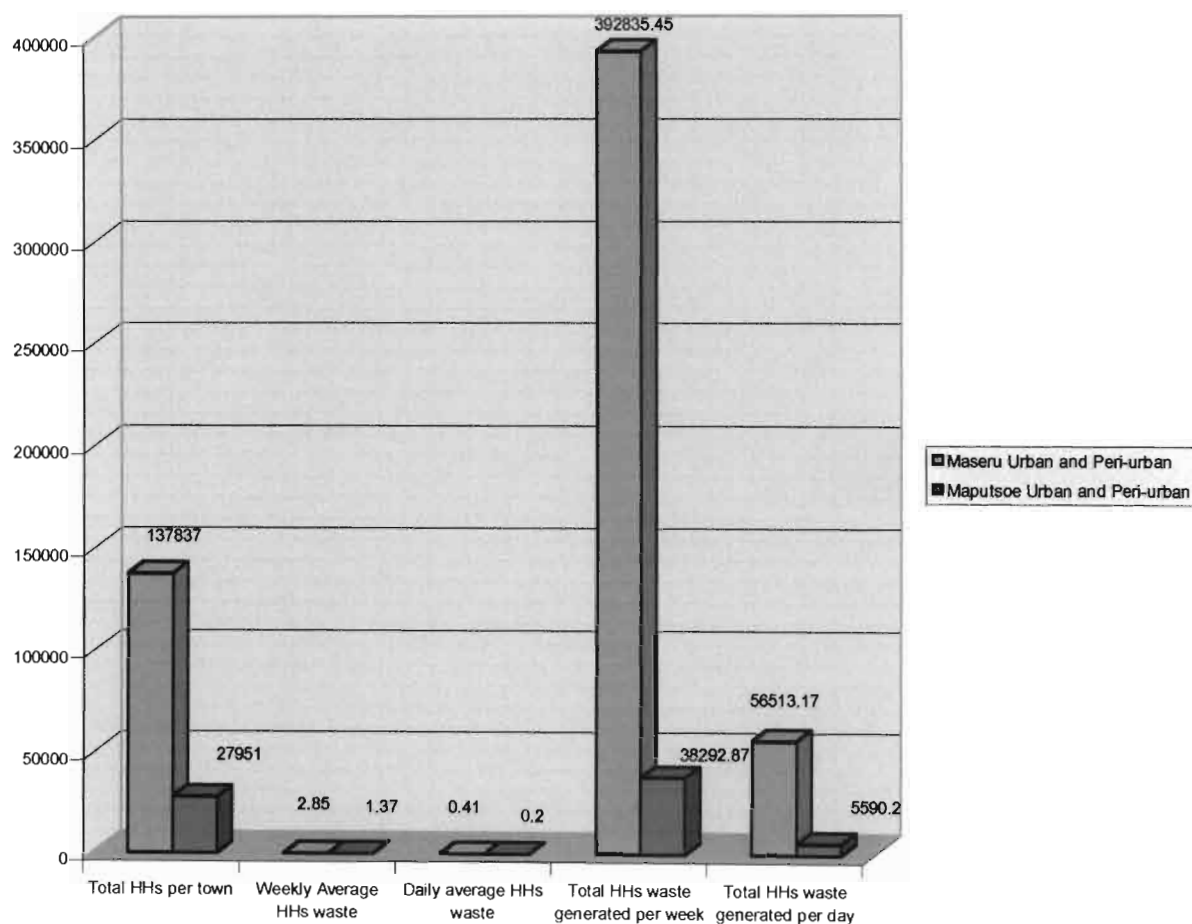
The summary of solid waste generated per week and per day by all households in Maseru and Maputsoe urban and peri-urban areas is shown in Table 4.6 and Fig.4.9. These results indicate that, if planning of solid waste collection services in Maseru and Maputsoe were to be undertaken soon, including the peri-urban areas of these towns, then it is expected that Maseru would generate an estimated solid waste quantity of 392835.45 kg/week (392.8 tonnes/week) while Maputsoe would generate 38292.87kg/week (38.292 tonnes/week). For further details on waste generation by location and site, see Maps 4.1, 4.2 and 4.3.

**Table 4.6 Summary of Weekly and Daily Solid Waste Generation from All HHs in Maseru and Maputsoe (kg/area/week or /day)**

Source	Total HHs <sup>5</sup> per Town	Weekly Average waste HHs	Daily Average HHs waste	Total waste generated per week	Total waste generated per day
Maseru Urban and Periurban	137837	2.85 *	0.41 *	392835.45	56513.17
Maputsoe Urban and Periurban	27951	1.37 *	0.20 *	38292.87	5590.20

Source: Computed by the Author from the Survey Data

\* These figures are weighted averages of all the households in the two towns.



**Figure 4.9 Total weekly and Daily waste generation in Maseru and Maputsoe**

<sup>5</sup> Source: Statistical Households projections excluding rural areas. If rural areas are included, the numbers for Maseru add up to 99,264, while the Maputsoe households add up to 39,000.

Sections 4.2.3, 4.2.4, 4.2.5, 4.2.6 have described household waste generation and quantities in Maseru and Maputsoe. In addition, Sections 4.5.5 and 4.5.6 outlined in detail waste compositions and quantities in these towns. It is not a best practice to know only about the quantities generated, without having a general view of the frequency of waste generated. It has been documented in literature that it is necessary to determine the distribution characteristics of observed solid waste data in order to develop viable and sustainable solid waste management systems (Tchobanoglous et al.1993).

In summary, on the households frequency of waste generation, it cannot be overemphasised that the value of frequency distribution of waste types to the concept of waste management is very vital. It adds value and creates a good picture of the abundance of the types of waste generated in a given area. It should be borne in mind that the development of waste management systems does not only involve the engineers alone, who in most cases only concentrate on waste quantities (volume and weights). The development of sustainable waste management would require the involvement of various stakeholders, including policy makers. Usually, these policy makers are not engineers by profession, and have a tendency of looking at data that easily directs them to make a decision. In this case, the data that would easily direct them is the waste product most likely to be found in the waste streams and its benefit, such as re-use and recycling of this waste type in terms of job creation potential. Quantity in terms of weight as the only factor upon which to formulate waste management plans would be misleading. For example, one bar of metal would weigh several times more than heaps of paper that would yield several rolls of tissue paper, if paper recycling plant was put in place.

To enhance the comments made in the foregone paragraphs, this concern was raised by most politicians and other stakeholders that were interviewed or interacted with during the study. Therefore, the study has taken into account the frequency in addition to the waste quantities generated. The combination of the two would easily direct all stakeholders to make meaningful decisions. The summary of frequency of waste generation adds value to the study because it shows the most likely types of waste that would be obtained in a given area and the amounts by mass of these types of waste.

Therefore, assessing the characteristics of a series of observations to determine the distribution frequency of different types of waste becomes the first step in planning waste management systems. In addition, the knowledge about frequency of waste generation plays a major role in the planning of waste management systems. To this effect, this particular subject matter is dealt within Sections 4.2.7 to 4.2.12.

#### **4.2.7 Frequency Distribution of Waste Generated by Households**

It must be reiterated, as stated above, that knowledge about the frequency of distribution of the waste generated is an important factor in the development of solid waste management plans and systems. The presentation of frequency gives a picture of the most likely abundant and available component of solid waste in a given location. Therefore, it is shown in the Figures 4.10, 4.11, 4.12, 4.13, 4.14, 4.27, and 4.28 that frequency of waste components generated is a critical factor in the development of solid waste management systems.

#### **4.2.8 Ha Ts'osane**

The surveyed households in this location indicated that 96% households generated paper while 91% of households generated plastics. The third category was organic waste generated by 70% of households. Beverage cans ranked fourth in frequency, where 62% of households generated this class of waste. Other classes included potential hazardous waste at 42% households, glass at 36% and textiles at 2% (Fig 4.10). The picture is different in the case of quantities generated. Even though organic waste is third in frequency of generation in relation to paper and plastics, it has the highest percent by mass in comparison with paper and plastics. The obvious explanation is that food waste weighs more than paper and plastic.

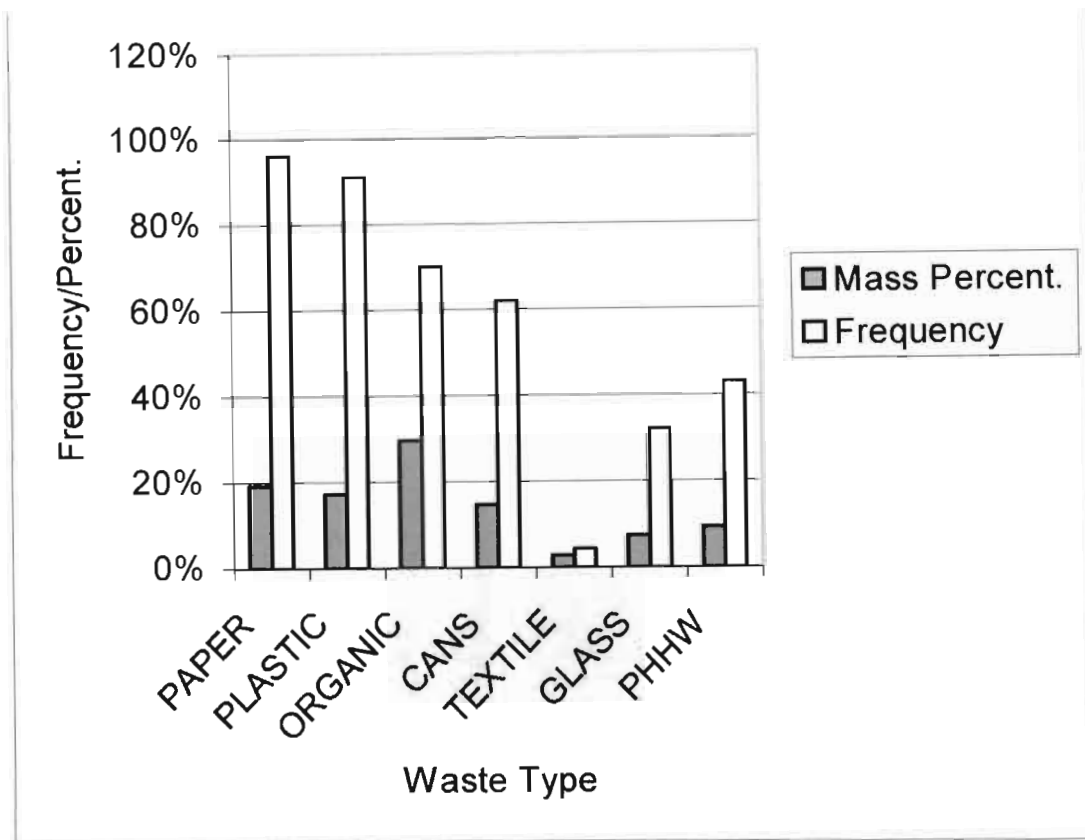


Figure 4.10 Graph of Waste Percentage by Mass and Frequency (Tsosane)

#### 4.2.9 Katlehong (Middle Income Area)

In the case of Katlehong, the survey results showed that 97% households generated paper, while 94% households generated plastics. Organic waste ranked third at 88%, followed by cans, at 69%, then glass at 44%; and potential hazardous wastes at 9% (Fig 4.11).

The scenario in terms of percent by mass is similar to that of HaTsosane. Though organic waste ranks third in frequency, it has the highest percent by mass with reasons as given in Section 4.2.8.

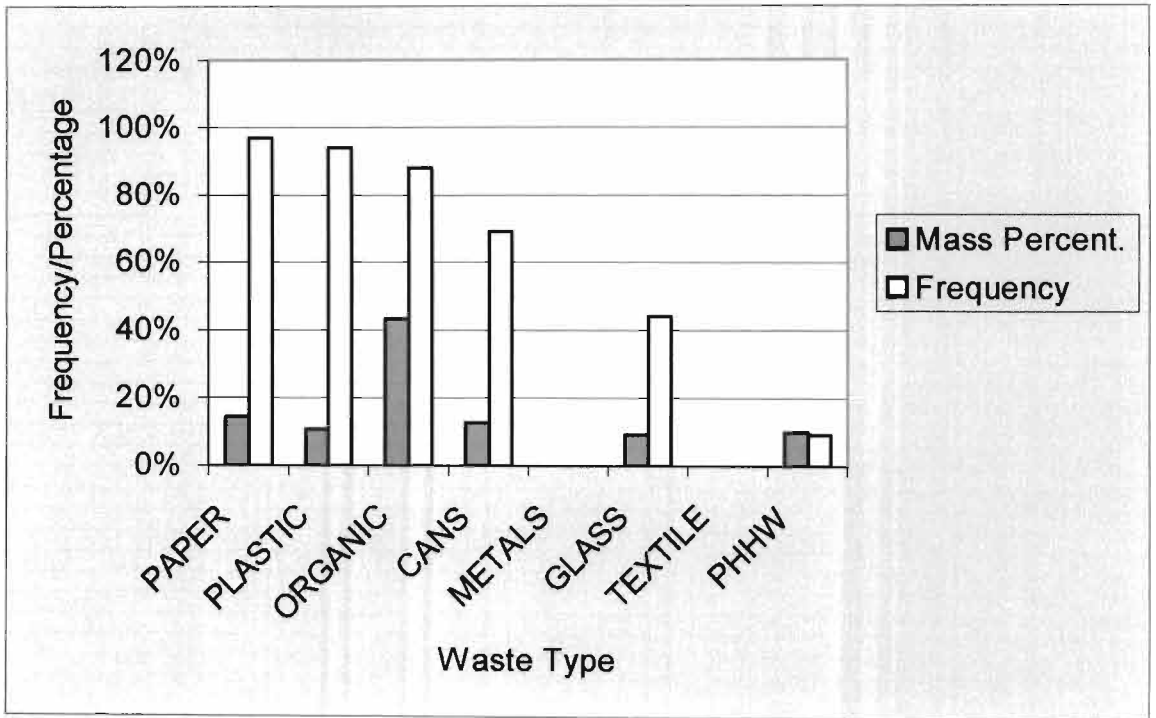


Figure 4.11 Graph of Waste Percentage by Mass and Frequency (Kathlehong)

#### 4.2.10 Hillsview (High Income Area)

This is the area where Senior Government officials reside. In addition, some of the business people reside in this area as well (GOL, 1996).

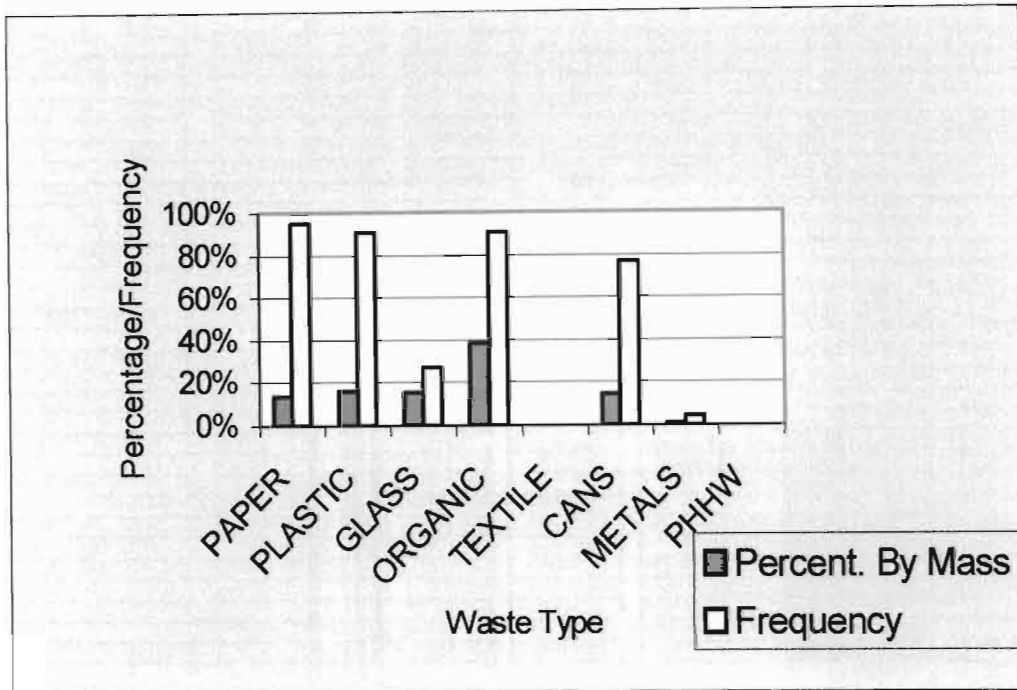


Figure 4.12 Graph of Waste Percentage by Mass and Frequency (HillsView)

From the survey results as indicated in Fig. 4.12, it was observed that 97% households produced paper. On the other hand, 91% households generated both categories of organic and plastic waste. Those houses whose bins did not have organic waste gave as a reason that this waste was fed to chickens and dogs. In addition, 78% households generated beverage cans, while 25% generated glass. In terms of percent by mass of the waste generated, organic waste still dominated at 40 % with paper and plastics almost half the percentage of organic waste.

#### 4.2.11 Maseru West (High-Income Area)

This is another residential area where top government officials and other high-ranking officials, including members of diplomatic missions reside. Data from this area (Fig.4.13) indicated that three classes of waste, namely: paper, plastic and organic, had the same frequency. These three classes of waste were generated by 97% households. Generation of cans as waste was second in frequency, in which 81% households generated this class of

waste. The third in frequency was glass, which was generated by 61% households. Only 6% household generated the potential hazardous household waste, while 2% generated textile materials.

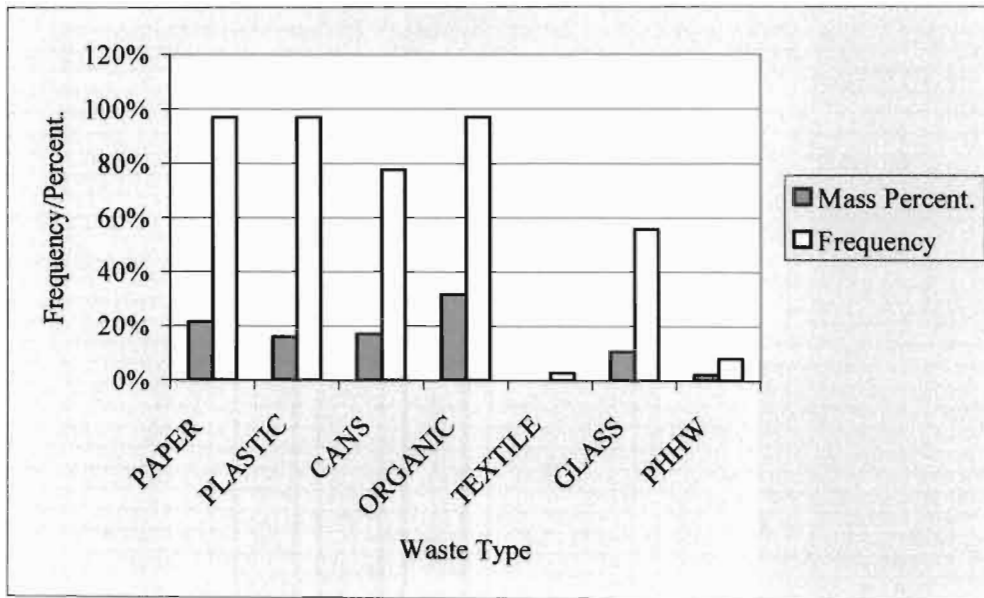


Figure 4.13 Graph of Waste Percentage by Mass and Frequency (Maseru-West)

Similarly, in Maseru West, the picture is not different from Hillsvieiw when it comes to percent by mass of the waste generated. Organic waste has the highest percent by mass, followed by paper and plastics.



#### 4.2.12 Maputsoe (Low -income Area)

The results of Maputsoe households (Fig.4.14) displayed in most cases similar trends to those of HaTs'osane low-income household in Maseru, except for the cans and glass components.

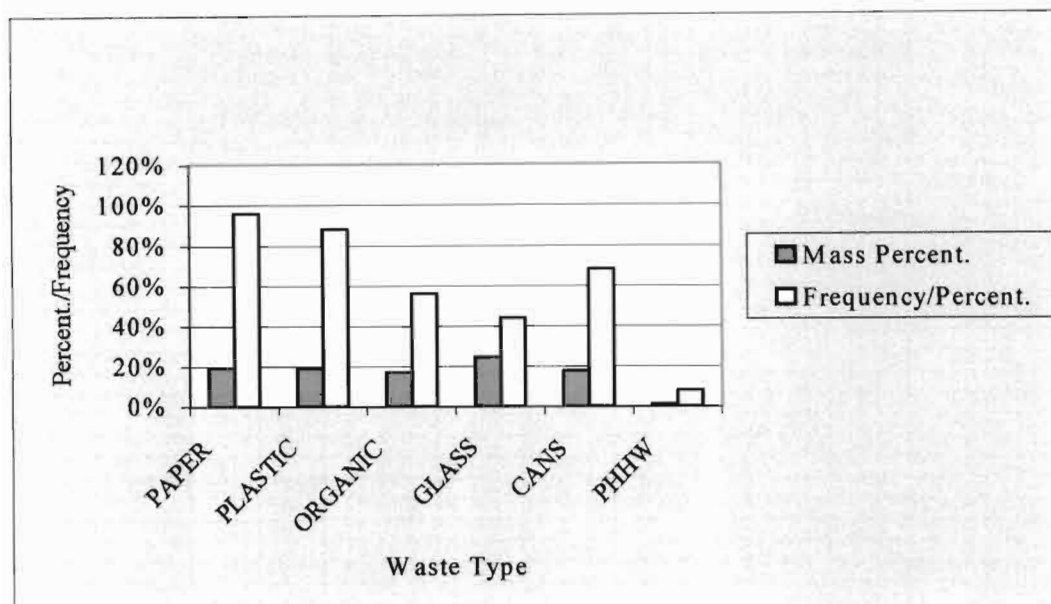


Figure 4.14 Graph of Waste Percentages and Frequency (Maputsoe, Low Income)

These results showed that 96% households generated paper. Similarly, plastic ranked second, with 88% generating this class of waste. Generation of beverage cans ranked third, with 68% households generating this component of waste. The fourth ranked waste in this category was organic waste, generated by 56% households followed by glass at 44%. Only 11% households produced potential hazardous waste. In this case, it is seen that, unlike the result for Maseru, beverage cans in this town feature highly among the types of waste generated.

In terms of percent by mass, glass has the highest percent by mass (approximately 30%) as compared to other components, despite being fifth in frequency. The reason is that glass weighs heavier than the rest of the components indicated.

The implication of these results is that when planning waste management systems, each location should take into account the prevalent waste generated.

### 4.3 ANALYSIS OF HOUSEHOLD QUESTIONNAIRE RESPONSES

As indicated in Section 3.10.1, a total of 251 questionnaires were submitted to the householders. Although the questionnaires were pre-tested for between 35 to 60 minutes time of completion, the respondents received them as take-home questionnaire in order to give them time to think over the questions. This had another advantage in that it enabled the participation of the head of household (who in most cases was not available because was at work as a household breadwinner). It must be emphasised here that the researcher was fully aware that take-away home questionnaire could also have a negative impact. However, enough effort was made to emphasise to the respondents to answer as honestly and accurately as possible because this was for their own benefit. In this study, the issues investigated from householders were as follows:

- Separation of waste at source and willingness to separate,
- Awareness of recycling / re-use and the value of waste generated,
- Type of waste collection services offered, and their preference,
- Willingness to pay for waste services and the affordability.
- Community involvement: in terms of waste pre-collection and satellite waste collection and multi-material drop-off points,
- Preferred means of transportation of these waste, and
- Gauge awareness of polluter-pays principle.

These issues were taken into account because the success of solid waste management system depends on its acceptance by the community and whether it meets their expectations and preferences. This would then foster community-based support for sustainability of the service. The issues indicated in this section addressed the community involvement requirements. The analysis of the data in this section is per area of households.

It must be borne in mind that gauging the willingness-to-pay and affordability of the waste service could be a complex issue because it involves inquiry of peoples' incomes. Within the limitations of this study, the researcher attempted to handle this issue the best way possible. In this case, the study took into account that a price-oriented approach would perhaps be the most essential element in the offering of municipal solid waste service. Hence, information would be required on the value placed on different levels of the waste service. This

information would help to ensure that contributions should be paid by those who benefit from the system in order to recover the cost for the waste service rendered. The study also took into account that willingness to pay for the full costs of a waste service was a clear indication that the service was valued and therefore would most likely be used and maintained. In this way, the information obtained would help to put in place a system that would be able to generate funds required to sustain the service.

Within the limitations of the study, the information required for gauging affordability was through the elicitation of information concerning household income. Though this route produces good results, the results are usually less reliable. The poor reliability of results is because income questions receive arbitrary answers. Hence, estimations and conclusions based on the income-generated data should be approached with caution. Therefore, in this study, efforts were made to assure the respondents of the need for accuracy and honesty. However, from the respondents' results, it is clear that the starting point bids of M1-5 per month in the affordability-to-pay questions was seen as an anchor point. The respondents were biased by the lowest amounts they were confronted with for valuing the solid waste system. The first range of M1-5 was selected by the researcher because at the time of data collection, the fee was M5 per month per household.

It must be noted also that monthly incomes data was sourced only for households. While there was a general expression of willingness to pay for the waste service by the households, data showed that a good number of respondents in households were not willing to spend above M5 per month, other than paying M5 per month. This response was biased towards the lowest range bid provided. In addition, the M5 per month was what they paid for the waste service, hence an influence by this figure. The full results of this assessment are outlined in the subsequent paragraphs.

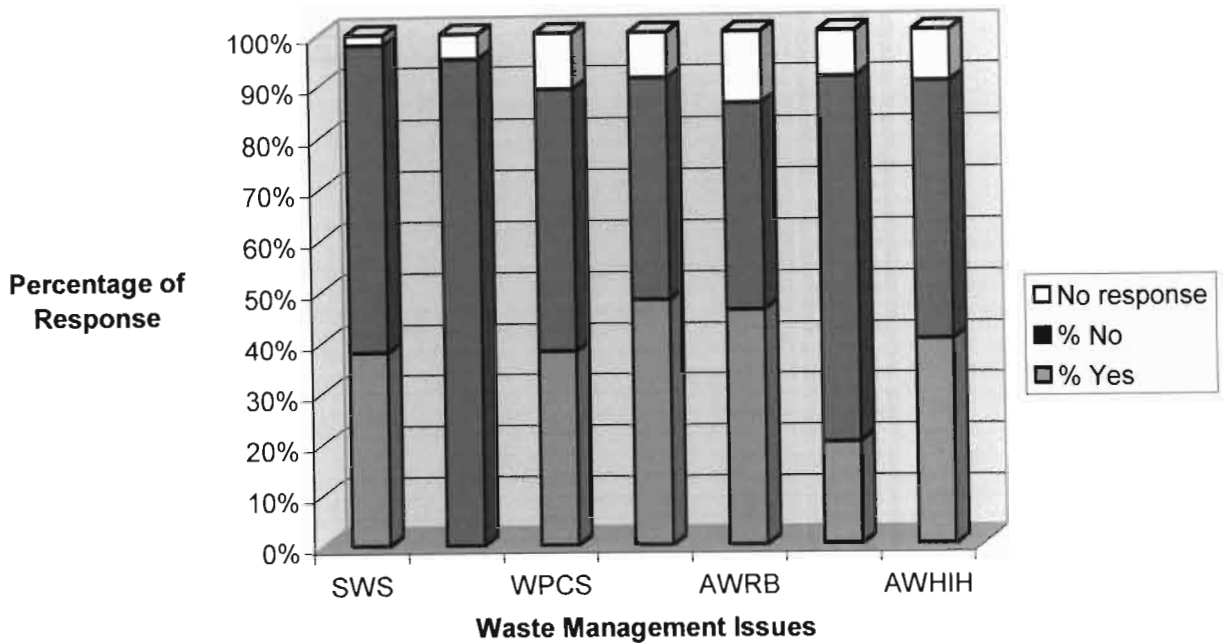
Another point to note is that in the affordability-to-pay graphs, each bid range given was weighed against 100%. This was so because certain households indicated they could afford more than one bid range. In this case, it must be noted that the totals of all the bars in the graphs are not expected to add up to 100%. Because each bar is a representative of 100%.

**Ha Tsosane:** From Figures 4.15 and 4.16, and Table 4.7, it is shown that 95% of households indicated non-existence of formal waste collection service in HaTsosane. For those who indicated they had waste collection service this meant the waste that they collected themselves for use as domestic biomass energy source and for selling to scavengers for re-use and recycling purposes. This point is strengthened by the responses on awareness of the benefit of recycling. As shown from the figures and table, 46% of households indicated awareness. On the other hand, the lack of formal waste collection services in HaTsosane could be the reason why most of the householders (51%) were unwilling to pay for these services. However, there was a general good indication of support and paying for the service, if the waste management process involved communities, such as creation of satellite waste collection and drop-off points, using community members' transport, etc. In this regard, 71% of households showed support for using personal vehicles. It was also observed in the results that the majority of households were ignorant about the polluters-pays principle and the adverse impacts that may result from the activities of waste handling.

**Table 4.7 Questionnaire Analyses for HaTsosane Households**

Issues raised by questionnaire	% Yes	% No	% No response
Separation of waste at source	38	60	2
Waste collection services offered	0	95	5
Willingness to pay for collection services	38	51	11
Establishment of waste collection Satellite drop-off points	48	43	9
Awareness of waste recycling benefit	46	40	14
Awareness of polluter pays principles	20	71	9
Awareness of waste handling impacts on human health	40	50	10

Source: Computed by the Author from the Survey Data



**SWS**= Separation of Waste at Source      **WCS**= Waste Collection Services  
**WPWCS** = Willingness to Pay for Waste Services      **WSCP**= Waste Satellite Collection Points  
**AWRB** = Awareness of Waste Recycling Benefits      **APPP**= Awareness of Polluter Pays Principle  
**AWHH** = Awareness of Waste Handling Impacts on human Health

**FIG 4.15 Ha Tsosane: Community's Response to Aspects of Waste Management**

In Hatsosane, the affordability of waste collection service, as seen in Fig. 4.16 showed that of those households which indicated affordability, 33% indicated the range of between M1-5, with few (7%) in the M6-20, and non above these ranges. As already pointed out in Section 4.1.3, this is major concern. Even though a good number of households opted for the M1-5 range, it is envisaged that this amount would be far from sufficient in meeting the cost recovery for waste service offered. Another important point about this area is as that it did not receive formal waste collection services, therefore the residents would not be able to compare the affordability values to any other fee charged. Hence, the smallest value of M1-5 was appealing. However, there was a good indication that should a waste collection service be put in place in HaTsosane, the inhabitants of this location would highly recommend the need for the government to put in place waste management system that would involve the communities and create jobs. In this case, this would involve making use of personal

vehicles, hand animal carts and horses, when taking waste to the satellite waste collection or drop-off points.

The study has created a picture for the status of waste service in Ha Tsosane. At the time of the study, there was no waste service in this location. This could have been the contribution to the choice of lowest affordable value of M1-5 because they had no reference point. Of now, the charge has been put at M10 per household per bin. Ha Tsosane has an estimated number of 1713 households and this would give a revenue of M17,130 per month or sum of M205,560 per annum. This amount would go a long way to support job creation activities through MSWM in the area if there was a community-based waste management system.

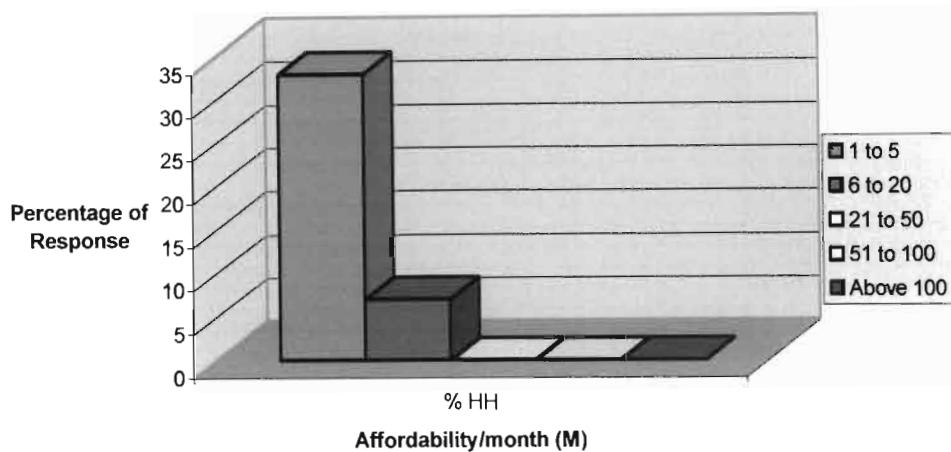


Fig 4.16 HaTsosane: Community’s Response to Affordability of Waste Collection Services

**Katlehong:** In Katlehong the picture is slightly different from that of HaTsosane in terms of questionnaire responses concerning waste management issues. As seen in Fig. 4.17 and Table 4.8, good number of households (70%) acknowledged that they received waste collection service. On the other hand, only 30% indicated separation of waste at source. Those that separated waste at source did so mainly for selling to scavengers and feeding chickens. However, even though the number of households willing to pay was 42%, it is an encouraging finding, taking into account the sporadic nature of this service in Maseru. On the contrary, the households in Katlehong were less in favour (38%) of establishing satellite waste collection or drop-off points. On the other hand, should such a venture involve the community in using motorised means of transport, human-animal drawn carts or horses, only

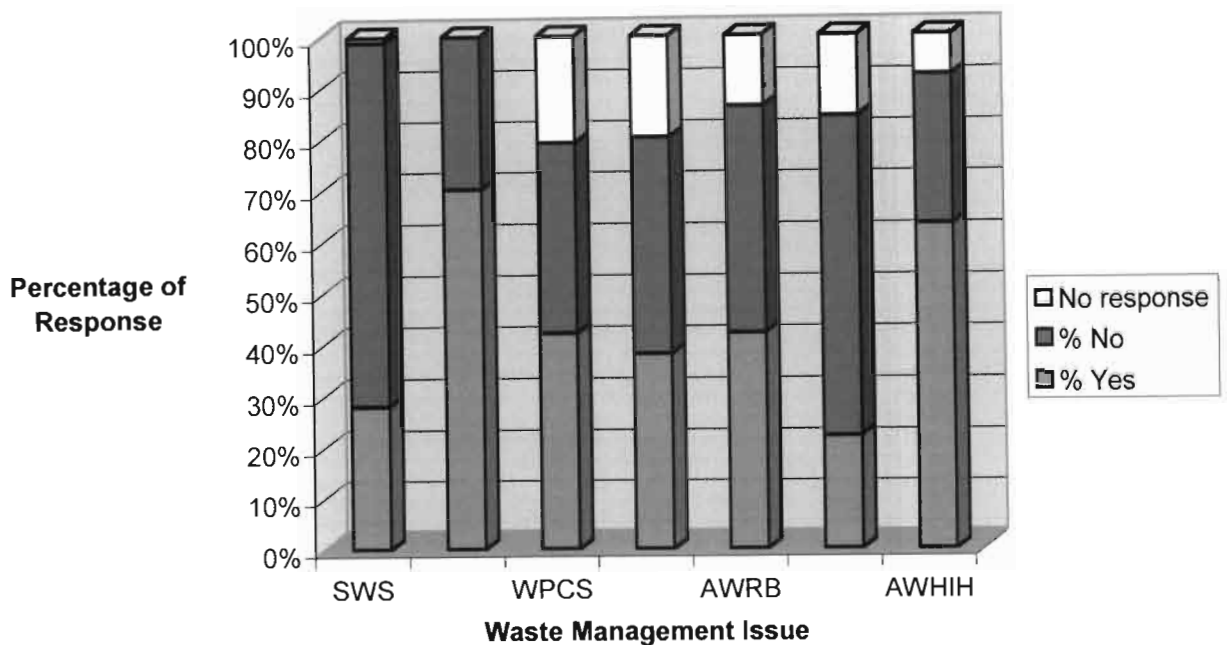
then would they be able to support this service. The level of recycling awareness was at 42%, signifying a lack of understanding on environmental issues in this location.

The general low awareness of environmental issues signify the need to raise awareness. As shown from the results, even though considerable number of households received waste service, still, the nature of service offered was sporadic. This could have led to low willingness to pay for the service.

**Table 4.8 Questionnaire Analysis for Katlehong Households**

<b>A Questionnaire Raised Issue</b>	<b>% Yes</b>	<b>% No</b>	<b>% No response</b>
Separation of waste at source	28	71	1
Waste collection services offered	70	30	0
Willingness to pay for collection services	42	37	21
Establishment of waste collection Satellite drop-off points	38	42	20
Awareness of waste recycling benefit	42	44	14
Awareness of polluter pays principles	22	62	16
Awareness of waste handling impacts on human health	63	29	8

Source: Computed by the Author from the Survey Data



**SWS**= Separation of Waste at Source      **WCS**= Waste Collection Services  
**WPWCS** = Willingness to Pay for Waste Services      **WSCP**= Waste Satellite Collection Points  
**AWRB** = Awareness of Waste Recycling Benefits      **APPP**= Awareness of Polluter Pays Principle  
**AWHH** = Awareness of Waste Handling Impacts on human Health

Fig 4.17 Katlehong: Community's Response to Different Waste Management Aspects

Relating to affordability, Figure 4.18 indicates that most of those who responded were in favour of paying amounts between M1-5. Only 5% indicated M6-20. On the polluter pays principle, very few (22%) were aware of it. Similarly, fewer households (37%) had knowledge of the impacts on human health resulting from waste handling. For those who responded to the question of means of support for the sustainable waste collection service, households suggested support in investing more in waste management activities of the city councils to enable these institutions to do proper waste management work. The reason for low levels of awareness is, as indicated already, lack of environmental awareness campaigns, specific policy, and legal framework on solid waste issues. In addition, the choice of M1-5 by more households again point out to the amount they usually paid per month for this service (M5). Katlehong had an estimated 490 households. This would mean revenue of M4, 900 per month would be raised from this location, giving an estimated total of M58, 800 per annum.



This amount if realised in full would go along way to improve waste collection service in Maseru.

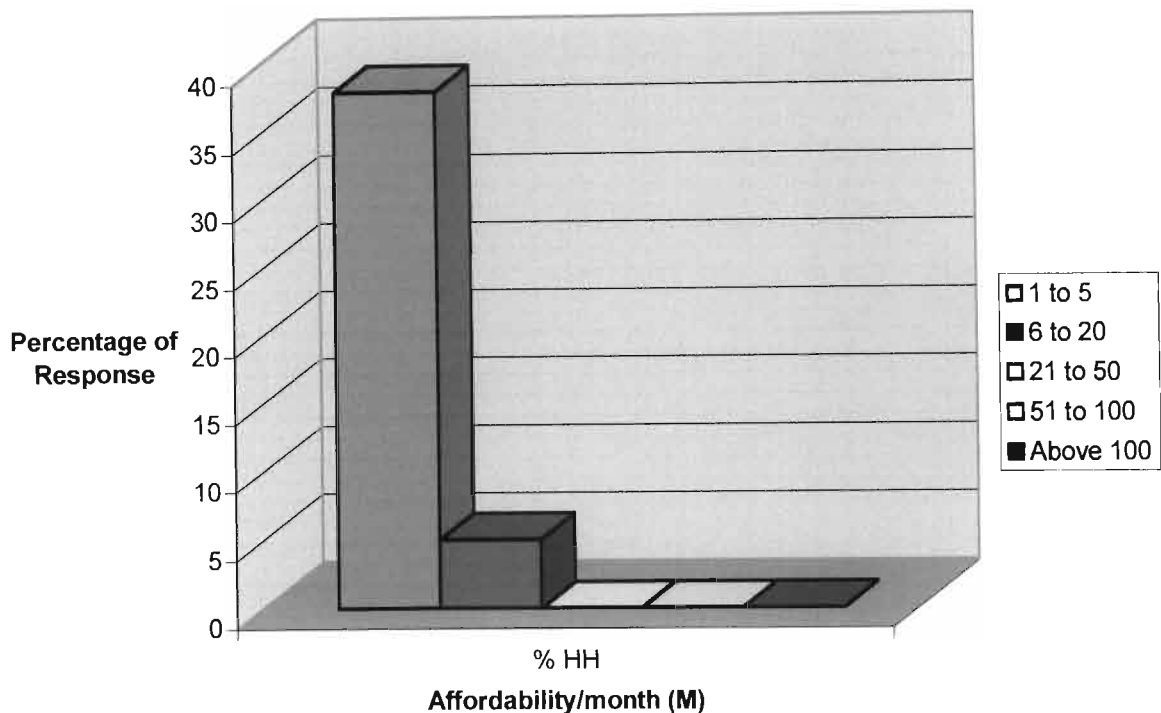


Fig 4.18 Katlehong: Community’s Response to Affordability of Waste Collection Services

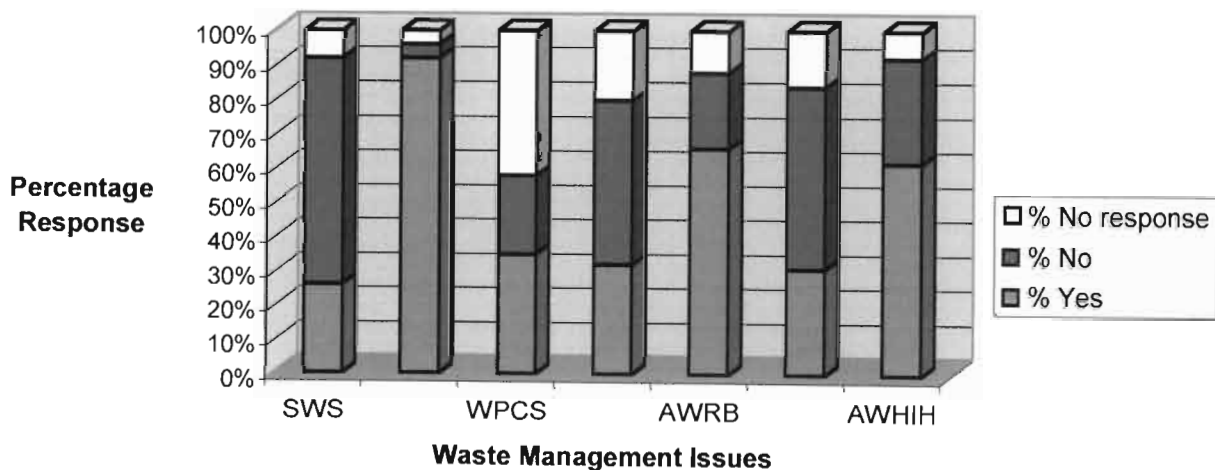
**Hillsview/New Europa:** Results in Table 4.9, Figures 4.19 and 4.20 show that Hillsview recorded the highest waste collection services in which 92% households received the waste service. From the feedback of the study, it was revealed that separation of waste at source was very low. Only 26% households separated waste at source, and this was done for the major reason of selling to scavengers and feeding animals and chickens. The other key issue was willingness to pay for waste services. Taking into account that this location had 92% households receiving waste collection services, it was expected that the willingness to pay for the service would be high. However, this was not so, just a mere 35% households indicated a willingness to pay for the waste collection services. The major reason for this result was that the services were sporadic and erratic. It was also surprising to note that a large number of households (42%) were undecided on this issue. Efforts were made to persuade the respondents to answer all questions, but in certain cases, an unusually bigger number of households in this area declined. The picture would have been different if those households 42% had given their responses. In this area, those in favour of establishment of the satellite

waste collection or drop-off points were also few (32%). It was also observed that if community-based waste management was established, the use of vehicles for community members was highly regarded as a priority, over human-drawn handcarts, bicycles and animals drawn carts in this order of preference. In this area, the level of recycling benefits awareness was reasonably high, at 66%. This was expected because the majority of the inhabitants were educated and have travelled overseas where the issues of waste management are seriously tackled. The generally low percentage in the given responses to many questions was attributed to the unsatisfactory service offered.

**Table 4.9 Questionnaire Analysis for Hillsview Households**

A Questionnaire Raised Issue	% Yes	% No	% No response
Separation of waste at source	26	66	8
Waste collection services offered	92	4	4
Willingness to pay for collection services	35	23	42
Establishment of waste collection Satellite drop-off points	32	48	20
Awareness of waste recycling benefit	66	22	12
Awareness of polluter pays principles	31	53	16
Awareness of waste handling impacts on human health	63	31	8

Source: Computed by the Author from the Survey Data



SWS= Separation of Waste at Source      WCS= Waste Collection Services  
 WPWCS = Willingness to Pay for Waste Services      WSCP= Waste Satellite Collection Points  
 AWRB = Awareness of Waste Recycling Benefits      APPP= Awareness of Polluter Pays Principle  
 AWHH = Awareness of Waste Handling Impacts on human Health

**Fig 4. 19 Hillsview: Community's Responses to Different Waste Management Aspects**

On affordability, as shown in Figure 4.20, only 23% indicated that they could afford to pay for the services at between M1-5, and a mere 7% could afford at both ranges of M6-20 and M21-50. The low willingness could be explained by the views of the poor quality of services rendered. The awareness of impacts on the human health as a result of waste handling was also very low (31%) among these households. These results seem very inexplicable because if the inhabitants were aware of the benefits of waste recycling, it would be most likely that in the same way, they should be aware of the latter. In general, there was a suggestion from Hillsvie households that the Government should consider investing more into the waste management ventures to enable the Local Authorities (LA) responsible for waste management to boost waste collection services. In this case, 22% supported this suggestion and the other 22% supported use of community-based approach.

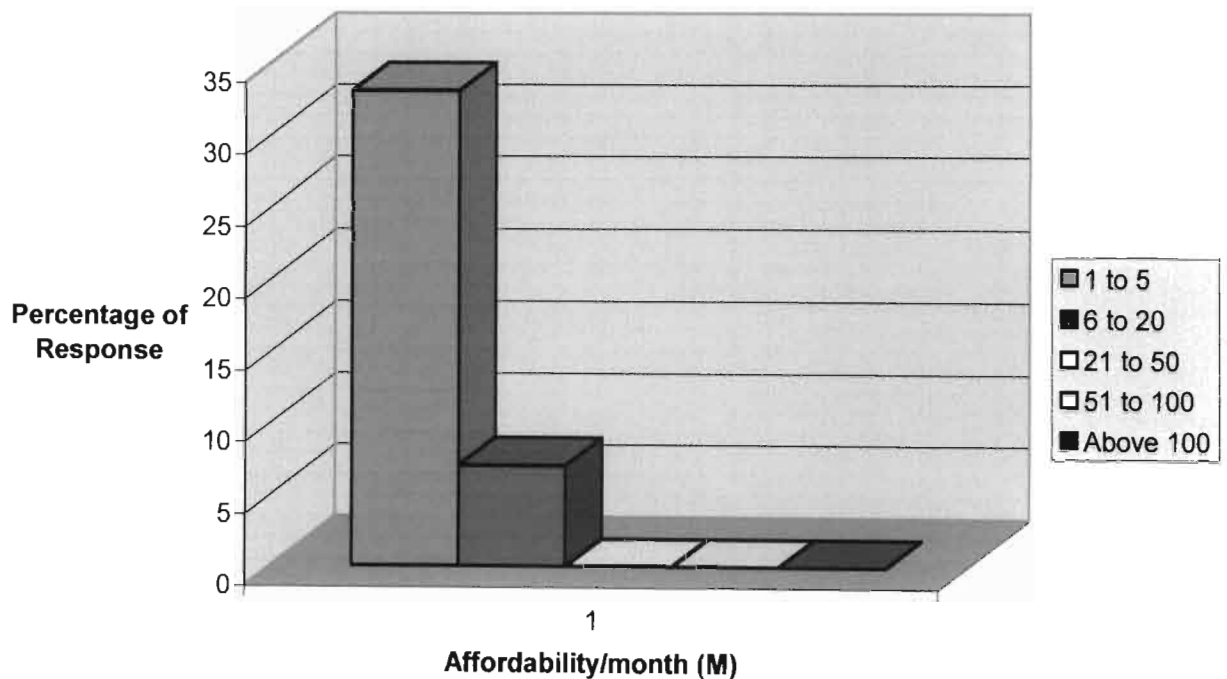


Fig 4.20 Hillsvie/New Europa: Community’s Response to Affordability of Waste Collection Services

In the case of Hillsvie, though the response on affordability was generally poor, there has been a noticeable shift in the affordability bid ranges towards higher bid ranges. This is a welcome development as it can be used in determining amounts of waste service fees for the area. In this case, the waste service fee could be made higher than that of Ha Tsosane and Katlehong, depending on what mode of waste service fee adopted by the Local Authorities. The current service fee at M10, this would give revenue of M4, 740 per month or M56, 880

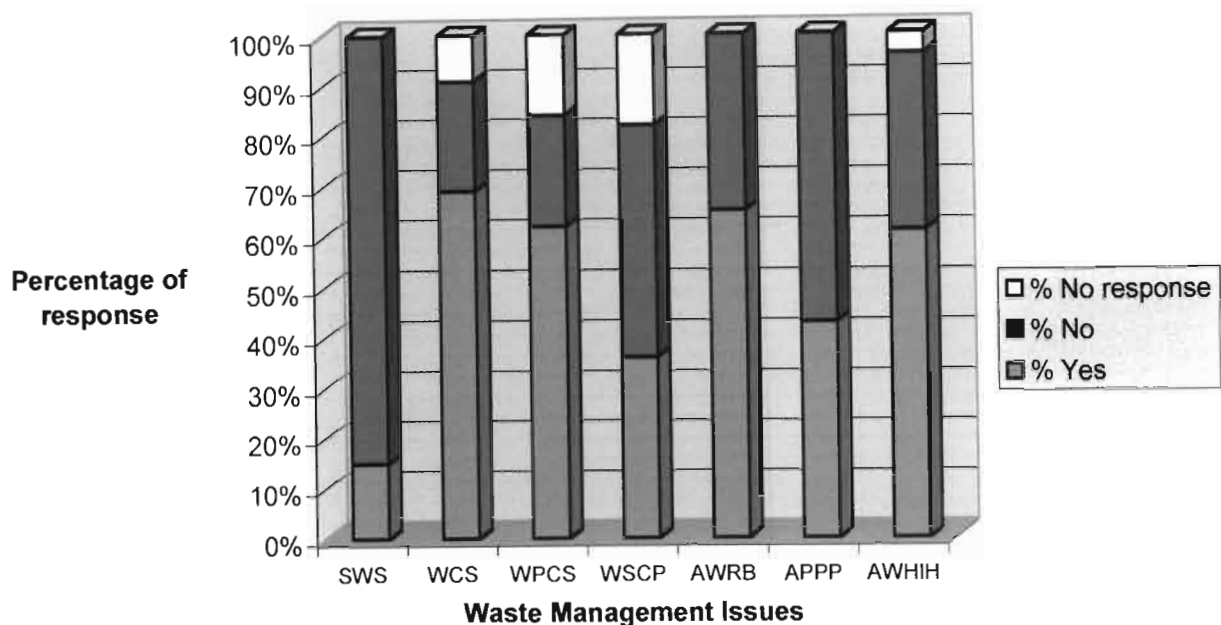
per annum for the 474 households in Hillsvie. This value would be close to that of Katlehong, thus it brings the point of unfairness when a flat rate fee is applied. There is more waste generated per household in Hillsvie than in Katlehong due to the economic structure differences of the two areas: the former being higher in income than the latter.

**Maseru West:** As indicated in Table 4.10, Figures 4.21 and 4.22, Maseru West seems to receive less waste collection services than Hillsvie. Of those households that responded, 76% indicated having waste collection services. Despite this, households in Maseru West showed more willingness to pay for these services than the Hillsvie: 62% in Maseru West as opposed to 35% Hillsvie. This is an encouraging development because despite having fewer services currently, there is more willingness to pay for the services. On the point of separation of waste at source, 15% households indicated they practice this, as they do provide to waste harvesters or feed to animals. The issue of establishment of satellite waste collection/drop off points was not well received in this area. Only 36% indicated willingness to do so. As a high-income area, benefits from waste management activities, such as creating jobs, would not be a priority. Most of the households (60%) favoured the use of motorised transport by community owners, if the community-based approach was to be introduced. The preference of means of transport was motorised vehicles, followed by animal-drawn carts (10%), hand-drawn carts and horses. In this area, as in Hillsvie, a relatively high percentage (65%) was aware of the recycling benefits. Though only 43% were aware of the polluter-pays principle, a relatively high proportion of the households (61%) was aware of the adverse impacts on human health resulting from waste handling

**Table 4.10 Questionnaire Analysis for Maseru West Households**

<b>A Questionnaire Raised Issue</b>	<b>% Yes</b>	<b>% No</b>	<b>% No response</b>
Separation of waste at source	15	85	0
Waste collection services offered	76	24	10
Willingness to pay for collection services	62	22	16
Establishment of waste collection Satellite drop-off points	36	46	18
Awareness of waste recycling benefit	65	35	0
Awareness of polluter pays principles	43	57	0
Awareness of waste handling impacts on human health	61	35	4

Source: Computed by the Author from the Survey Data



**SWS**= Separation of Waste at Source      **WCS**= Waste Collection Services  
**WPWCS** = Willingness to Pay for Waste Services      **WSCP**= Waste Satellite Collection Points  
**AWRB** = Awareness of Waste Recycling Benefits      **APPP**= Awareness of Polluter Pays Principle  
**AWHH** = Awareness of Waste Handling Impacts on human Health

**Fig 4.21 Maseru West: Community's Response to Different Waste Management Aspects**

On the question of affordability, the Maseru West area recorded the highest percentage of household affordability for waste collection service. This again comes as a welcome development when considering that the area received relatively less service when compared to Hillside. As indicated in Fig 4.22, 42% households could afford in this M1-5 range, 8% in M6-20, 12% in range M51-100. As in the case of Hillside, the shift towards a higher range bid was noticed as well, especially in the M51-100 range. This is also a very encouraging sign, though the question of whether this would sustain the service is another issue. The current charge per month per house is M10. It is therefore re-iterated that the flat rate fee for waste service is far from being fair. Considerations should be made to develop charges that take into account the economic status of the area, as shown in Section 4.2 that generation of waste is a factor of the socio-economic status of the household. Using the records that Maseru West has 1948 households, the revenue collection from this areas rounds

up to M19,480 per month, culminating into M233,760 per annum. This amount was not far above the figure that would be realised from the Ha Tsosane, a low-income area, yet there was no service offered in the latter. This suggests that the MCC would make some gains if it offered service to Ha Tsosane in full, especially the community-based approach due to vehicle inaccessible nature of some places in this area. Details on this are already given in early paragraphs of this section.

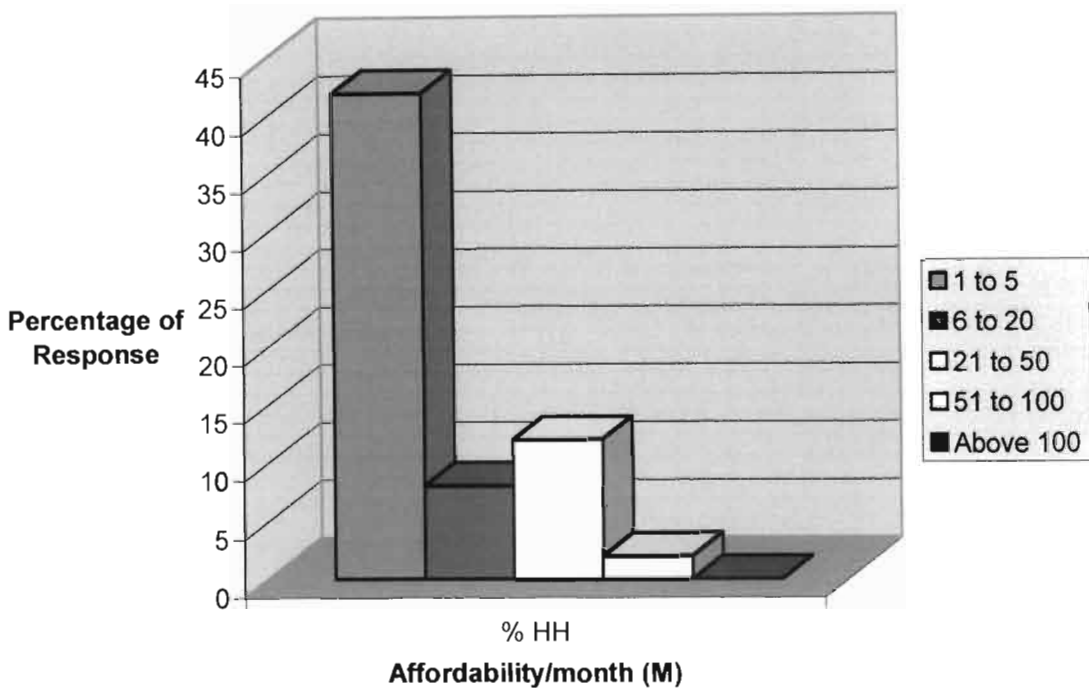


Fig 4.22 Maseru West: Community’s Response to Affordability of Waste Collection Services

**Maputsoe:** Results in Figure 4.23 and Table 4.11 show that Maputsoe (low-income) has very small coverage of waste collection services (12%). If this almost non-existence of waste collection is taken into account, it would be right and proper to say that concerning willingness to pay, at 39%, there was relatively high degree of willingness to pay for the service. However, this was conditional to provision of the good quality service. In addition, there was also relatively higher number of households that separated waste at source (46%). This was understandably so because it was observed during the study that most of the combustible waste were utilized by the households as source of biomass energy; yet some

were collected by scavengers and a farmer who fed the organic waste to the animals. It does not come as a surprise that 54% households were in favour of establishment of waste collection or drop-off points because this was in line with community involvement, which was almost already being practised in this area. Motorised means of transport were favoured by 60%, followed by animal-drawn carts. However, even though households in fact practised community-based waste management, only 32% were knowledgeable of the benefits of recycling. The knowledge about the pollute-pays principle was also very low, at 32%. Despite this, a high proportion of households (69%) were aware of the impacts on the human health resulting from waste handling.

It would be difficult to explain the low level knowledge of the benefits of recycling and re-use. Perhaps, the attributable reason could be lack of environmental education and awareness.

**Table 4.11 Questionnaire Analysis for Maputsoe households**

A Questionnaire Raised Issue	% Yes	% No	% No response
Separation of waste at source	46	53	1
Waste collection services offered	12	84	4
Willingness to pay for collection services	39	52	9
Establishment of waste collection Satellite drop-off points	54	41	5
Awareness of waste recycling benefit	32	56	12
Awareness of polluter pays principles	32	42	26
Awareness of waste handling impacts on human health	69	27	4

**Source: Computed by the Author from the Survey Data**





Tsosane had no reference point. On the other hand, the expected solid waste collection fee to be recovered from Maputsoe urban with 2,927 households would be M 29,270 per month or M 351,240 per annum, assuming a 100% recovery of waste collection fee. This amount would exclude the peri-urban areas of Maputsoe. During the time of the study, only 12% households received the waste collection service from the Town Clerk’s office. The 12% households would yield revenue of M 42,149 per annum, signifying a loss of M309, 091 per annum. These figures indicate how critical the situation was. It would therefore be appropriate to introduce an integrated community-based waste management system in Maputsoe.

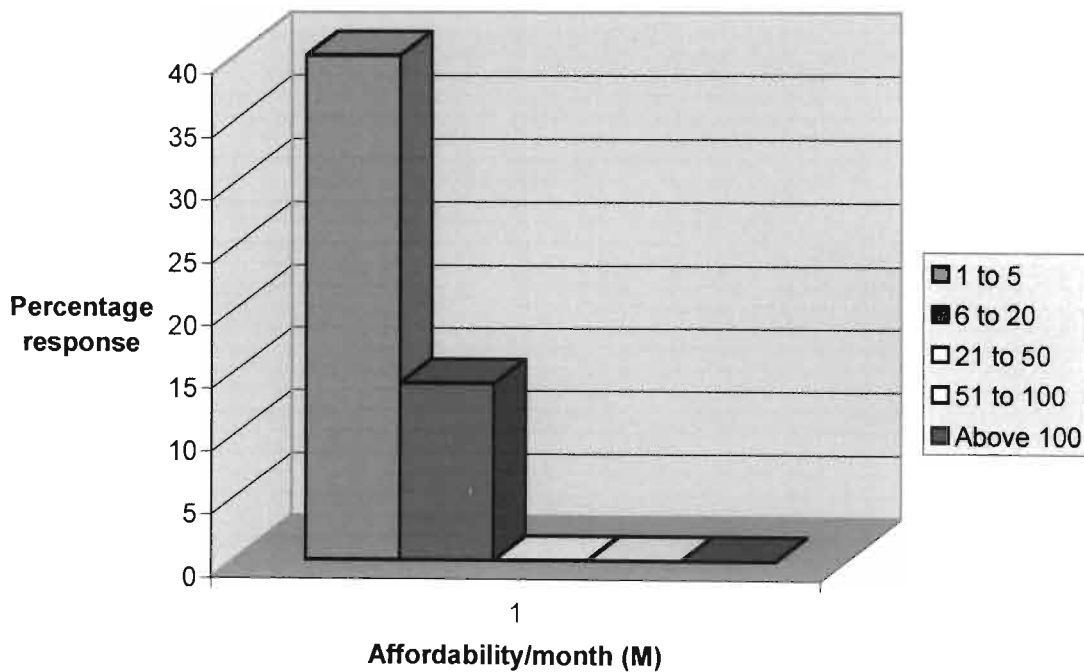


Fig 4.24 Maputsoe Low Income: Community’s Response to Affordability of Waste Collection Services

#### 4.3.1 Summary on the shortfalls of the methods used for gauging affordability to pay and willingness to pay

It has been shown that the method of gauging affordability using the bids ranges would only serve as a guide upon which, generally, decisions on affordability would be based. But, if very accurate results would be required, this information needs to be supplemented by other means of gauging affordability.

A price-oriented approach would perhaps be the most essential element in the offering of municipal waste services. In this case, information is required on the value placed on different levels of the services. Contributions should be paid by those who benefit from the system in order to recover the cost.

Willingness to pay for the full costs of a particular service, it is a clear indication that the service is valued and most likely be used and maintained. Hence able to generate the funds required to sustain the services. From the respondents it has been shown that the starting point bids used in the affordability to pay questions was seen as an anchor point. The respondents were biased by the amounts they are confronted with for valuing the solid waste system. While there was a general expression of willingness to pay for the waste service, the affordability for households showed a large number of respondents in house hold not willing to spend more than M5 per month. This was because at the time of the data collection, the fee for waste service was around this figure. Currently, the fee has been raised to M10 per household (dust bin) per month.

One aspect which should have been explored would have been to gauge the response if it was the local authorities which would cover the total cost of the waste service. This would have gauged the impression that only those who receive the waste service were to pay for the service. There would be need to try this. It is a gap, which requires to be covered. The way of gauging this would be expressing in the questionnaire the aspect of voluntary contribution from residents but refrain from a contribution from the Local Authority (LA).

Another factor is lack of point of reference for those areas, which did not receive formal waste collection services. Therefore the residents of such households would not be able to compare the affordability values to any other fee charged, hence the smallest value of M1-5 was appealing.

It is apparent that for households, the indicated questionnaire starting point of affordability (M1-5) in Maseru and Maputsoe is too low and not practical. Therefore, as a benchmark, it would be useful to utilise the expenditure approach in addition to monthly incomes. In this case, it has been established that between 0.7 and 2.5% of monthly expenditures for cost of

living can be contributed to cost of SWM services by households in low-income countries (Cointrean & Levine, 1994; Alfa & Dashazo, 1996; Pfammatter and Schertenleib 1996; World Bank, 1992). This internationally accepted figure can be used as assessing people's affordability to pay for SWM services and like wise, to verify over or under estimation of the willingness to pay results. This gap may require to be done before implementing the solid waste management system. An assessment of average monthly expenditure per month may be needed in order to estimate close sustainable affordability-to-pay expenses for solid waste collection. Hence, it can be concluded that based on the affordability and willingness to pay by households at M1-5 for the solid waste management system for Maseru and Maputsoe is somewhat under estimated.

Although less reliable, the affordability to pay for SWS can also be verified through elicitation of household income. The less reliability comes in because income questions are susceptible to arbitrary answers of the respondents. Hence, estimations and conclusions based on the income-generated data should be approached with caution and validated by means of data on cost of living expenses. From the data on socio-economic results under Section 4.2.5, the income bracket has monthly average of M220 middle income M1020 while the high income M5600. In this case, the average monthly income for all categories of household would lead to a suggestion that payment of between M20 and 30 would be a good proxy for determining the affordability.

The other approach would be changing different rates according to category of the residential areas, unlike a blanket fee. This signifies the point that, before implementing the waste management system, the affordability and willingness to pay for waste services should be additionally carried out and the best route would be taking into account the monthly expenditures of households.

#### 4.4 COMMERCIAL AND INDUSTRIAL ESTABLISHMENTS WASTE GENERATION

In Lesotho, a database on numbers of industries and commercial establishments is not stored electronically. The compilation of the data on this subject was done manually from data files and folders with the help of personnel at the Ministry of Trade and Industry. This information was then verified by referring to other previous similar studies. From this database, it was estimated that there were 93 industries in Maseru urban and 26 in Mapustoe giving a total of 119 industries in both towns. Similarly, the commercial establishments were estimated to be 4634 in Maseru and 635 in Maputsoe totaling to 5269 commercial establishments in both towns. Based on these numbers and the results from field study, as indicated in Tables 4.12, 4.13, and 4.14, the required calculations on quantities of waste generated by these establishments were made.

**Table 4.12 Weekly Averages of Solid Waste Generation per Establishment<sup>6</sup> (Kg/esta/week)**

Category of Waste		Paper	Plastic	Organic /Food wastes	Beverage Cans/Foils	Textiles/ Fabric	Glass	PHHW <sup>7</sup>	
<b>Establishment</b>	<b>Number of Establishm ent Surveyed</b>								Total Average waste generated
<b>Industries (In Maseru)</b>	N = 11	7.08	6.97	15.48	0.42	49.64	0.36	#1139.10	<b>1219.05</b>
<b>Commercial Establishment (In Maseru)</b>	N = 13	345.90	232.40	35.60	4.90	-	0.40	-	<b>619.20</b>

Source: Computed by the Author from the Survey Data

<sup>6</sup> Information on the number of establishments excluded the government public institutions which were extensively researched by Mhlanga and Gulilat (1997), and whose findings of Average Annual Solid Waste Generation per establishment were 828 kilograms per annum.

<sup>7</sup> Most of the potential hazardous waste indicated under industries ( # ) is the fly dust of clay from brick making. This would be useful material for covering the waste and the sanitary landfill site.

Results in Table 4.12 showed that the 11 surveyed industries in Maseru generated an average quantity of 1,219.05 kg per industry per week. Likewise, the 13 surveyed commercial establishments in Maseru generated an average quantity of 628.00 Kg per establishment per week. Although quantities generated per establishment were lower for commercial establishments than those of industries were, the former are the overall major contributor of municipal solid waste, as shown in Table 4.14 and Fig. 4.26. The simple explanation is that there were more commercial establishments than there were industries.

A further attempt was made to establish waste quantities generated per site in a given area, as indicated in Table 4.13 and Fig. 4.25. This was done in order to get a proper picture that would help in the preparations of integrated waste management systems. In this study, the industries and commercial establishments for Maputsoe were not sampled. This was due to limited time and financial constraints. Besides, these industries and commercial establishments have similar characteristics in modes of production and operation. Therefore, an assumption was made that the values of waste generated by establishments in Maputsoe should be derived from the Maseru survey results.

**Table 4.13 Total Weekly Average Solid Waste Generation by establishments in a Surveyed Area (Kg/Area/Week)**

Area of Surveyed Establishment	Number of Establishments per Surveyed Area <sup>8</sup>	Weekly Average waste generated per Establishment	Waste Generated by establishments per Area per week	Total Waste Generated by Establishments per Area per day
Ha Thesane Industrial Site (Maseru)	38	1219.05	<b>46,323.90</b>	<b>6617.70</b>
Rail Station Industrial site (Maseru)	23	1219.05	<b>28038.15</b>	<b>4005.45</b>
Maputsoe Industrial Site Maputsoe	26	1219.05 <sup>*</sup>	<b>31695.30</b>	<b>4527.90</b>
Maseru Commercial Centres (Maseru)	4634	628.00	<b>2910152.00</b>	<b>415716.14</b>
Maputsoe Commercial Centres (Maputsoe)	635	628.00 <sup>*</sup>	<b>398780.00</b>	<b>56965.85</b>

Source: Computed by the Author from the Survey Data

\* These figures are weighted averages of all the households in the two towns and are derived from the Maseru main survey results.

<sup>8</sup> Information on the number of establishments was sourced from Ministry of Trade and Industry. (Maseru has a total number of 93 industrial establishments).

The results from computations shown in Table 4.13, Fig. 4.25 and Map 4.1 indicate that all 38 industries in Ha Thesane industrial site generated an estimated total quantity of 46,323.90 kg/week (46.32 tonnes/week) or 6,617.70 Kg/day (6.62 tonnes/day). Those 23 industries located in the railway station area in Maseru generated an estimated quantity of 28,038.15 kg/week (28.04 tonnes/week) or 4,005.45 Kg/day (4.01 tonnes/day). In the case of Maputsoe, as indicated in Table 4.13 and Map 4.2, the derived calculations gave an indication that the 26 industries in this place would generate 31,695.30 kg/week (31.695 tonnes/week) or 4,527.90 kg/day (4.53 tonnes/day).

Quantities of waste are important in order to plan and design the solid waste management system. Lack of understanding of waste quantities has contributed to a number of problems, such as over-designed or under-designed systems. From the results of this study, it has shown that the waste generated from the surveyed areas was not small, taking into account that there was no sanitary landfill in Maseru, or in Maputsoe. Therefore, the figures indicated that waste generation was likely to be significant in Maseru and Maputsoe; hence, its management needed urgent attention.

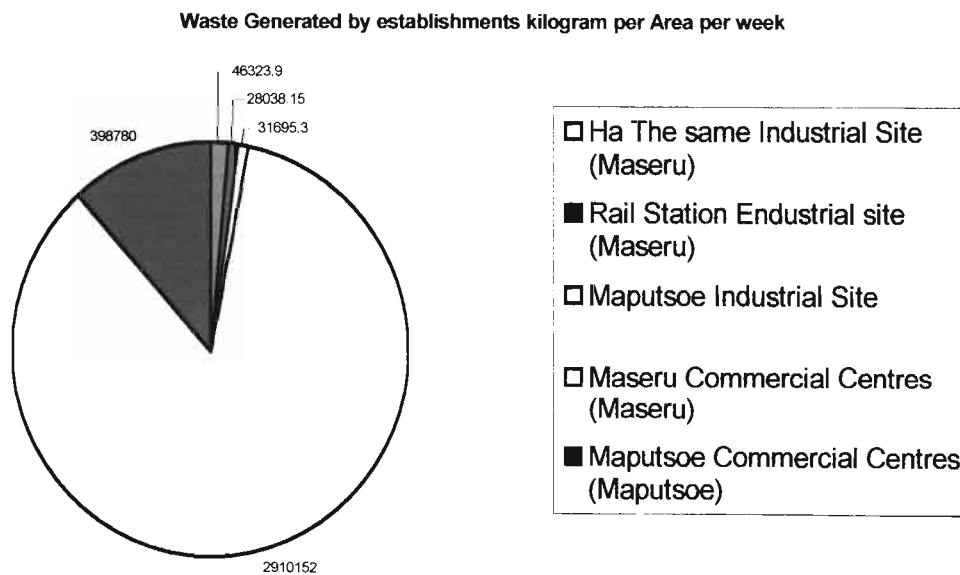


Fig. 4.25 Weekly waste generation by establishment in kilograms per surveyed area.

In terms of commercial establishments, the 4.634 commercial establishments in Maseru generated a total waste of 2,910,152.00 kg/week (2,910.2 tonnes/week) or 415,716.14 kg/day (415.7 tonnes/day). The derived values for Maputsoe gave rise to Maputsoe commercial establishments generating 398,780.00 Kg/week (398.78 tonnes/week) or 56,965 kg/day (56.97 tonnes/day). (See Fig. 4.25, Maps 4.1, 4.2, and Table 4.13 for further details).

As indicated the figure of industries, commercial establishments were even the more critical source of waste in Maseru and Maputsoe. They were the major contributors of solid waste in these towns. When developing the waste management plans, these issues should be taken into account.

In summary, as indicated in Table 4.14, Figure 4.26 and Map 4.3, all the industries in the Maseru urban area generated a total waste quantity of 113,371.65 Kg/week (113.37 tonnes/week) or 16,195.95 kg/day (16.20 tonnes/day), while the derived values for Maputsoe gave rise to 31,695.30 Kg/week (31.695 tonnes/week) or 4,527.90 Kg/day ( 4.53 tonnes/day). Commercial establishments were the largest contributor of waste generation. As shown in Table 4.14, all commercial establishments in Maseru generated 2,910,152.00 kg/week (2910.2 tonnes/week) or 415,716.14 Kg/day (415.7 tonnes/day).

There are two reasons why it is necessary to understand the reasons for undertaking any expensive activity such as the municipal solid waste collection (Lardinois et al,1996). One such a reason is to assign it a priority in relation to other activities that make demands on scarce government or national resources. The second reason is the need to modify the ideas and methods that have been used elsewhere for the best suited to local conditions. The most important parameter in solid waste management is the quantity to be managed in order to determine the size and number of facilities and equipment required to manage such waste. Also important, is the service fee collected for each unit quantity of waste delivered to the facility. Hence, it would be very important to take into account the waste values indicated in the foregone lines when preparing a detailed waste management plan for the two towns. In this case, methods and technologies that have been developed in industrialized countries for solving such problems should not be seen as the modern solutions for all situations, the community-based would be the appropriate route to follow.

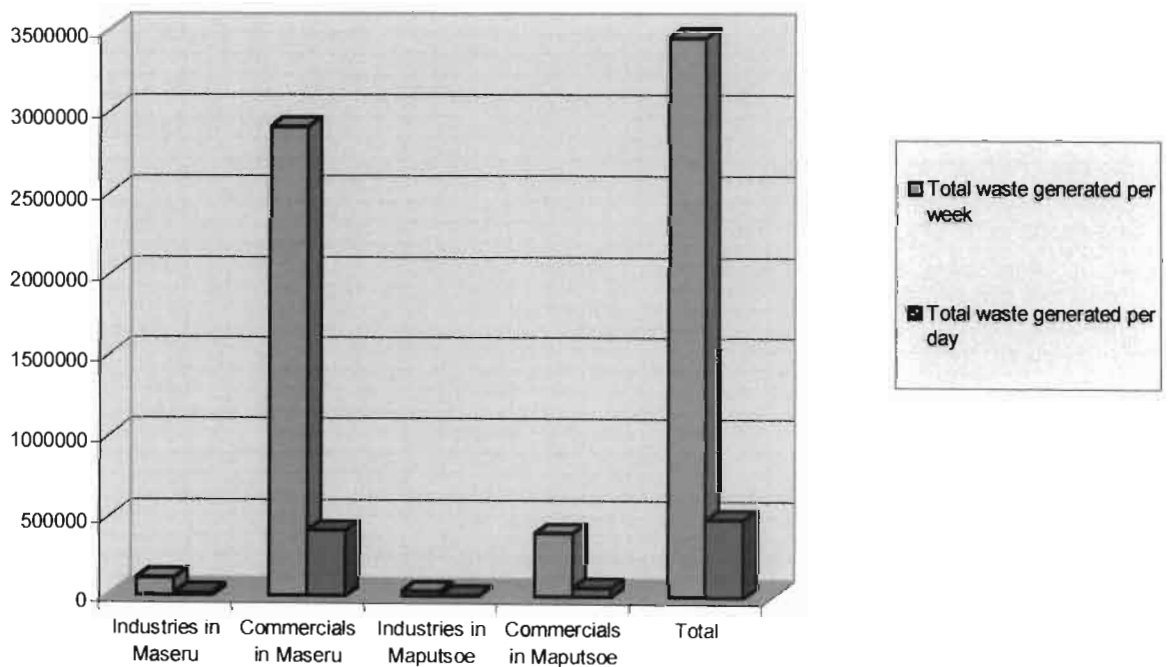
**Table 4.14 Summary of Weekly and Daily Solid Waste Generation from All Establishments in Maseru and Maputsoe (kg/week or /day)**

Source of Area Surveyed	Total Esatablishments <sup>9</sup> per Town	Weekly Average waste	Daily Average waste	Total waste generated per week	Total waste generated per day
<b>Industries in Maseru</b>	93	1219.05 <sup>*</sup>	174.15 <sup>*</sup>	113371.65	16195.95
<b>Commercials in Maseru</b>	4634	628.00 <sup>*</sup>	89.71 <sup>*</sup>	2910152.00	415716.14
<b>Industries in Maputsoe</b>	26	# 1219.05 <sup>*</sup>	# 174.15 <sup>*</sup>	31695.30	4527.90
<b>Commercials in Maputsoe</b>	635	# 628.00 <sup>*</sup>	# 89.71 <sup>*</sup>	398780.00	56965.85
<b>Total</b>	<b>5388</b>	-	-	<b>3453998.95</b>	<b>493405.84</b>

Source: Computed by the Author from the Survey Data

\* These figures are weighted averages of all the households in the two towns.

# These figures are derived from Maseru values on assumption that the industries and commercial establishments are similar in both towns.



**Fig. 4.26 Weekly and daily waste generation by establishment in Maseru and Maputsoe**

<sup>9</sup> Information on number of establishments was sourced from the Ministry of Trade and Industry. (Maseru has a total number of 93 Industrial establishments; while Mapustoe has 26). “Surveyed,” means only areas confined to the boundaries where the main study was undertaken.



From Fig.4.26, a picture has been created on which of the sources generated most waste in these towns and in what tonnage. In proportionality, Maseru has shown by far, that largest amounts of waste were generated here. This, therefore entails that if a priority was to be given as to where would the buy-back centres and recycling plants be first located, of the two towns, Maseru takes the lead. This would also be an important consideration to make.

## **4.5 FREQUENCY DISTRIBUTION OF WASTE GENERATED BY ESTABLISHMENTS**

### **4.5.1 Industries**

The importance of knowledge of frequency for waste types generated and the need to link it to waste quantities was heavily debated on in Section 4.2.7. It may be worth reiterating this issue relating to the establishments. In this case, it has been observed that Section 4.4 has described establishments waste generation in terms of quantities in Maseru and Maputsoe. As indicated in Section 4.2.7, with good reasons given in this same Section, it is not a best practice to know only about the quantities generated, without having a general view of the frequency of waste generated. Therefore, the frequency distribution for commercial and industrial waste generated is given in the next paragraphs.

The data collected from the survey on industrial establishments, as indicated in Fig.4.27 shows that paper was generated by 91% of industries, followed by organics at 82%. The third most commonly generated waste were plastics generated by 73% industries and cans and textiles were the fourth most frequently generated waste by 55% industries. In the fifth position was glass at 18%. The other class of waste, which occurred in industry, is the dust sweepings and clay fall-offs in brick making factories. One industry recorded this type of waste, which is recorded under potential hazardous waste (PHHW) in Table 4.12. It may be worth noting that this clay material could be valuable for the covering of the disposed wastes at the landfill.

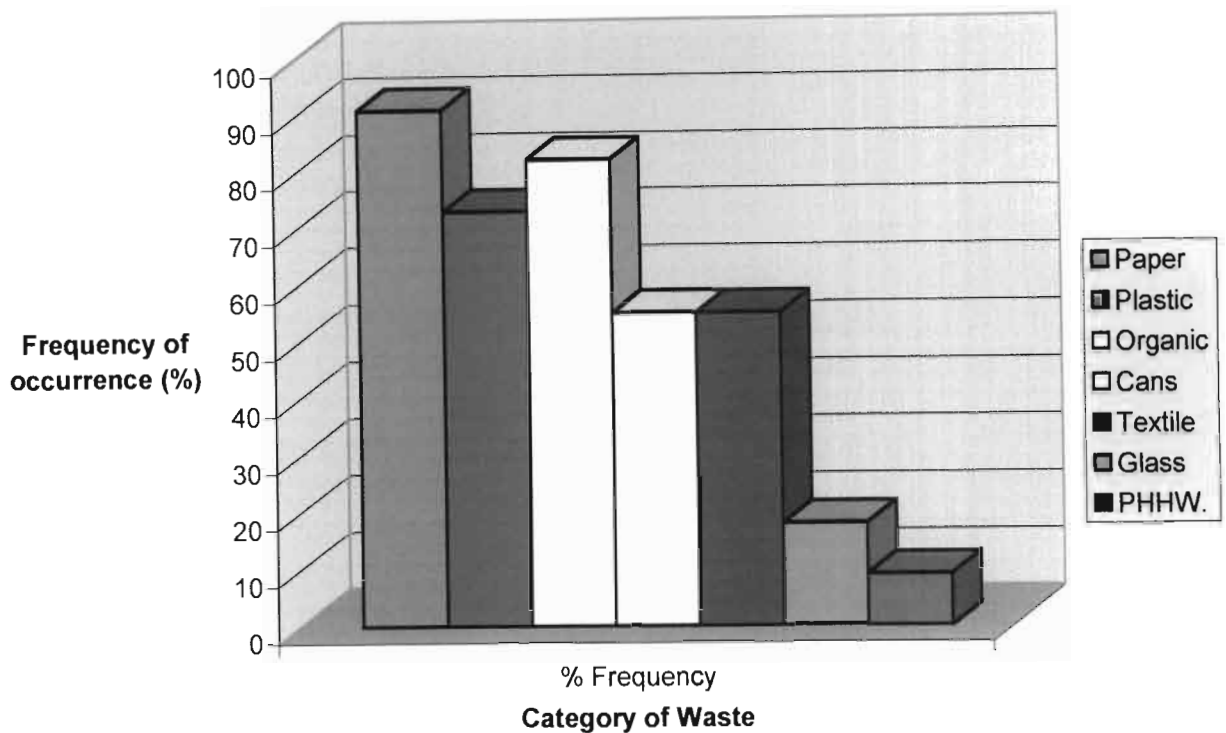


Fig. 4.27 Frequency of waste generation by industries

The high abundance of paper and organic waste from the industries also avail another opportunity to link these wastes with composting into organic manure for urban agriculture. This activity would help alleviate the problems of Lesotho having to spend its foreign exchange on importation of tomatoes and vegetables from South Africa. The abundance of textile would be another advantage. As fore indicated in Section 4.7.4, one recycling company generated a considerable amount of profit from selling this type of waste to Durban, South Africa.

#### 4.5.2 Commercial Establishments

In the case of commercial establishments as shown in Fig.4.28, paper and plastic were predominantly the most frequently available types of waste; both were generated by 100% of the surveyed commercial establishments. Both the organic and glass were in second position, but generated by only 38% of these establishments. The beverage cans were the least frequently generated type of waste, with only 23% establishments generating this type of

waste. Notably, other types of waste were not observed.

This points out that, for commercial establishments, paper and plastics were in abundance and hence could be put to a recycling test. These two would be the drive for recycling and re-use activities in terms of job creation because they were generated by the major contributor of solid waste in the commercial establishments.

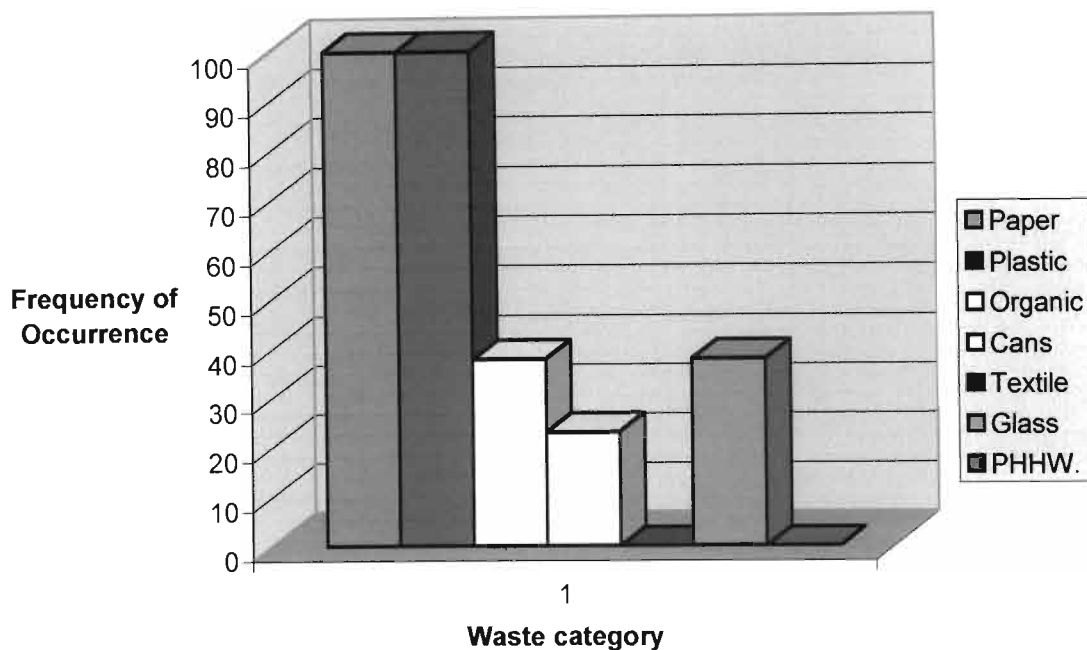


Fig 4.28 Frequency of waste generation by Commercial establishments

#### 4.5.3 Questionnaire Analysis for Industrial Establishment

Figure 4.29 and Table 4.15 provide a broader picture concerning waste management issues in the industries in these towns. From the results, it is shown that 56% industries received waste collection services. Despite this relatively reasonable coverage, only 18% expressed willingness to pay for the waste services. Another observation of concern was the low level of separation of waste at source (27%). In normal circumstances, it would be expected that industries would champion this, but in this case, it was the opposite. This serious problem requires attention as a matter of urgency. The issue of establishment of satellite waste

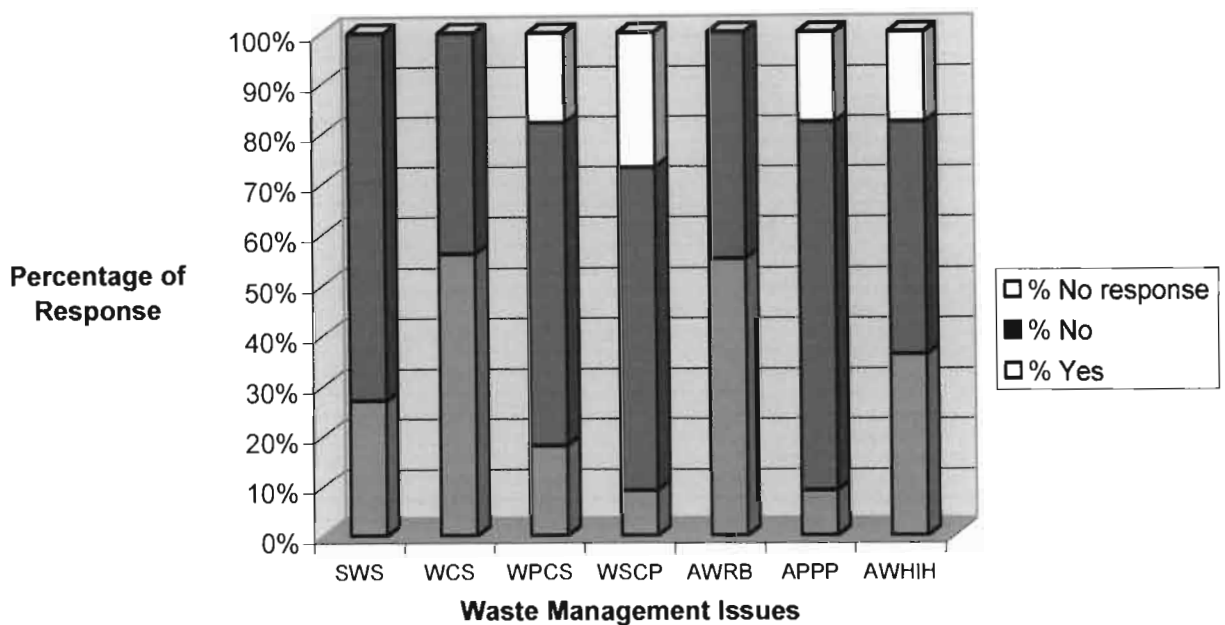
collection or drop-off points was as low as 9%, which was understandable, because most likely it could have been assumed that this was mainly about community-based type of waste management system and hence of little interest to them. This would be the reason for awareness campaigns to explain the benefits of integrated waste management. In contrast, a notably higher percentage of awareness was observed concerning recycling. About 55% industries expressed an awareness of recycling benefits. Another disappointing concern was the response to the polluter-pays principle. The aspect, of which the industries were expected to be highly aware, was as low as 9%. This has very serious implications from an environmental point of view, because most pollution problems are brought about by industrial processes. Hence, if these pollution problems have to be ameliorated, it would require awareness by industrialists. A concomitant problem was lack of awareness concerning impacts on human health resulting from waste handling. This point also recorded a low percentage (36%). This implies that occupational health principles in industries would not be followed because those who would be the champions of these causes were ignorant.

The implications of these facts are that as much as Lesotho government strives hard to achieve its obligation of sustainable development, most of the key stakeholders that would bring this to realisation are just as ignorant. Hence, a stakeholders awareness campaign on these debated issues cannot be over-emphasised.

**Table 4. 15 Questionnaire Analysis for Industries**

Questionnaire Raised Issue	% Yes	% No	% No response
Separation of waste at source	27	73	0
Waste collection services offered	56	44	0
Willingness to pay for collection services	18	64	18
Establishment of waste collection Satellite drop-off points	9	64	27
Awareness of waste recycling benefit	55	45	0
Awareness of polluter pays principles	9	73	18
Awareness of waste handling impacts on human health	36	46	18

Source: Computed by the Author from the Survey Data



**SWS= Separation of Waste at Source      WCS= Waste Collection Services**  
**WPWCS = Willingness to Pay for Waste Services      WSCP= Waste Satellite Collection Points**  
**AWRB = Awareness of Waste Recycling Benefits      APPP= Awareness of Polluter Pays Principle**  
**AWHH = Awareness of Waste Handling Impacts on human Health**

**Fig 4.29 Industries' Response to different Waste Management Aspects**

The issue of affordability of waste collection services relating to the industries as shown in Fig.4.30 deserves attention. Even though there were some, who indicated willingness to pay the higher bid ranges of M51- 100 (11%) and above M100 (10%), these industries were very

few. If this were to go by, it would be necessary to solicit more responses before these ranges would be adopted as the acceptable and affordable industry fees for waste collection services.



**Fig 4.30 Industries: Response to Affordability of Waste Collection Services**

It must be noted that the current fee for waste service per skip per month for textile industries is at M 800, while for those non-textile industries is at M 600. This study did not cover the separation of textile industries from non-textile industries. Assuming most industries in Lesotho are textile, for the 93 industries in Maseru as shown in Table 4.14, the estimated revenue collection would be M 74,400 per month or M 892,800 per annum. Likewise, for Mapustoe, 26 industries would yield M20, 800 per month or M249, 600 per annum. With an efficient revenue collection system put in place and a sustainable integrated solid waste management system running well, this would give benefits to the communities. It is important to note that the charges for waste service for industries should be collected for each unit quantity of waste delivered or collected, not a flat rate, as is the practice currently.

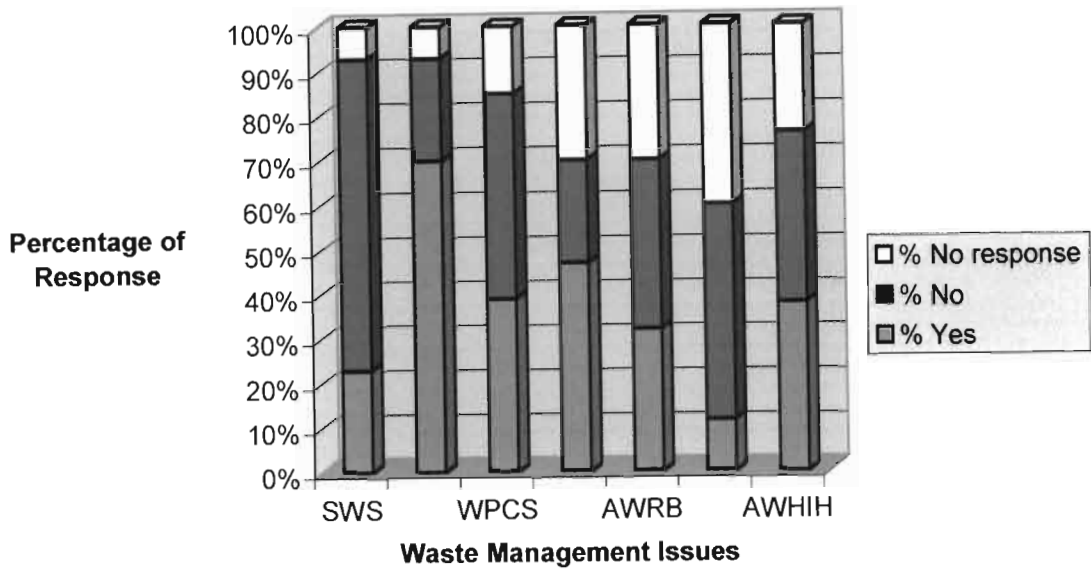
#### 4.5.4 Questionnaire Analysis for Commercial Establishments

As shown in Figure 4.31 and Table 4.16, a reasonable number (70%) of the commercial establishments indicated that they receive waste collection services. However, despite such a large coverage, only 39% were willing to pay for these services. Again, as in the case of industries, those that separated waste at source were as low as 23%. The trend of a low level of awareness was common, on concerning many important waste management issues. For example, the awareness of the benefits of recycling was 32%. Recycling activities support the activities of satellite waste collection or drop-off points. Even this important issue, those that indicated support of this important issue were fewer in number (47%). This signifies the need for a concentrated awareness-raising campaign aimed at the commercial establishments. The results further showed that only 11% were aware of the polluter-pays principle and only 38% were aware of impacts on human health because of waste handling. The low level of awareness about the most important environmental components of sustainable business only points out to the big responsibility the government would have to shoulder to raise the awareness to the level that would encourage sustainable development in the country.

**Table 4.16 Questionnaire Analysis for Commercial Establishments**

<b>A Questionnaire Raised Issue</b>	<b>% Yes</b>	<b>% No</b>	<b>% No response</b>
Separation of waste at source	23	70	7
Waste collection services offered	70	23	7
Willingness to pay for collection services	39	46	15
Establishment of waste collection Satellite drop-off points	47	23	30
Awareness of waste recycling benefit	32	38	30
Awareness of polluter pays principles	11	46	38
Awareness of waste handling impacts on human health	38	38	24

Source: Computed by the Author from the Survey Data



**SWS**= Separation of Waste at Source      **WCS**= Waste Collection Services  
**WPWCS** = Willingness to Pay for Waste Services      **WSCP**= Waste Satellite Collection Points  
**AWRB** = Awareness of Waste Recycling Benefits      **APPP**= Awareness of Polluter Pays Principle  
**AWHH** = Awareness of Waste Handling Impacts on human Health

**Fig 4.31 Commercial Establishments: Response to Different Waste Management Aspects**

Affordability of waste collection services as indicated in Fig.4.32 is another issue of concern regarding the commercial establishments. Considering that they are the major generators of waste as shown in Section 4.4, it would be very obvious to expect them to show a greater willingness to pay for the service. In this case, only 16% indicated could afford between M1-5, the other 16% also showed they could afford between M6-20, and only 8% could afford to pay between M51-100. It cannot be overemphasised that for Lesotho to achieve sustainable levels of solid waste management, it would require tantamount efforts for awareness-raising campaign concerning waste management issues. The low values placed on the affordability would in no way get the Local Authorities to offer their waste collection services effectively. More reasons for these sentiments are given in Section 2.6 of Chapter 2.

However, the current fee for waste service offered to commercial establishments is M10 per bin per month, same as households. This is far too low taking into account how much waste



the commercial sector produces. Even though these entities were large in number, thus leading to more revenue collected from them at M10, if unit cost was applied to them as well, the Local Authorities would collect even more revenue from these establishments than the amounts realised currently. Assuming that these entities faithfully honoured their dues, the amount raised per month for the 4634 commercials in Maseru alone would yield M 46,340, culminating to M 556,080 per annum. This figure would be beneficial if the service involved community-based waste management. But if the huge electra haul trucks would be the only means of providing waste service, then most likely the story would be different because of the costs involved in running these trucks as shown in Table 2.6 of Chapter 2.

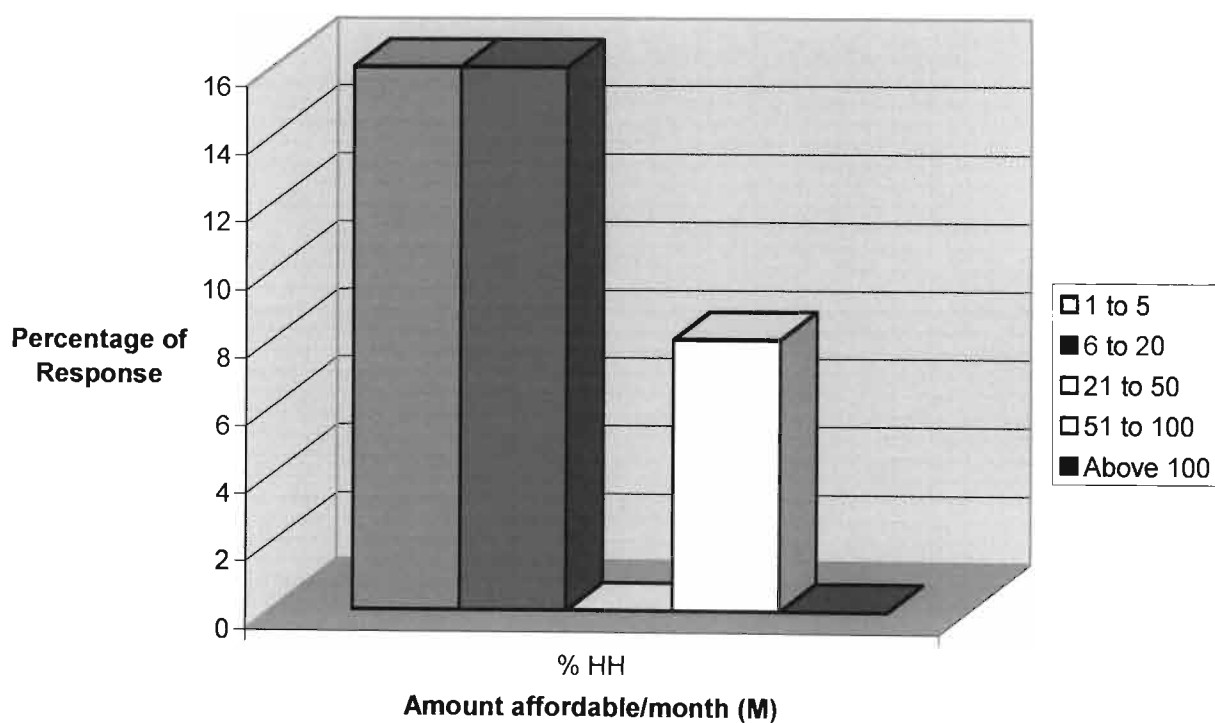


Fig 4.32 Commercial Establishments : Response to Affordability of Waste Collection Services

#### 4.5.5 Physical Composition of Waste Generated.

In this study, an assumption has been made that all the households and establishments surveyed had public dustbins (PDBs)<sup>10</sup>. In the study, two plastic bags were supplied to each entity for sample collection over a week. The analysed results are shown in Table 4.17 and elaborated upon in subsequent paragraphs.

**Table 4.17 Physical composition of Public Dustbin (PDBs) waste by source and category in surveyed Areas of Maseru and Maputsoe (Kg/week)<sup>11</sup>**

Source	Low Income HH	Middle Income HH	High Income HH	Industries	Commercial establishments	Total generated waste in Kg/week	% Share
<b>Total number of HHs/Establishment<sup>12</sup> per category</b>	4640	490	2422	119	5269		
<b>Composition of Waste</b>						<b>Quantity</b>	<b>% Share</b>
<b>Paper</b>	1624.00	284.20	1283.66	842.52	1822547.10	<b>1826581.48</b>	<b>53.3</b>
<b>Plastic</b>	1392.00	191.10	1598.52	829.43	1224515.60	<b>1228526.65</b>	<b>35.8</b>
<b>Organics/Food waste</b>	1948.80	627.20	1937.60	1842.12	187576.40	<b>193932.12</b>	<b>5.6</b>
<b>Beverage Cans/ Foils</b>	1299.20	215.60	2082.92	49.98	25818.10	<b>29465.80</b>	<b>0.9</b>
<b>Textiles/Fabric</b>	46.40	-	-	5907.16	-	<b>5953.56</b>	<b>0.2</b>
<b>Glass</b>	928.00	117.60	823.48	42.84	2107.60	<b>4019.52</b>	<b>0.1</b>
<b>PHHW</b>	556.80	24.50	121.10	13552.90	-	<b>136255.30</b>	<b>4.0</b>
<b>Total</b>	<b>7795.20</b>	<b>1460.20</b>	<b>7847.28</b>	<b>145066.95</b>	<b>3262564.80</b>	<b>3424734.43</b>	<b>100</b>
<b>% Share</b>	<b>0.2</b>	<b>0.1</b>	<b>0.2</b>	<b>4.2</b>	<b>95.3</b>	<b>-</b>	<b>100</b>

Source: Computed by the Author from the Survey Data

<sup>#</sup> Large contribution of the potential hazardous waste (PHHW) indicated under industries is the fall-off dust of clay from brick making. This would be useful material for covering the waste and the sanitary landfill site.

<sup>10</sup> Limited surveys done by the MCC in December 1995 revealed that there were approximately 4026 dustbins owned by households in Maseru (Mhlanga & Gulilat, 1997). An assumption has been made that each sampled entity had a public dustbin (PDB).

<sup>11</sup> The values have been generated from weekly averages in Table 4.3 for households and Table 4.12 for establishments

<sup>12</sup> Information on the number of households was extracted from Households Population, 1996, Vol. IIID (a), Bureau of Statistics, Maseru, Lesotho, while that on establishments was sourced from the Ministry of Trade and Industry. (See Annex A 3 for further information)

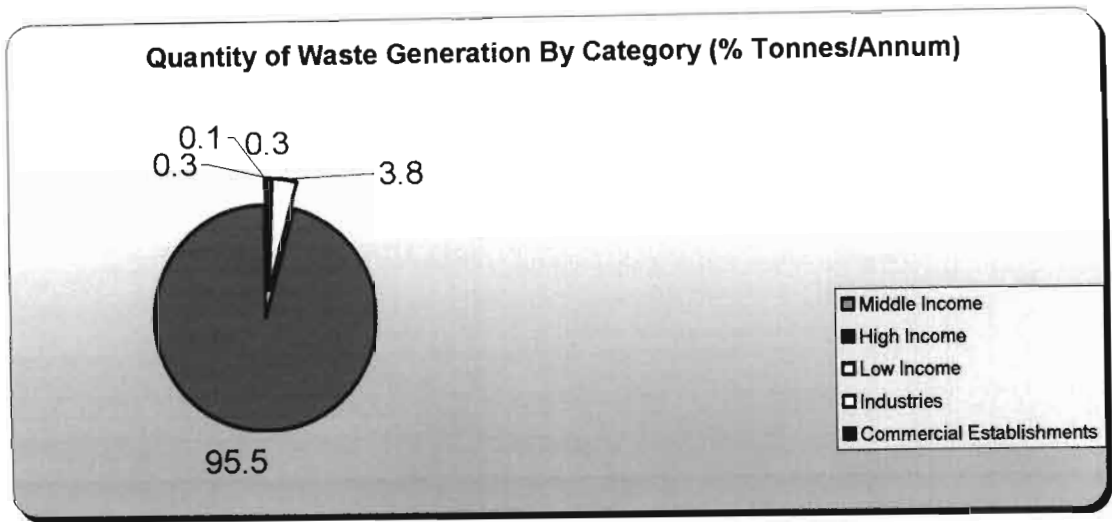


Fig. 4.33 (a) Physical composition of Public Dustbin Waste by Source

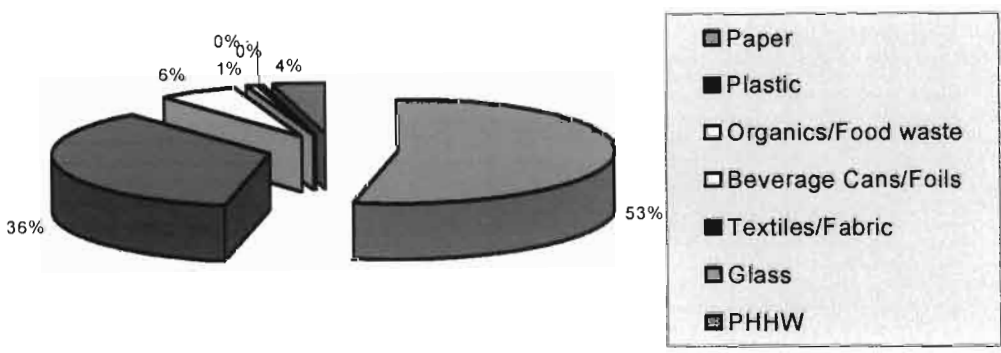


Fig. 4.33 (b) Physical composition of Public Dustbin waste by Category

In Table 4.17 and Fig. 4.33 (a), it is shown that the main sources of PDBs are the commercial establishments, accounting for 95.5% of all the waste generated in the surveyed areas. From the same table, it is noted that other sources of importance are industries<sup>13</sup> at 4.2%.

<sup>13</sup> It must be noted that in this study, industrial waste like sludge, rubble and other heavy components were not taken into account. Only the municipal related solid waste generated has been considered, and mostly contains high quality of re-usables and recyclables.

Generally, it has been observed that, when taking into account only the surveyed areas, households seem to be the least contributors to the generation of municipal solid waste, with a total contribution of 0.5%. The statistics may change depending on whether the overall number of household has been taken into account. In general, the contribution of waste generation by source in the sampled areas could be summarized as follows the 4640 low income HHs generated 7350.34Kg/week, 490 middle-income generated 1460.20Kg/week, 2422 high income 7818.32 Kg/week, 119 industries generated 145,066.95 Kg/week, and 5269 commercial establishments generated 3262564.80 Kg/week. (See Maps 4.1 and 4.2). This information would be useful when designing integrated waste management systems in these places. Instead of putting emphasis only on high-income areas, as is the current practice, some low-income household areas could have the great potential to generate more waste in comparison with other high-income areas. This information therefore would serve as a tool in decision-making.

The physical composition of waste in the surveyed areas of Maseru and Maputsoe as shown in Table 4.17 and Fig. 4.33 (b), indicates that the quantity by mass of solid waste generated in these towns mainly consists of paper, with a percentage share of 53.3% of the total waste generated in these areas. The second highest quantity of generated waste by mass is plastic, at a percentage share of 35.8%. Comparably, the recyclables like paper, plastics, beverage cans and glass constitute a total of 90.1%, unlike the organics at 5.6%. This data would also be critical and useful when considering recycling and job creation overtures.

These results tally well with the findings by Mhlanga and Gulilat (1997), except for a portion of results on household waste generation of paper and plastics. In this study, it has been established that it was only high-income households, which generated larger quantities of plastics than paper, while the Mhlanga and Gulilat report generalised that all households generated more plastics than paper. The reason could be that the Mhlanga and Gulilat (1997) study relied heavily on the responses from the interviewees, rather than on the physical sorting and characterization of the waste. The implication of these results in combination with those of frequency as shown in Sections 4.3 and 4.4, is that paper would be the first option to consider for ventures, should investment into recycling options be made, even though its returns is lower than other types of recyclables.

**Table 4.18 Annual Composition and Quantity of Waste Generation per category and source in Surveyed areas of Maseru and Maputsoe (Tonnes/Annum)<sup>14</sup>**

Source	Low Income HH	Middle Income HH	High Income HH	Industries	Commercial establishments	Total waste generated in Tonnes/Annum	
<b>Number of operational weeks per Annum</b>	52	52	52	35.62	39.32		
<b>Composition of Waste</b>						<b>Quantity</b>	<b>% Share</b>
<b>Paper</b>	84.45	14.78	66.75	30.01	71662.55	<b>71858.5</b>	<b>53.5</b>
<b>Plastic</b>	72.38	9.94	83.12	29.54	48147.95	<b>48342.9</b>	<b>36.0</b>
<b>Organics/Food waste</b>	101.34	32.61	100.76	65.62	7375.50	<b>7675.8</b>	<b>5.7</b>
<b>Beverage Cans/ Foils</b>	67.56	11.21	108.31	1.78	1015.17	<b>1204.0</b>	<b>0.9</b>
<b>Textiles/Fabric</b>	2.41	0.00	0.00	210.41	0.00	<b>212.8</b>	<b>0.2</b>
<b>Glass</b>	48.26	6.12	42.82	1.53	82.87	<b>181.6</b>	<b>0.1</b>
<b>PHHW</b>	28.95	1.27	6.30	4828.39	0.00	<b>4864.9</b>	<b>3.6</b>
<b>Total</b>	<b>405.4</b>	<b>75.9</b>	<b>408.1</b>	<b>5167.2</b>	<b>128284.0</b>	<b>134340.6</b>	<b>100</b>
<b>% Share</b>	<b>0.3</b>	<b>0.1</b>	<b>0.3</b>	<b>3.8</b>	<b>95.5</b>	<b>100</b>	

Source: Computed by the Author from the Survey Data

<sup>14</sup> Assumes 250 working days (261 working days per year less 11 public holidays) for industries, and 276 working days (287 working days per year less 11 public holidays) for commercial establishments. These days have been converted into week; i.e. 35.62 and 39.32 for industries and commercials respectively.

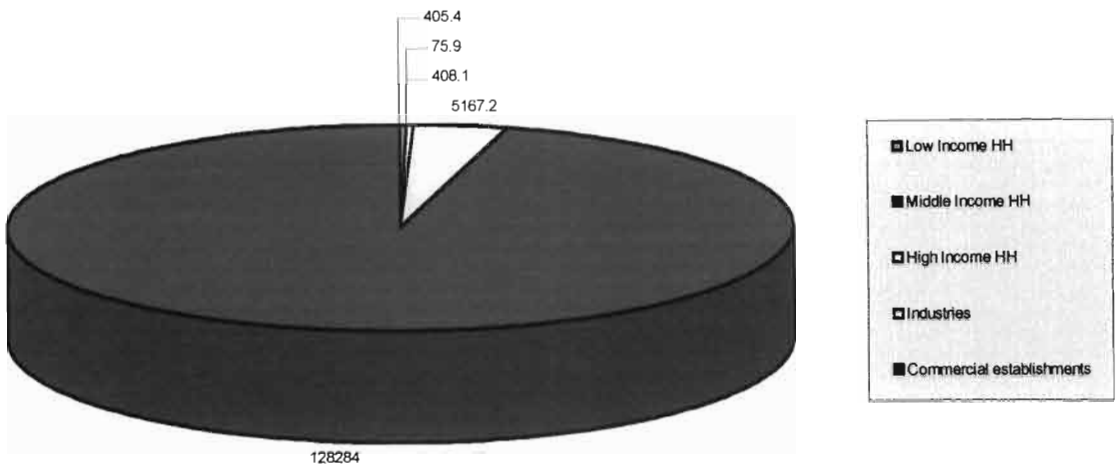


Fig. 4.34 Annual quantities of waste generation by Source

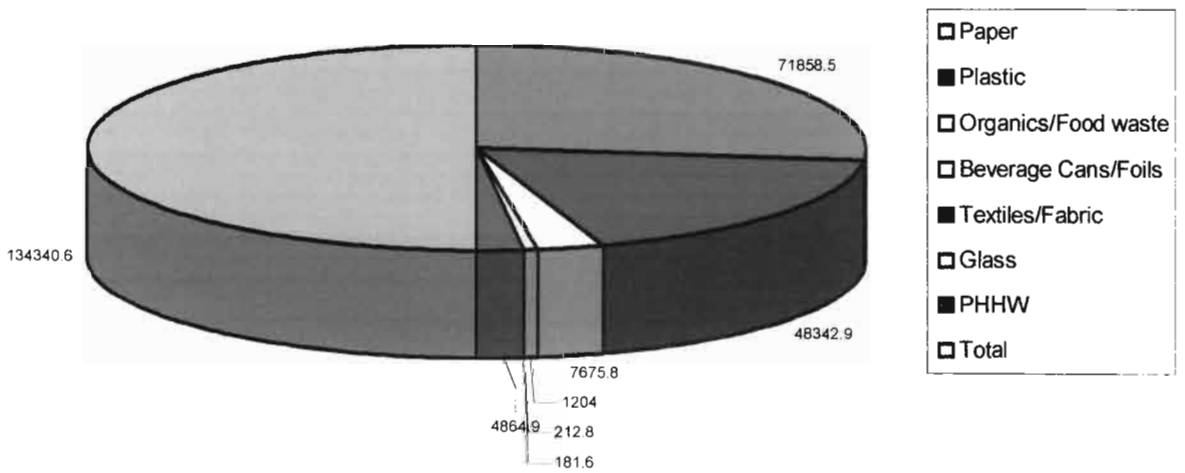


Fig. 4.35 Annual quantities of waste generation by Category

The results in Table 4.18 reveal the annual generation and overall composition of solid waste for the different socio-economic categories in Maseru and Maputsoe. These two towns are the major contributors to the generation of solid waste in the whole country. This information therefore creates a general representation of the waste generation situation in Lesotho. This table also illustrates the same trends with Table 4.17 in which, commercial establishments are the major generators of solid at 95.5%, with industrial establishments ranking second at 3.8%. High-income and low-income households have almost the same contribution-despite the fact that the former generated much more waste per household.

The point concerning number of certain category of entities generating waste is very important as a factor when designing waste management plans. It signifies the role a type of entity could play in the amount of waste generated. The greater the number of entities, the more waste would be generated. In this study, it has been estimated that in total, the surveyed areas in Lesotho generated a total quantity of 134,340.6 tonnes of solid waste per annum with the largest portion of this waste being paper and plastics (See Map 4.3 for more information).

#### 4.6 WASTE COMPOSITION COMPARISON BY COUNTRIES

Comparing how waste has been managed elsewhere in the world would help to give direction to Lesotho on strategies for such an exercise. It also gives a general picture on how well the performance is, currently. In comparison, the composition of solid waste for Maseru and Maputsoe, with those reported for some other countries in the world (Ali Khan, 1989; Beukering et al.1999; WHO, 1995), as shown in Table 4.19 and Fig. 4.36 (a and b) shows that Lesotho generates solid waste which has higher composition of paper at 53.5% more than the USA and the UK at 44.0% and 37.0% respectively. Similarly, the plastic content of Lesotho solid waste comparably shows, by far, being the highest generator of this waste component at 36.0%, with countries like Abu Dhabi being the second highest and yet generate only 12% of this component of waste. This means that both paper and plastics are highly used in many places in Lesotho, especially in commercials and households because of packaging and home use. Such large quantities of recyclable waste would create opportunities for re-use and recycling activities.

**Table 4.19 Comparison of average composition by weight of major solid waste components in Lesotho versus other countries in the world (% weight)**

Country	Lesotho	Bangalore India	Abu Dhabi	Kuwait	Saudi Arabia	USA	UK
<b>Component of Waste</b>							
<b>Paper</b>	53.5	16.5	6.0	35.0	34.0	44.0	37.0
<b>Plastic</b>	36.0	6.7	12.0	5.0	1.0	3.0	2.0
<b>Organics/Food waste</b>	5.7	33.4	49.0	37.5	35.0	27.0	28.0
<b>Beverage Cans/ Foils</b>	0.9	1.5	8.0	5.5	5.0	9.0	8.0
<b>Glass</b>	0.1	2.9	9.0	5.0	1.0	9.0	17.0

Source: Computed by the Author from the Survey data (Lesotho) and Literature Data (other countries)



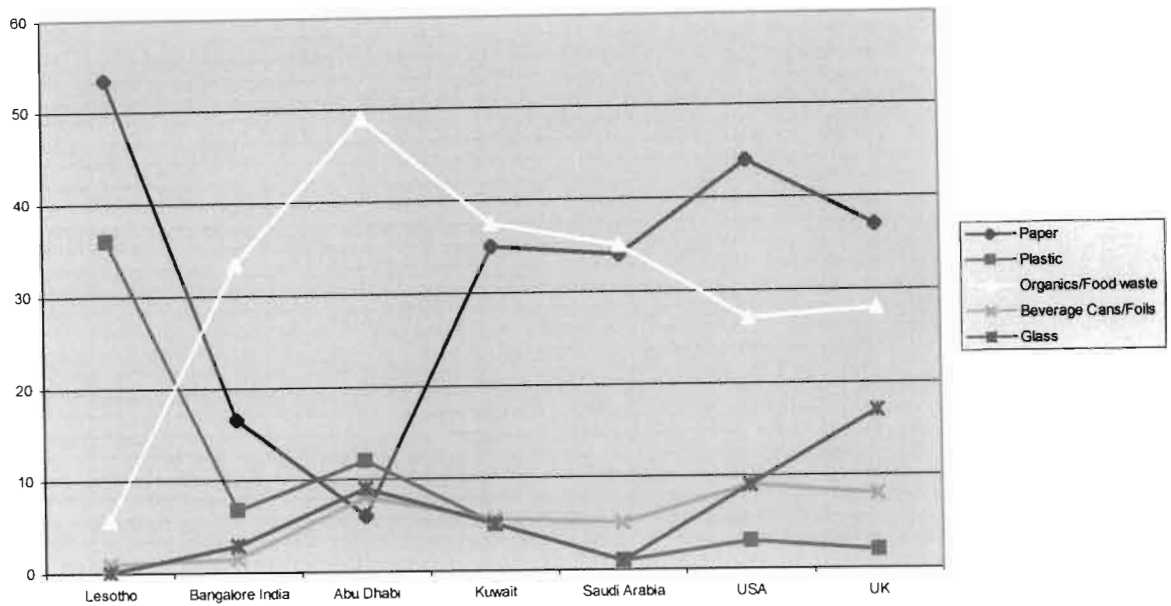


Fig. 4.36 (a) Comparison of average composition by weight of major solid waste components in Lesotho versus other countries in the world

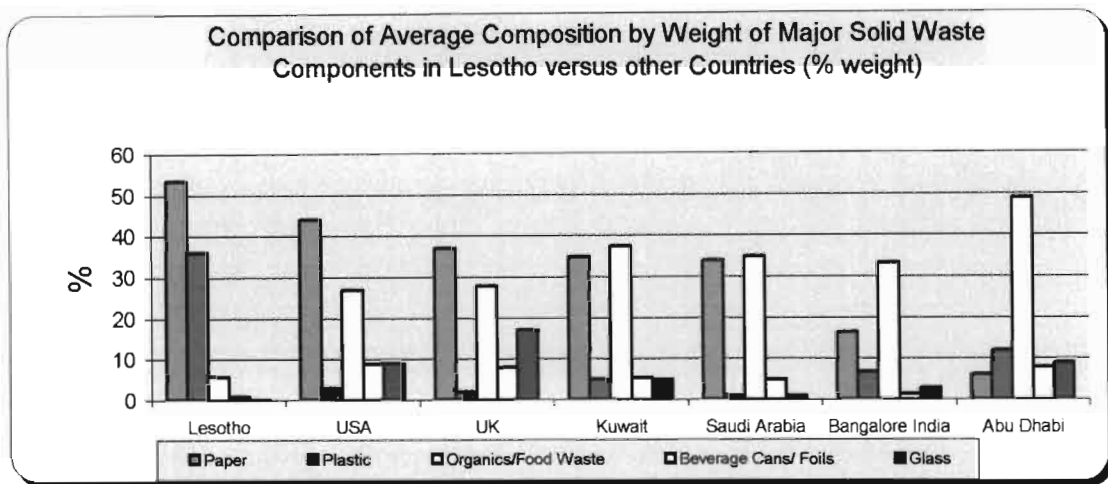


Figure 4.36 (b) Comparison of average composition by weight of major solid waste components in Lesotho versus other countries in the world

It should be noted that this does not imply that Lesotho generates more waste than America, the UK and other countries listed. But the comparative rate of paper and plastic observed in Lesotho is presumably due to a high consumer spending rate, a lack of fully developed recycling programmes and a low level of environmental awareness among the people, as already pointed out in Sections 4.1.3 and 4.3 in this chapter. As a result, percentage-wise,

Lesotho seems to be on the higher side than many countries, but in real terms of quantities, it is not.

#### 4.6.1 Source – Wise Waste Generation

The results from Tables 4.20 and 4.21, and Figs. 4.37 (a & b) and 4.38 (a & b) illustrate the influence of other factors on the generation of waste. The generation of waste depends on what activities take place within a facility and, in addition to this, the number of facilities generating that type of waste. For example, commercial establishments in Maseru and Maputsoe contribute to about 82.0% and 80.9% respectively. Furthermore, in Section 4.5 under Table 4.18, it was shown that taking into account the waste generation in the surveyed areas only, industries produced more waste than households, ranked second to commercial establishments. However, the picture is different when it comes to comparison of all the entities in a given area. In this case, as seen in Section 4.6, households, on the whole, generate more waste per annum than industries. This is a very important and critical factor to take into account when designing integrated solid waste management systems in the country.

**Table 4.20 Source – Wise Estimated Generation of solid waste in Maseru (tonnes/annum)**

Source of Waste	Quantity	% Share
<b>Households (137837)*</b>	20675.55	15.0
<b>Industrial Establishments# (93)*</b>	4038.23	3.0
<b>Commercial Establishments # (4634)*</b>	112837.90	82.0
<b>Total</b>	157551.7	100

Source: Computed by the Author from the Survey Data

# Taking into account that there are five productive working days for the industries, and that most commercial establishments are fully operational for five and half days per week only.

\* This data is derived from Households Population, 1996, Vol. IIID (a ), Bureau of Statistics, Maseru, Lesotho, while that on establishments was sourced from the Ministry of Trade and Industry.

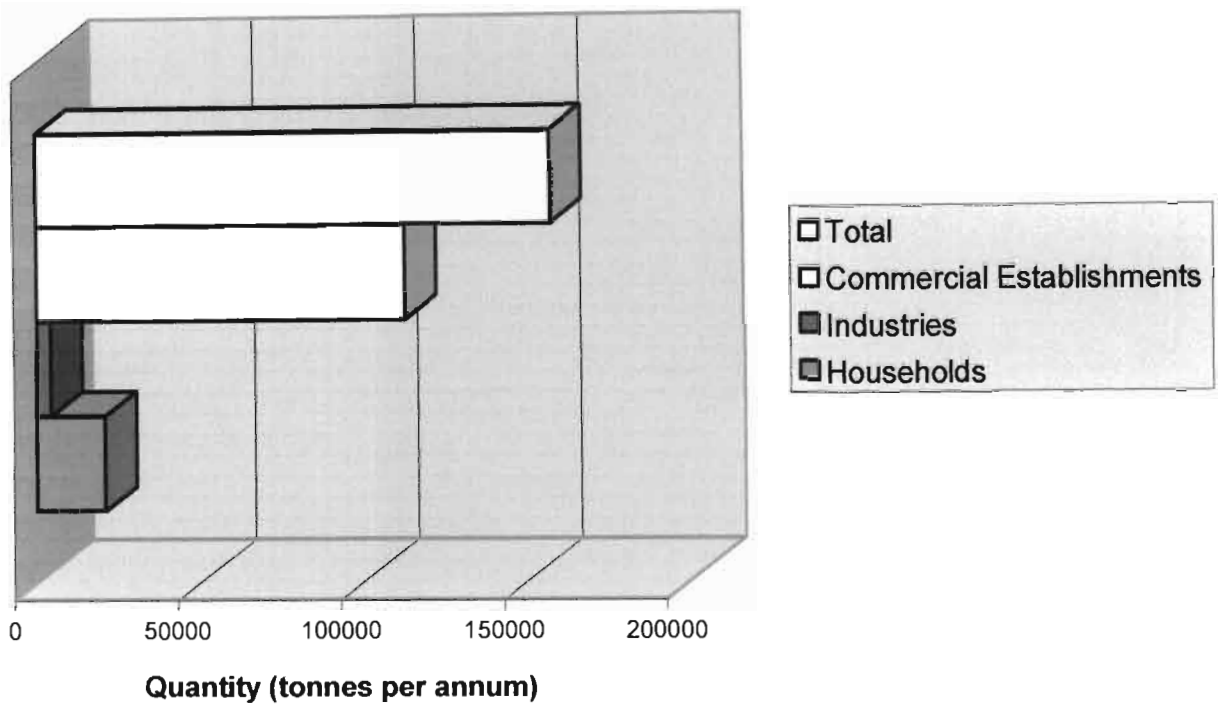


Fig. 4.37 (a) Estimated total Annual waste generation in Maseru (Tonnes per Annum by Source)

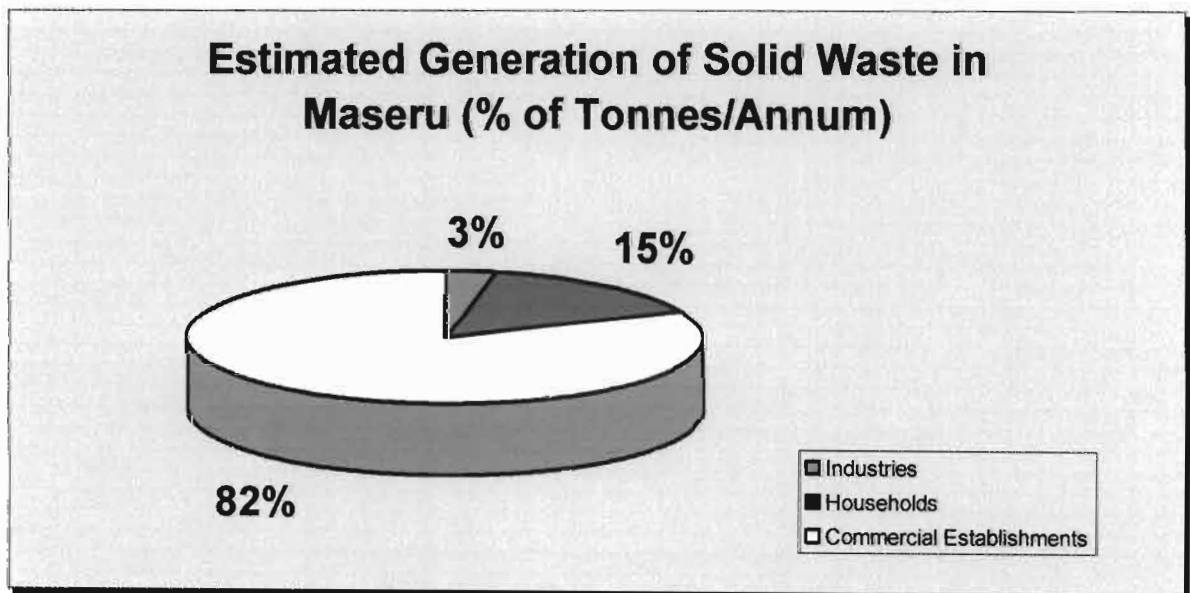


Fig. 4.37 (b) Estimated total Annual waste generation in Maseru (% by Source)

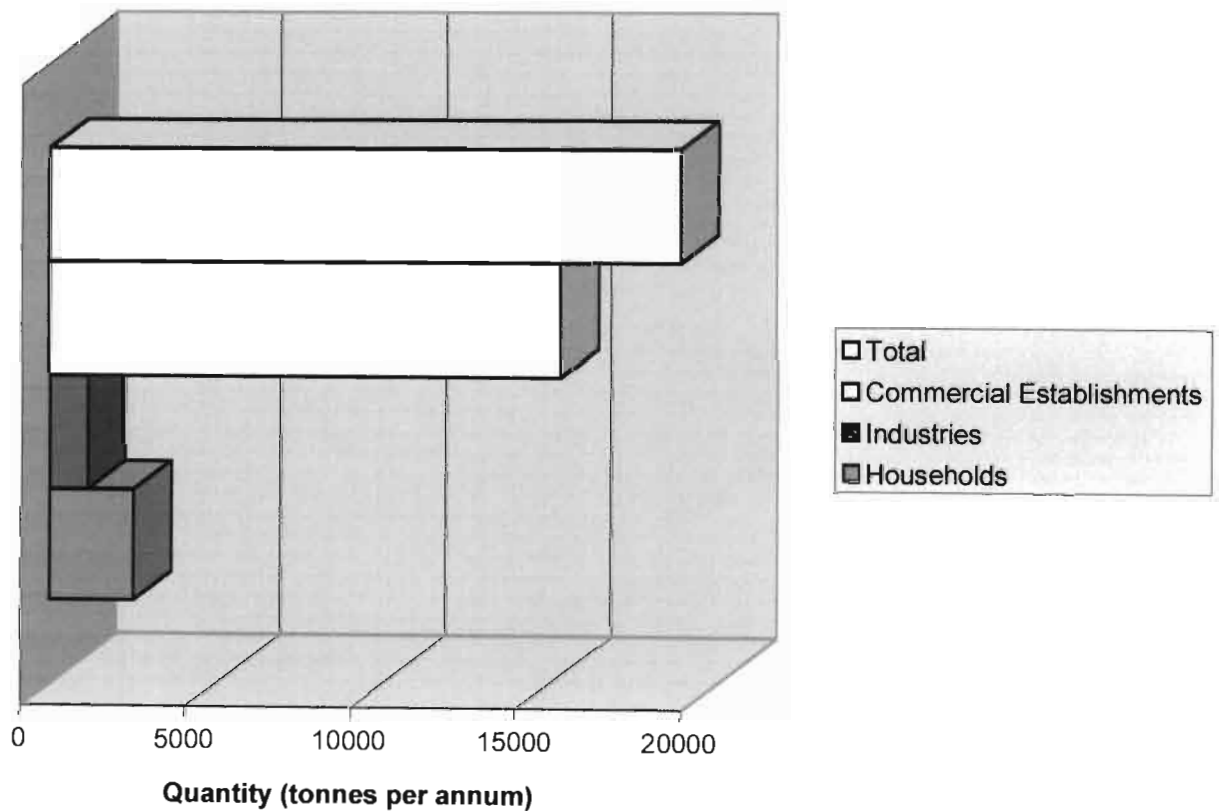
**Table 4.21 Source-wise Estimated Generation on solid waste in Maputsoe (Tonnes/Annum)**

Source of Waste	Quantity	% Share
<b>Households</b> (27951) *	2515.59	13.2
<b>Industries</b> # (26) *	1128.92	5.9
<b>Commercial Establishments</b> # (635) *	15462.25	80.9
<b>Total</b>	19106.8	100

Source: Computed by the Author from the Survey Data

# Taking into account that there are five productive working days for the industries, and that most commercial establishments are fully operational for five and half days per week only.

\* This data is derived from Households Population, 1996, Vol. IIID (a) Bureau of Statistics, Maseru, Lesotho, while that on establishments was sourced from the Ministry of Trade and Industry.



**Fig. 4.38 (a) Estimated total Annual waste generation in Maputsoe (Tonnes per Annum)**

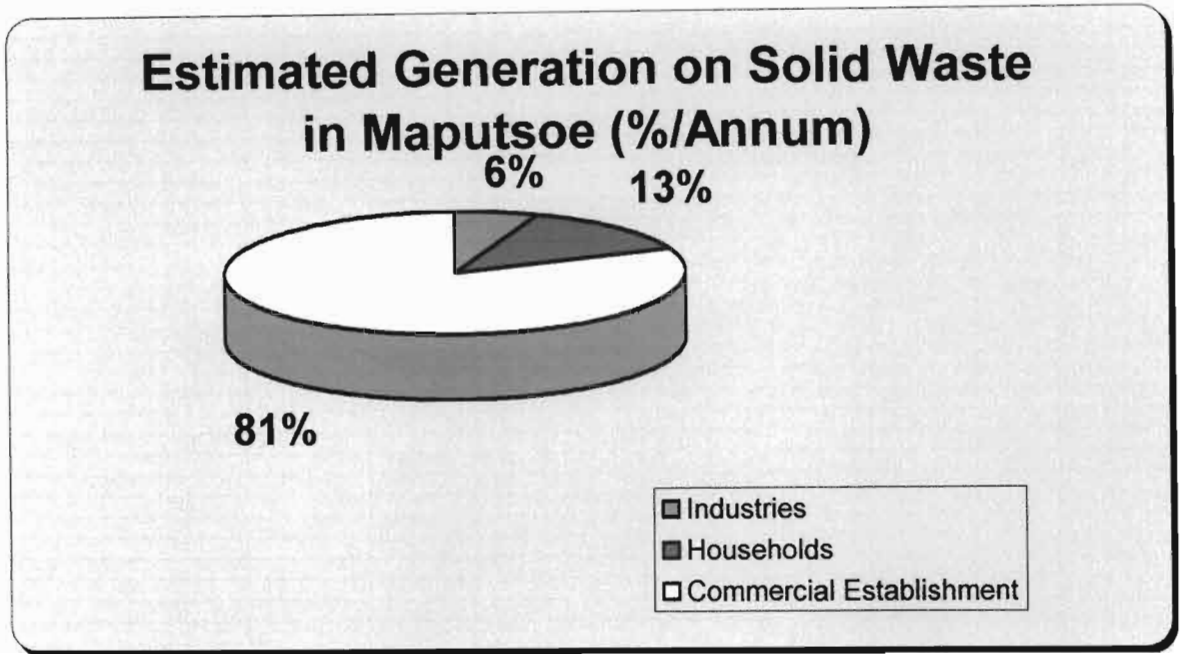


Fig. 4.38 (b) Estimated total Annual waste generation in Maputsoe (% by Source)

The major factors influencing the high contribution by commercial establishments are the activities of those facilities, which generate larger quantities of waste per establishment and also the number of facilities, which is more than the number of industries. In the case of households versus industries, the number of household plays a major role. Because households are more than industries, they contribute more waste than industries in both Maseru and Maputsoe. This is different from findings in Section 4.5 under Table 4.18 in which, industrial establishments were seen to have generated more waste than households when considering generation of waste per given surveyed area only. As already stated, this type of information is vital for the overall planning of sustainable solid waste management systems.

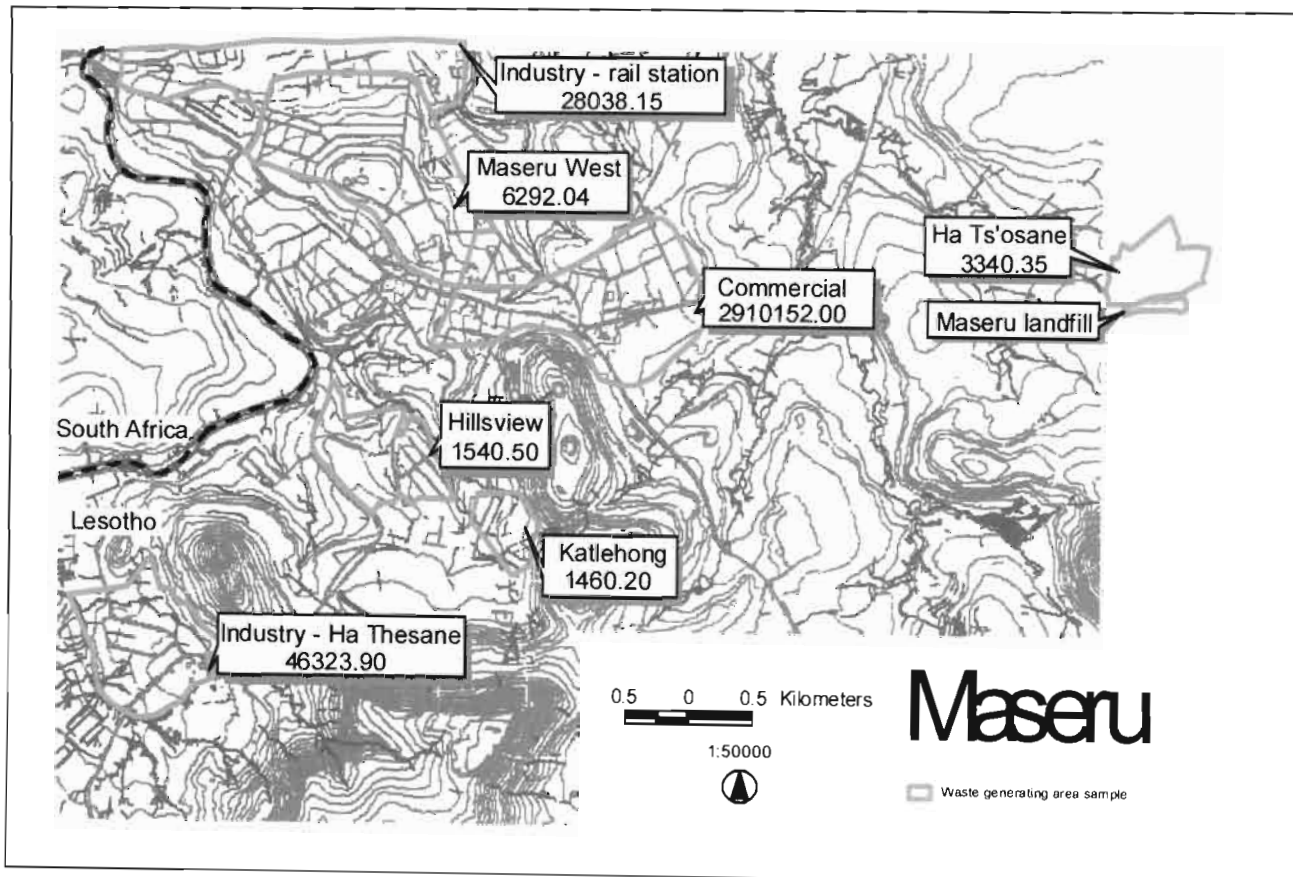
In summary, the entities: households, industries and commercial establishments generated total quantities of 157,551.7 tonnes of waste per annum in Maseru and 19,106.5 tonnes per annum in Maputsoe. From the results in Section 4.5.5, it has been established that approximately 54% of total waste generated was paper, 36% plastics, 6% organics and 1% cans. This implies that in Maseru alone, 85,078 tonnes of waste paper is produced per annum, 56,719 tonnes of waste plastics, 9,453 tonnes of organic waste and 1,576 tonnes of cans.

These figures indicate potential for recycling, re-use and recovery. Paper provides is first choice for such a venture.

As a summary of waste generated in Maseru and Maputsoe per week, Maps 4.1, 4.2 and 4.3 give the indicative values for these towns. It should be noted that the location indicated on the maps are estimated positions of these places and not the exact location according to the accurate geographic scale of latitude and longitude. This summary adds value to the study because it shows at a glance the estimated amounts of waste generated in certain areas of the surveyed towns and the estimated geographic and topographic locations of these surveyed areas. For example, the unlicensed dumpsite in HaTsosane is shown with its estimated geographical location in Maseru, and more importantly, the topography position of this site with regard to Maqalika Dam in Maseru, as evidenced by the contour lines

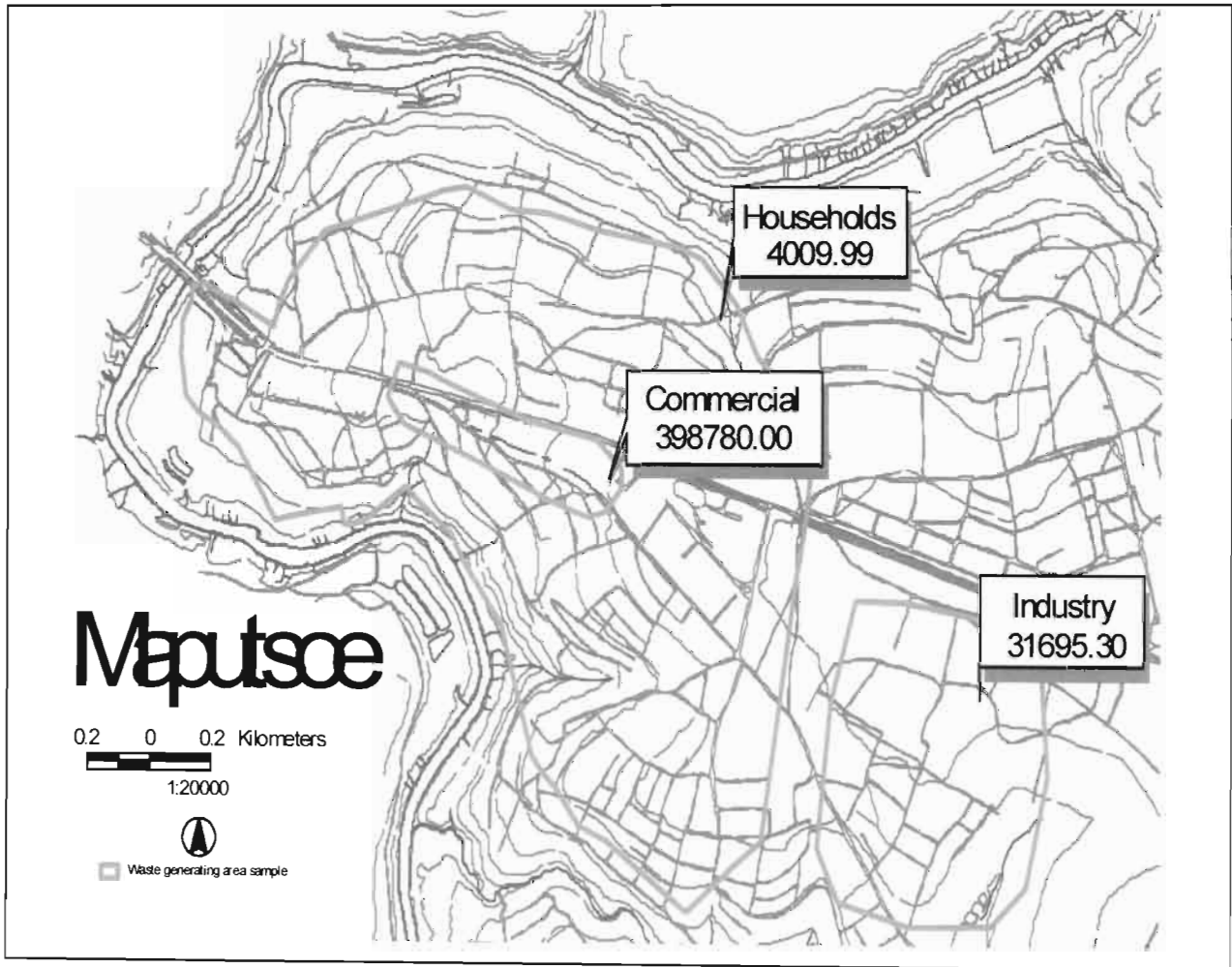
MAPS OF MASERU AND MAPUTSOE SHOWING WASTE QUANTITY GENERATION BY LOCATION (KG/WEEK)

Map 4.1 Waste Generation by location in Maseru (kg per week)



Source: Generated by the Author

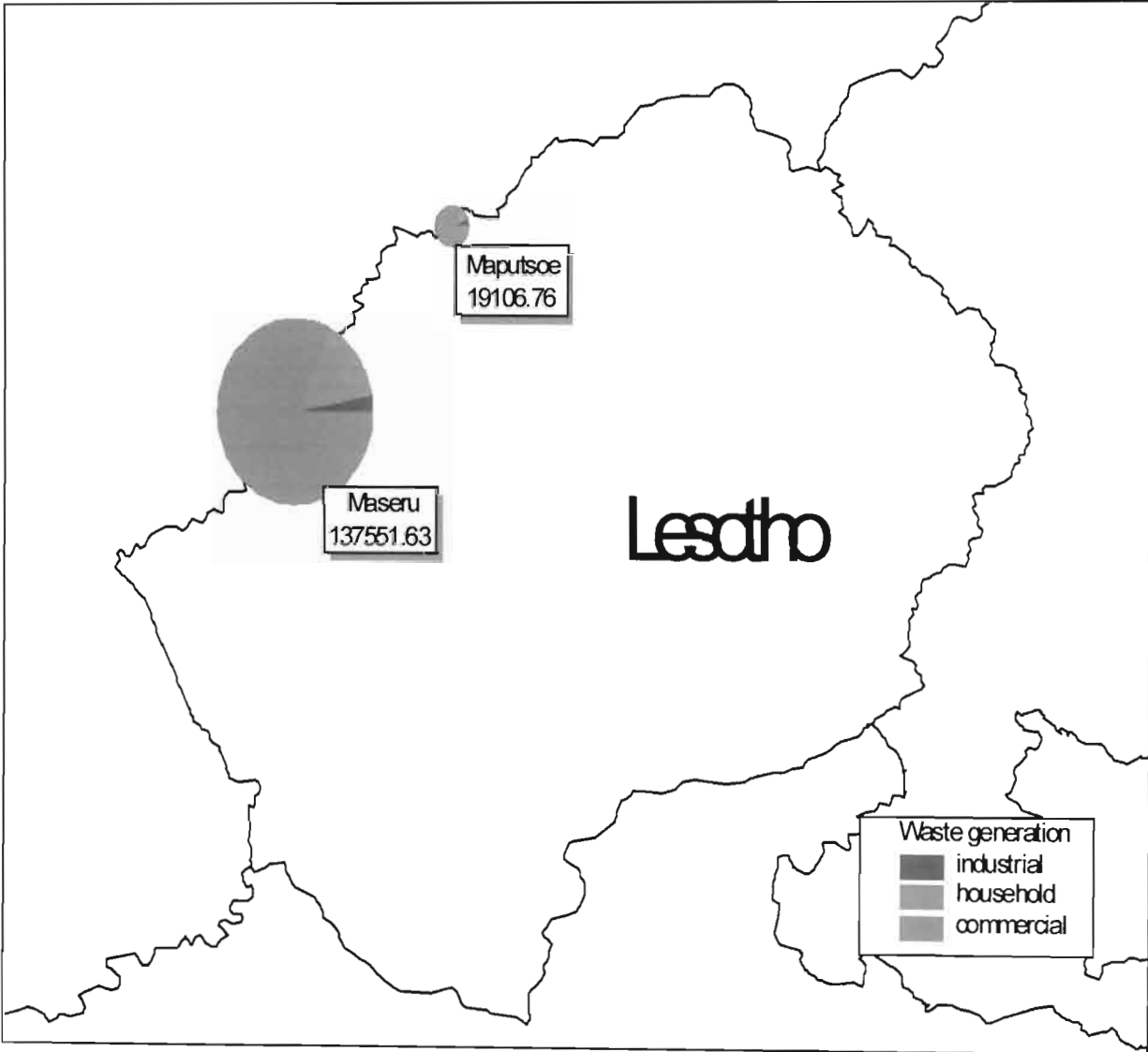
Map 4.2 Waste generation by location in Maputsoe (kg per week)



Source: Generated by the Author



Map 4.3 Estimated Total waste generation in Maseru and Maputsoe (Kg per week)



Source: Generated by the Author

#### 4.7 RESOURCE CONSERVATION AND WASTE RECOVERY: REUSE AND RECYCLING

The essence of resource conservation and recovery is driven by various economic factors, such as reduction in costs of solid waste management; conservation of natural resources and energy and creation of jobs. Therefore, resource conservation and recovery is mainly centred on the issues outlined, such as:

- **Municipal waste reduction:** the design, manufacture, purchase, or use of materials (such as products and packaging), which reduce quantity and toxicity of waste generated. In this way, costs of disposal (recycling, municipal composting or filling and/or combustion) are minimized. This reduces pollution.
- **Product reuse:** reusable products are used more than once.
- **Reduced material usage per product unit:** reducing amount of material used in a product results in less waste generated when the product is discarded. For example, consumers can be encouraged to buy packaged products in large containers, instead of many small containers.
- **Separation of waste at source:** the more household waste is separated, the greater the maximum contribution to recycling.
- **Bottle bills:** bottle deposits would make people aware of the need to return bottles. This could contribute to income generation activities and in conserving the natural resources. Bottle bills should be integrated into overall recycling programmes such as paper recycling, kerbside cardboard recycling, establishment of buy-back and recycling centres. For example, the annual return rate in New York of beer bottles only is 90% and of both the soft drink and beer bottles combined is 80% of the total six billion bottles generated (Liu & Liptak, 2000).
- **Recycling:** by using waste as a source of raw material for new products, environment impacts associated with extracting raw materials are reduced waste and is managed.

#### 4.7.1 Waste Recovery: Re-use and Recycling

According to Liu and Liptak (2000), almost all solid waste materials can be recycled in some way if people are willing to devote enough time and money to the recycling effort. Because time and money are always limited, distinctions must be drawn between materials that are more and less difficult to recycle. Table 4.22 shows the compostable, combustible, and recyclable fractions of Municipal Solid Waste (MSW). The materials listed as recyclable are those for which large-scale markets exist if the local recycling industry is well developed. The list of recyclable materials vary for different areas.

The waste categories shown in Table 4.22 give general indicative characteristics of MSW composition and utilities to which these categories of waste could be subjected. In the USA, approximately 75% of MSW is compostable or recyclable. However, no solid waste district of substantial size in the USA has documented a 75% rate of MSW recovery and reuse. Reasons include, among others:

- Some recyclable materials become unmarketable through contamination during use;
- A significant fraction of recyclable material cannot be recovered from the consumer;
- A portion of both recyclable and compostable material is lost during processing (sorting recyclable materials or removing non-recyclable and non-compostable materials from the waste stream);
- Some compostable material does not decompose enough to be included in the finished compost product and is discarded with the process residue (Liu & Liptak, 2000).

The drive to minimise waste production is provided by government or industry policies. As industries optimise production and reduce resource consumptions to gain competitiveness in today's global market economy, they adopt more efficient manufacturing methods, in order to minimize raw materials requirements and avoiding packaging. Waste prevention measures aim at changing public's attitude towards consumption.

In this case study, a summary of estimates of waste generated by all the entities considered indicate that 157, 551.7 tonnes of waste per annum is generated in Maseru, with 19,106.5 tonnes per annum in Maputsoe. Taking into account that about 91% of this waste is recyclable material, 5.7% biodegradable organic materials and 0.2% re-usable material, this offers an opportunity for job creation through municipal solid waste management.

**Table 4.22 Combustible, Compostable, and Recyclable components of MSW <sup>a</sup>**

Waste Category	Waste Utilisation <sup>#</sup>
Corrugated cardboard Kraft paper High -grade paper Magazines and mail	Combustible, compostable, and recyclable
PET bottles HDPE bottles Polyethylene film other than trash bags	Recyclable and combustible but not compostable
Aluminium cans Tin and bimetal food and beverage cans Other metal <sup>b</sup> Glass food and beverage containers	Recyclable but not compostable or combustible
Other paper Yard waste Food waste Disposable diapers	Compostable and combustible but not recyclable
Other plastic Wood Textiles and rubber/leather Other organics	Combustible but not compostable or recycle
Other aluminium Other metal <sup>b</sup> Batteries Other inorganics	Not combustible or compostable or recyclable

Source: Modified from Liu & Liptak, 2000

<sup>a</sup> Materials listed as recyclable are those for which large-scale markets exist in areas where the recycling industry is well developed.

<sup>b</sup> A substantial portion of this category is readily recyclable, and a substantial portion is not. Some of the material listed here as non-recyclable can be recovered in a recyclable condition by an efficient ferrous recovery system at a combustion facility.

<sup>#</sup> Liu & Litak (2000) estimate that in a given quantity of MSW the proportion are as follows: recyclable =33%, compostable = 67%, while combustible = 87 %.

#### 4.7.2 Waste Collection and Disposal Systems

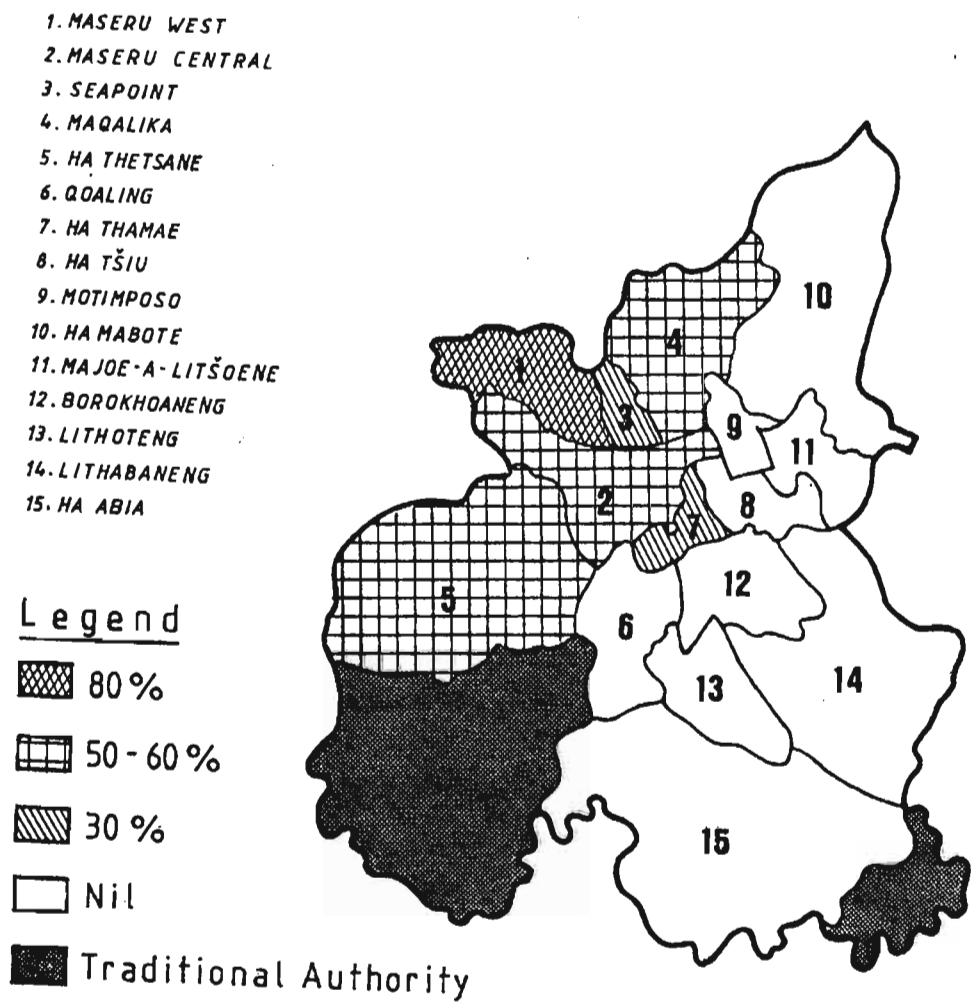
This study concentrated on Maseru and Maputsoe urban and peri-urban areas. In general, it was observed that the refuse collection services in Lesotho are limited to urban centres only, such as Maseru City Council (MCC). Currently, solid waste management in the MCC falls under the Town Clerks Office, in the Department of Health and Environment, Pollution Control Section. The MCC service concentrates mainly on the electoral wards of Maseru West and Maseru Central, which house the bulk of urban households, industrial and commercial establishments with coverage ranging between 65%-80%. The average coverage of the refuse collection service in the entire MCC area is 15%-20% (see Map 4.4). As already indicated in Chapter 3, Section 3.10.2, refuse collection service is offered once per week on average.

Unlike Maseru City, the coverage for waste collection services in Maputsoe Town is minimal. For example, Mhlanga and Gulilat (1997) recorded that a mere 20 domestic premises, 20 commercial and 15 industrial establishments were covered, as opposed to a total of 27951 households, 26 industrial and 635 commercial establishments. The services of waste collection and disposal in this town fall under the Town Clerk's offices. The implication is that currently, as established by this study, only a small percentage (12%) of the entities receive waste collection services.

There are no proper sanitary landfills operated in urban areas of Maseru and Maputsoe. Disused quarries, dongas and streams are used as dumpsites. In Maseru, the main dumpsite is at Ha'Tsosane (Lancers Gap, see Map 4.1). This dumpsite is surrounded by houses and it slopes into the stream that feeds Maqalika Dam, the major source of water supply for Maseru (see photo plate 2.1 in Chapter1). Mhlanga and Gulilat (1997) noted that the level of service is unreliable, especially in residential areas. This is due to various factors such as equipment breakdown and poor supervision and planning. In this case, people resort to dumping in illegal places and burning the waste. Similarly in Maputsoe, the recognized dumpsite is Hanyenge, which is also a disused quarry.

The major problem with these dumpsites is that hazardous wastes such as batteries, insecticides, weedkillers, pesticides and medical waste are dumped in these sites. Yet, children and scavengers are frequently seen in search of useful materials such as edible and salable items; and animals in search of edibles, thus rendering them prone to disease contraction and poisoning.

**Map 4.4 Maseru Refuse Collection Coverage in Percentage**



Source: Modified by the Author from Maseru City Council Annual Report 2000/2001

### 4.7.3 Waste Products Utilisation

Chapter 2 of this thesis elaborates on Lesotho's commitment to the values of sustainable development, set out in the United Nations Charters of 1992 Agenda 21.

In this discussion, focus is specifically placed on Chapter 21 of Agenda 21, which covers sustainable use of natural resource through the principles of waste minimization and avoidance at source. Therefore, separation of waste at source, reuse and recycling are pivotal concepts, while taking into account environmental and health aspects.

While it is acknowledged that large-scale recycling activities in Lesotho have not yet fully taken off the ground, there is an element of waste minimization and reuse through household activities and trading of waste items in the informal sector. Meanwhile, a combination of growth of recycling industry in South Africa, and an increase in poverty and unemployment in Lesotho have been driving forces for venturing into this informal sector.

The Local Administration Act (1969) and the Sanitary and Refuse Removal Regulations (1972), which are cited in Section 4.1.1. of this chapter, do not address the question of community involvement and participation in waste management. Despite this shortfall, the above-mentioned driving forces resulted into the emerging of five recycling and waste reuse initiatives, namely:

- Welcome Waste Sorting and Recycling
- Collect-A-Can
- National Environment Youth Corps (NEYC)
- Maseru Waste, and
- Masianokeng Environmental Centre.

These companies and their activities are listed in Table 4.23 with the exception of Masianokeng, whose activities on waste management at the time of the study were on hold. This institution only concentrated on environmental conservation during this study period.

**Table 4.23 Waste collected by Recycling Companies and its Value**

Company	Welcome Waste			Collect-A -Can			NEYC <sup>25</sup>			Maseru collection			Total
	T/Y	B/kg (M)	S/kg (M)	T/Y	B/Kg (M)	S/Kg (M)	T/y	B/Kg (M)	S/Kg (M)	T/Y	B/Kg (M)	S/Kg (M)	
Plastic	60	0.10	0.8	-	-	-	52	Free	0.35	6	Free	0.15	66
Paper & Products	480	0.15	0.4	-	-	-	48	Free	0.28	100	Free	0.15	580
Beer/soft drinks Cans	60	0.10	0.3	862	0.40	0.50	53	Free	0.27	-	-	-	1007
Bottles/ Glass	216	0.10	0.3	-	-	-	28	Free	0.25	-	-	-	366
# Textile	696	Free	0.15	-	-	-	-	-	-	380	Free	0.16	1076
Food waste	850	Free	0.10	-	-	-	-	-	-	-	-	-	850
* Scrap metal	2400	0.10	0.30	-	-	-	-	-	-	-	-	-	2400
* Used oils	120	Free	0.10	-	-	-	-	-	-	-	-	-	165
* Others (Composite)	55	Free	3.5	-	-	-	-	-	-	-	-	-	55
<b>Total (T/Y)</b>	<b>4937</b>	<b>-</b>	<b>-</b>	<b>862</b>	<b>-</b>	<b>-</b>	<b>181</b>	<b>-</b>	<b>-</b>	<b>486</b>	<b>-</b>	<b>-</b>	<b>6565</b>
<b>Total (M)</b>	<b>-</b>	<b>0.55</b>	<b>5.80</b>	<b>-</b>	<b>0.40</b>	<b>0.50</b>	<b>-</b>	<b>Free</b>	<b>1.15</b>	<b>-</b>	<b>Free</b>	<b>0.46</b>	<b>8.86</b>

Source: Computed by the Author from the Survey Data

T/m = tonnes per month

T/y = tonnes per year

B/kg = buying per kilogram

S/kg = selling per kilogram

# This type of waste is irrecoverable and is sold by scavengers to beer brewers and for home use as an important source of energy.

\* These components were not included in the main study. However, this information is included to indicate their importance in the activities of solid waste management, especially recycling.

<sup>25</sup> NEYC is still under GoL/UNP project and is still a non-profit making enterprise pilot project.



The contribution of scavengers as role players in private enterprise solid waste management should not be underestimated, though documentation is a problem. At the time of this study, there was no proper national record of waste recovery in Lesotho. However, the data in Table 4.23 gives an indicative estimated amount of waste recovered by waste recycling companies in Lesotho, including their financial values. It must be emphasized that this study has tried to document details on the subject of waste harvesters in Lesotho. However, it is complex issue, because some scavengers still sell to foreign companies directly, without the knowledge of local dealers. From the results in Table 4.23, it is shown that among recycling/re-usables, textiles and food waste were normally given free. This would be a welcome idea if all the categories of waste were given free, especially if given to the waste harvesters rather than the recyclers. Giving waste, to waste harvesters would add value to promotion of job creation because they would in turn sell the waste to the recyclers and dealers, thus really creating a system that generates jobs.

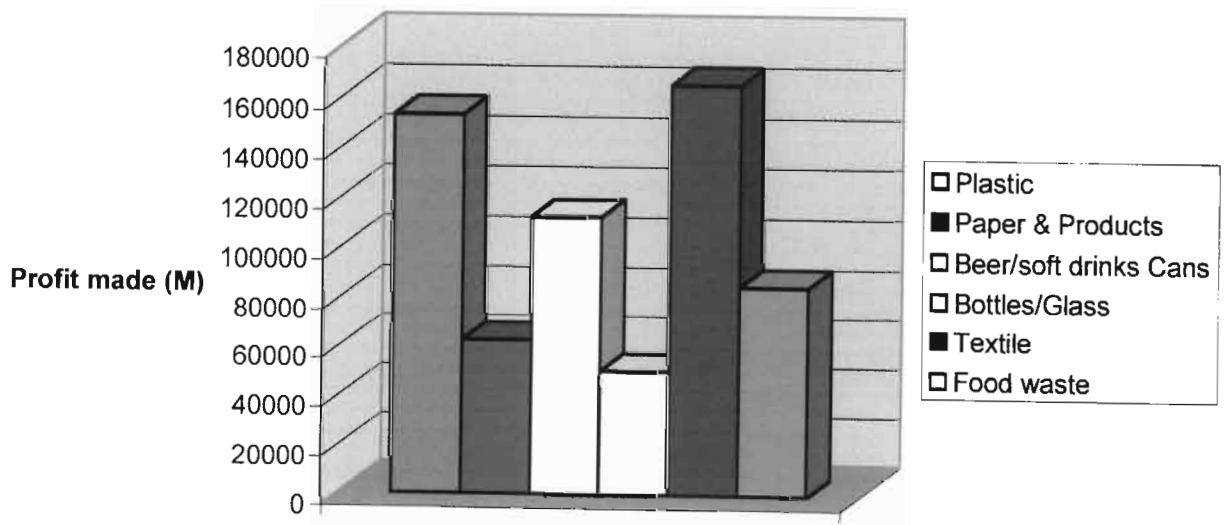
#### **4.7.4 Estimated Annual Income Earned by Recycling Companies**

The results in Table 4.24 and Fig 4.39 show the benefit of waste recovery. From these, it is seen that the total 3891 tonnes of waste collected by these recycling companies enables them to generate a profit of M 0.628 million per annum. With the exceptions of textiles and organics, the rest could be used as raw materials in industrial processes. One important point observed in Table 4.24 is that though paper was apparently most abundant type of waste, its returns were lower than those of plastics and textile were. This is very critical information because the development of entrepreneurship in waste management would require such information for prioritising the type of waste to start with in the business.

**Table 4.24 Estimated Annual Profit generated from selling major recyclable waste per company (Tonnes per year and Maluti earned per year)**

Company	Welcome Waste		Collect -A -		NEYC		Maseru Waste		Total	
	T/Y	Profit (M)	T/Y	Profit (M)			T/Y	Profit (M)	T/Y	Profit (M)
<b>Plastic</b>	480	120,000	-	-	100	15,000	52	18,200	632	153,200
<b>Paper &amp; Products</b>	60	48,000	-	-	6	900	48	13,440	114	62,340
<b>Beer/soft drinks Cans</b>	60	12,000	862	86,200	-	-	53	14,310	975	112,510
<b>Bottles/ Glass</b>	216	43,200	-	-	-	-	28	7,000	244	50,200
<b>Textile</b>	696	104,400	-	-	380	60,800	-	-	1,076	165,200
<b>Food waste</b>	850	85,000	-	-	-	-	-	-	850	85,000
<b>Total</b>	<b>2,362</b>	<b>412,600</b>	<b>862</b>	<b>86,200</b>	<b>486</b>	<b>76,700</b>	<b>181</b>	<b>52,950</b>	<b>3,891</b>	<b>628,450</b>

Source: Computed by the Author from the Survey Data



**Fig. 4.39 Profit gained from Waste Recycling by type of waste**

#### 4.7.5 Source of Waste for Recycling

Table 4.25 highlights the sources of waste for recycling in Lesotho as decoded from the questionnaires.

**Table 4.25 Sources of Waste for Recycling Companies**

Source of waste	% companies using this source versus total number of companies
Scavengers	50
Dumpsites	50
Companies, shops and industries	100
Schools and offices	50
Local Authority (LA)	25

**Source: Computed by the Author from the Survey Data**

As seen from Table 4.25, commercials and industrial establishments are the major source of recycling waste at the moment, followed by scavengers, dumping sites and schools. Few use waste from LA directly and hardly any utilize the waste from households directly. This indicates that household waste could play a major role in this picture through properly coordinated activities by communities and scavengers.

#### 4.7.6 Motivation for Waste Recovery (Recycle or Reuse)

The information on the motivation for recycling is shown in Fig 4.40

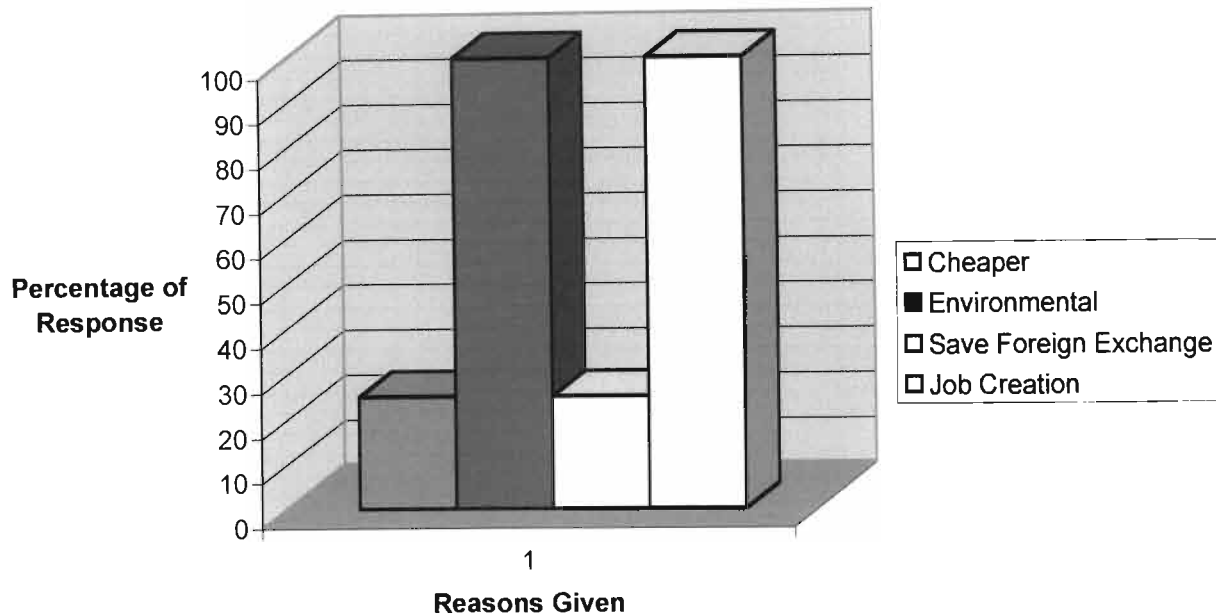


Fig. 4.40 Motivation for Waste Recycling/Reuse

Undoubtedly, environmental issues and job creation are the main reasons for the operation of waste recycling companies. From Fig. 4.40, 100 % of recycling entities indicated these two as their major priority, thus putting them at the core of their business. This carries well with the good intentions of the Government. For example, Government of Lesotho, as indicated in Sections 1.2 and 1.3 of Chapter 1, has both environment and job creation as part of the core policies of the government towards poverty alleviation.

Although most of these recycling companies are in their beginning stage, as shown in Table 4.26, they have total estimated manpower of 282. This excludes the Masianokeng Environmental Centre, whose data was not incorporated into this study. Of all these workers, 230 are unskilled labourers, while 52 are skilled, as shown in Table 4.26.

**Table 4.26 Birth Year and Labour Force of Waste Recycling/Re-use Entity (Informal Waste Sector)**

Company Birth/Labour Year	Welcome Waste 1986	Collect-a- Can 1993	NEYC 1997	Maseru Waste Collection 1995	Grand Total of Labour Force
Unskilled	49	2	176	1	230
Skilled	7	12	24	11	52
<b>Total Labour per Entity</b>	<b>56</b>	<b>14</b>	<b>200</b>	<b>12</b>	<b>282</b>

Source: Computed by the Author from the Survey Data

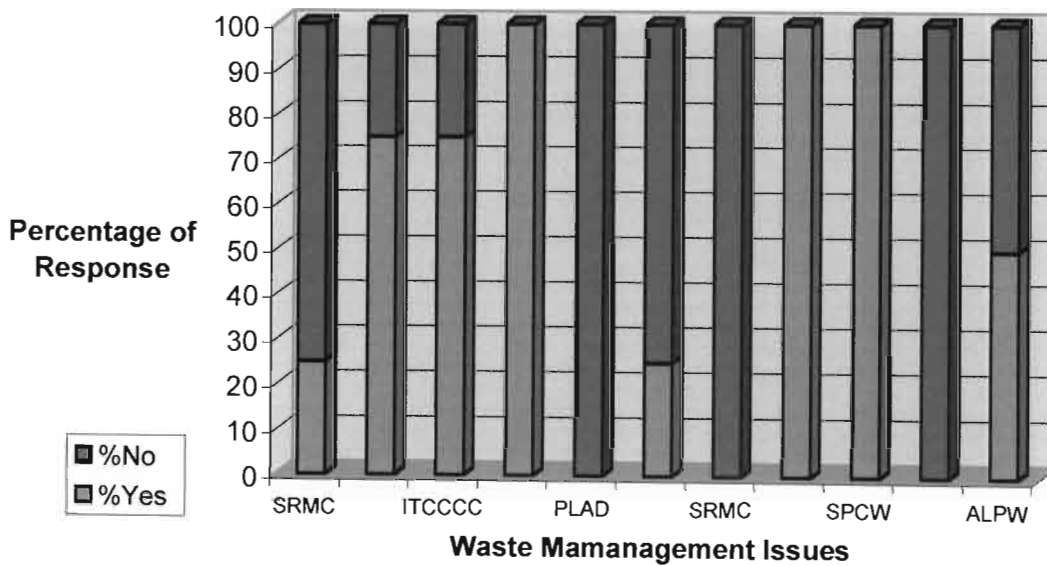
#### 4.7.7 Recycling Companies Perception of Community Involvement and Health Aspects

As shown from the responses in Fig 4.41, 75% agreed to use wheelbarrows as a means of transportation of waste at local level. Equally, also 75 % advocated the use of vehicles owned by members of the communities where satellite waste collection points are located. The desire for community participation by the recycling entities is highlighted by the results in Fig. 4.41. In this case, 100% of the entities agreed to the establishment of satellite collection points and employing casual labourers. What is noticeable is that 75% of these entities sell the materials collected. This shows that there is a need to support local recycling companies, for the following reasons: firstly, for any activity to succeed, it requires strong motivation and commitment by those who would execute this activity. In this case, the recyclers have shown that spirit. Secondly, this activity could contribute to job creation in the country and therefore requires government support as the theme of poverty alleviation and job creation forms part of Government’s priorities. This support should take formulate of deliberate policies that encourage recycling activities, such as funding guarantee for bank loans to these recycling entities.

**Table 4.27 Recyclers Responses on Economics & Health impacts.**

Item	Yes %	No %
Self recycle of materials collected	25	75
Selling of materials collected	75	25
Influence of transport costs on choice of collection sites	75	25
Need to establishment Satellite collection points	100	0
Pay to L A for access to dumpsites	0	100
Importation of raw waste materials	25	75
Self re-use of materials collected	0	100
Employing casual workers	100	0
Awareness of health risks of workers from handling waste	100	0
Supply of protective clothing to workers	100	0
Any noticeable poor health of workers resulting from poor protection	0	100
Awareness of legislation protecting workers (Labour Code of Health & Safety)	50	50

Source: Computed by the Author from the Survey Data



**SRMC**= Self Recycling of materials Collected      **SMC**= Selling Materials Collected  
**ITCCC** = Influence of Transport Cost on choice of collection sites  
**NESCP**= Need to establish Satellite Collection Points      **PLAD** = Pay to LA for Access to Dumpsite  
**IRWM** = Importation of Raw Waste Materials      **SMRC** = Self Reuse of Waste Collected  
**ECW** = Employing Casual Workers      **SPCW** = Supply of Protective Clothing to Workers  
**ANPHWRPP** = Any Noticeable Poor Health of Workers Resulting from Poor protection  
**ALPW** = Awareness of Legislation Protecting Workers

**Figure 4.41 Recycling Companies: Response to Different Waste Management Aspects.**

The health of the waste collectors was another critical point to be considered for the sustainability of this business. In this study, it was shown that the entire 100% of these entities were aware of health risks involved in the handling of the waste by collectors. To this effect, 100% of the recycling entities indicated that they provided protective clothing to their workers. This could have been a factor why waste handling diseases were not observed among their core workforce. As seen from Fig. 4.41 and Table 4.27, the entire 100% confirmed no observed waste handling related diseases occurring among their core workforce. Again, it was not possible to verify this information through the medical records of these people. When these workers were informally asked where they had their medical records, the answer was they had none.

It must be noted, though, that despite these companies providing their core workforce with protective clothing, not all of them were doing this with the knowledge of legal requirements. Only 50% of them were aware of the legislation on occupational health.

The owners of recycling companies raised a number of concerns, which hinder their progress. Such concerns were, among others, lack of equipment; absence of separation of waste at source; lack of incentives in waste recycling ventures and lack of awareness of the benefits of recycling. The Government is required to reverse these deficiencies, which may require changes to waste management policies, and institute waste management practices of benefit to recycling ventures. Such changes could be in the form of an emphasis on job creation, introduction of solid waste management policies and guidelines and regulations. Those regulatory instruments and policies highlighted in Section 4.1 have their shortfalls regarding the important issues concerning waste management. Recycling entities suggested that the Government should swiftly move to formulate these regulatory measures and assist these companies to secure funds for recycling. In addition, there may be a need to streamline institutional bottlenecks relating to solid waste management by specifying the roles of key players, one of the major bottlenecks currently.

## **4.8 SOLID WASTE MANAGEMENT: INFORMAL SECTOR**

Developing countries are faced with a multitude of inter-related social, economic and environmental problems and challenges. These problems and challenges include unemployment, extreme poverty, excessive population growth, poor living standards, and depletion of natural resources, pollution and environmental degradation.

In Lesotho, the urban influx and the decline in the formal job opportunities have resulted in many entering the informal sector. For example, Maps 2.6, 2.7 and 2.8 of Chapter 2 clearly indicate the influx into the towns of Maseru and Maputsoe. In addition, Section 1.3.3 of Chapter 1 indicates that the estimated potential work force of Lesotho is about 800,000 of which 225,000 is estimate to have formal employment. Mlosy (2000) estimated that the informal sector employs 379,085 people. This gives a national estimated indication of 63% of the economically active population in informal employment in one-way or the other.

The perception that agriculture could absorb the excess labour force does not hold in Lesotho. According to the records of “Pathway out of poverty” (1996), many observers have dismissed off broad based agriculture growth as a viable economic strategy for poverty reduction in Lesotho, pointing to the country’s limited and increasingly degraded natural resources. Therefore, other means of creating jobs have to be explored. In the case of Lesotho’s situation, the rural economy could be absolved from the need to create more sustainable rural livelihoods only if the urban economy were able to generate massive amounts of employment.

In this case, broad-based investment in human capital is one of the most important input in the creation of employment-intensive, poverty-reduction growth. Meanwhile, Mlosy (2000) further estimated that Maseru Town has a 64% informal sector involvement. This information compares well with other developing third-world countries, such as 60-70 % in Kumasi (Ghana) and 69 % in urban areas of Pakistan (Todaro, 1989).

### **4.8.1 Refuse Waste Harvesting (Scavenging)**

The informal sector of waste management (recovery, recycling and re-use) has proven to present solutions to some of these urban problems (Ali, 1997). For example. In developed



Western World, the informal sector of waste separation and recovery emerged in numerous cities after industrialisation and provided informal job opportunities. In the case of developing countries, it provides livelihood for poor individuals and informal groups. According to Furedy (1992) and Pacheco (1992), millions of urban Asians depend on waste harvesting. One good example is the city of Calcutta in India, where 40,000 people in this city rely on waste recovery (Furedy, 1992). Apart from Asia, the trend is the same elsewhere. In Bogota (Colombia), 30, 000 to 50,000 people earn their living through waste harvesting (Pacheco, 1992; McLean, 1999).

Thus, it can be argued that refuse waste harvesting is an important environmental and economic activity. The collection retrieval of recyclable waste contributes positively to keeping the environment clean, safe and contributes and in creating income through self-employment. The volume of waste collected, along with the emerging local market for waste products, has resulted in scavenging providing an important basis for self-employment.

In Lesotho, valuable waste is collected in streets and public refuse storage barrels or drums, from illegal dumpsites, including the municipal dump site at Ha Tsosane, 5 km out of the Maseru City center (see Map 4.1). Ranges of reusable and recyclable materials that include paper, plastic, cans, bottles and scrap metal, are being collected and sold. In the following paragraphs, results are given to create a general picture on the contribution of scavengers to the cleaning up of the towns and the economic improvement of the people.

The solid waste management process has both hard and soft issues. Hard issues are collection, transportation and disposal, while soft issues are social aspects of solid waste management, including the informal collection of waste. In this section, the soft issues are examined in the light of job creation opportunities and human health concerns.

#### 4.8.2 Profile of the Waste Harvesters (Scavengers)

A total of 36 waste collectors were interviewed. Of these, 61% were male and 39% were female. As indicated in Fig 4.42, the majority (39%) was between ages 15-25 years, followed by those between 26-45years (19%). Interestingly, those above 55 years (8%) were more in comparison with those between 46-55yrs (6%). It was surprising to see people above

55 years old to engage in such activities taking into account the rigorousness of this activity and that at that age, they should have been enjoying pension benefits, as the retirement age in Lesotho is 55. This signifies a lack of other formal opportunities in which these older people could have comfortably engaged, instead of the tiring waste scavenging. Among these waste harvesters, 28% did not know their age because they never knew their birth dates.

It is interesting that in terms of education wise, most waste harvesters (about 81%) had attained primary school, while 19% went up to Junior Certificate (J.C.) level. However, none of them went above the J.C. level. Perhaps it is worth noting that some of government workers are within the latter education level.

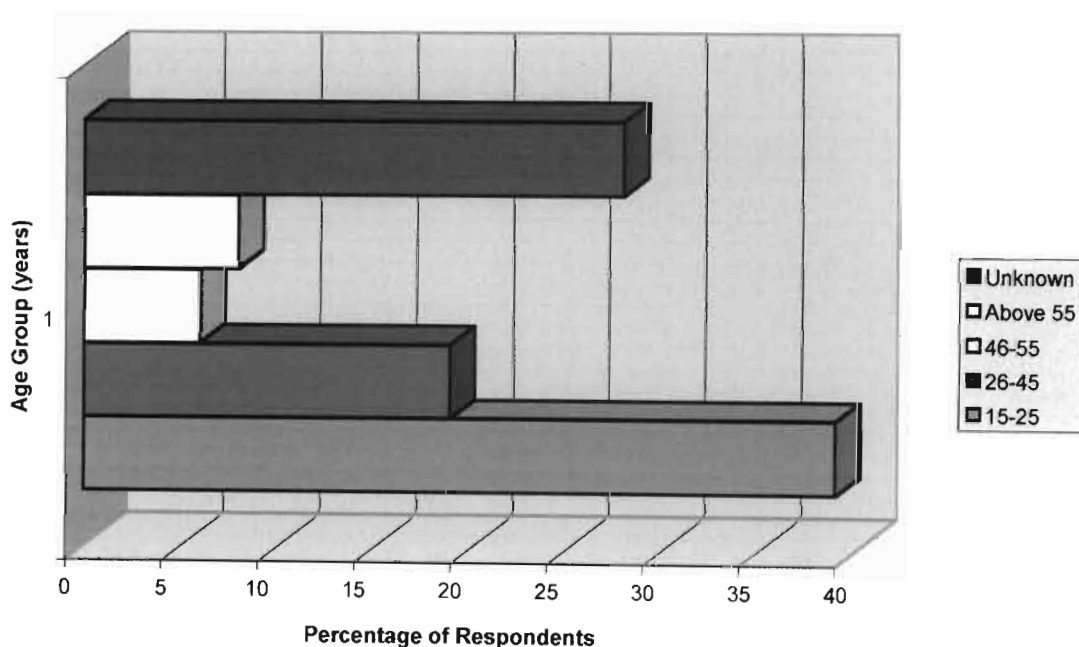
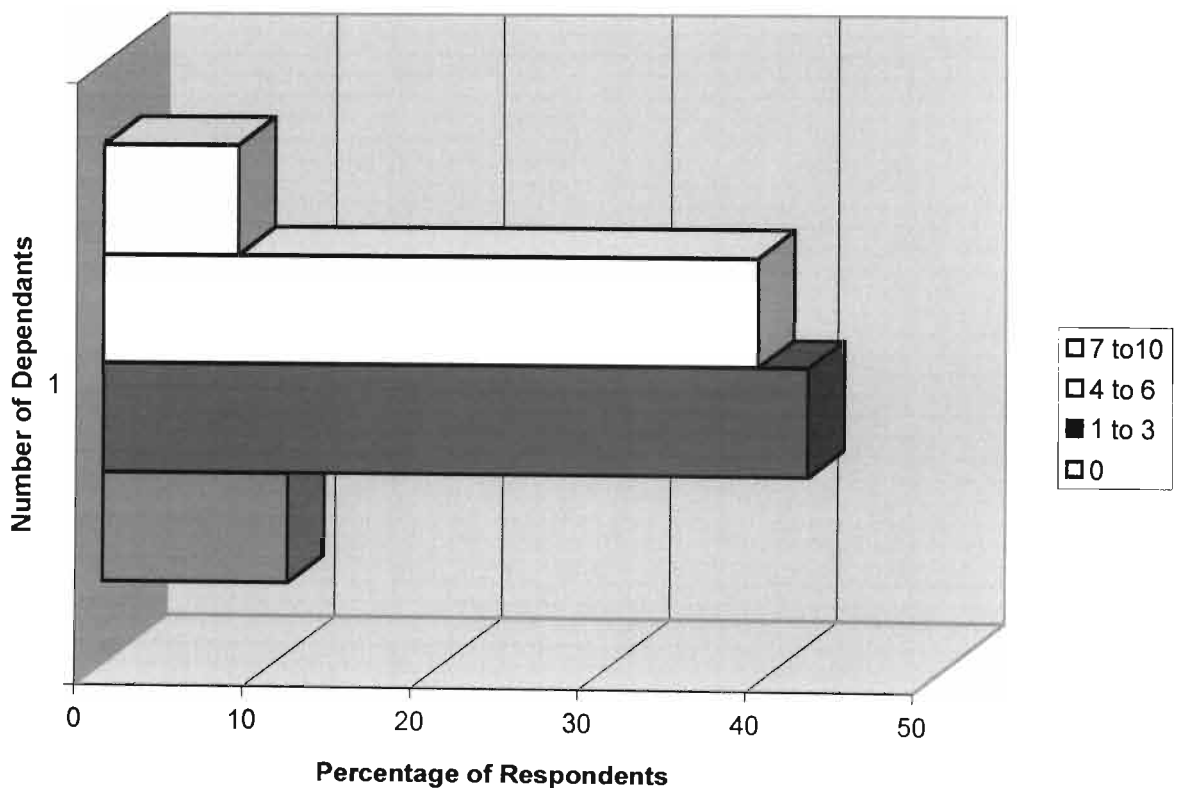


Fig 4.42 Waste Harvesters: Age Profile of Waste Harvesters (Scavengers)

This study also revealed certain profiles of these waste harvesters (scavengers). Those interviewed displayed the African customs of keeping relatives, which were included in the number of dependants they looked after in the households. As shown in Fig 4.43, 42% had about between one and three dependants, 39% had between four and six dependants and 8% had between seven and ten dependants. Those without dependents were only 11%. This implies that, for most of them, looking after such numbers of dependants is not a matter of

choice but is a cultural obligation. In this case, scavenging becomes an important source of income, and for some, it is not another source of income, but even as a matter of survival.

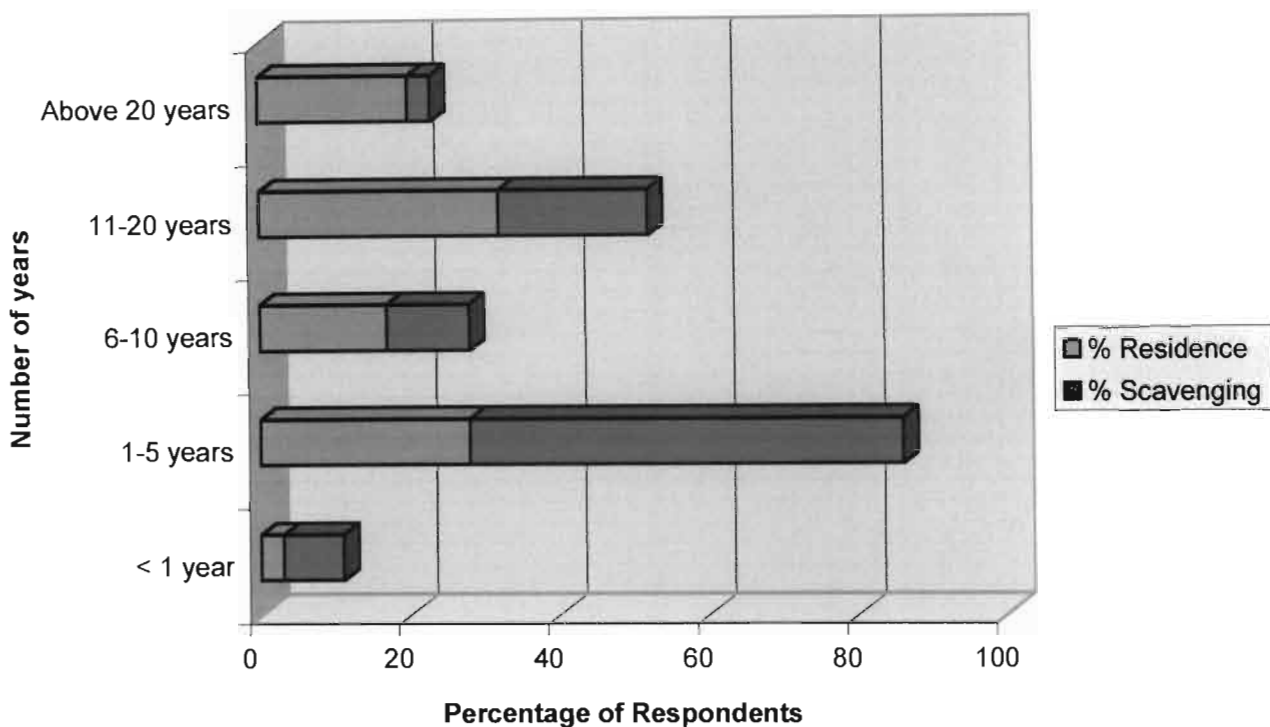
It has been revealed from the study that despite having many numbers of dependants, most of these scavengers did not have homes of their own. Only 17% had. For example, 44% were renting, while 36% stayed with friends. This point shows how the waste harvesters undergo endurance and sufferings. It would be most likely that some were kept by friends because they were breadwinners for such households.



**Fig 4.43 Waste Harvesters: Number of Dependants for per Harvester**

The study also investigated how long the waste harvesters have been resident in the area and how long they have been involved in the business of scavenging. Results from Fig 4.44 indicate that the majority have been resident in the area for a long time. Out of the total, 32% have been resident in this place for between 11 and 20 years, 28% for between 1 and 5 years, 20% for over 20 years, 17% between 6 and 10 years and only 3% lived in the area under

1 year. On the other hand, the number of years these scavengers have been involved in the waste harvesting activities displays a slightly different, picture. As shown from Figure 4.44, 58% scavengers have been in business for between 2 and 5 years, followed by 20% who have been in the business for between 11 and 20 years, then 11 % who have spent between 6 and 10 years and only 3% of them had been in the business for more than 20 years. The percentage of those who have been involved in the waste harvesting business for less than 1 year was slightly higher than those who had lived in the area for less than 1 year, giving the contrasting percentages of 8% and 3% respectively.



**Fig 4.44 Waste Harvesters: Duration of Residence and Waste harvesting**

Details in the proceeding paragraph paint a picture of an increase in the number of fresh people entering into this informal market. While those who have lived in one place for between 11-20 years are 32 %, those who have been working in this business over the same period is only 20%, yet those that have been working in this business over a period of 2-5 years are 58%. This suggests that there has been a dramatic increase in the number of entrants into this business. In fact, the bar “1 to 5 years” on the chart of Fig. 4.44 clearly paints this

picture. This indicates an increase in the labour market and a decrease in the employment opportunities in the formal sector. This is all even the more reason for the Government to encourage informal sector because it absorbs excess labour.

#### 4.8.3 Occupations Before Becoming Waste Harvesters (Scavengers)

The categories of previous occupations of these scavengers are given in Fig.4.45. This figure shows that 45% were involved in casual work, 37% were unemployed (23% rural and 14% urban), 12% were involved in subsistence farming and 6% were miners in RSA.

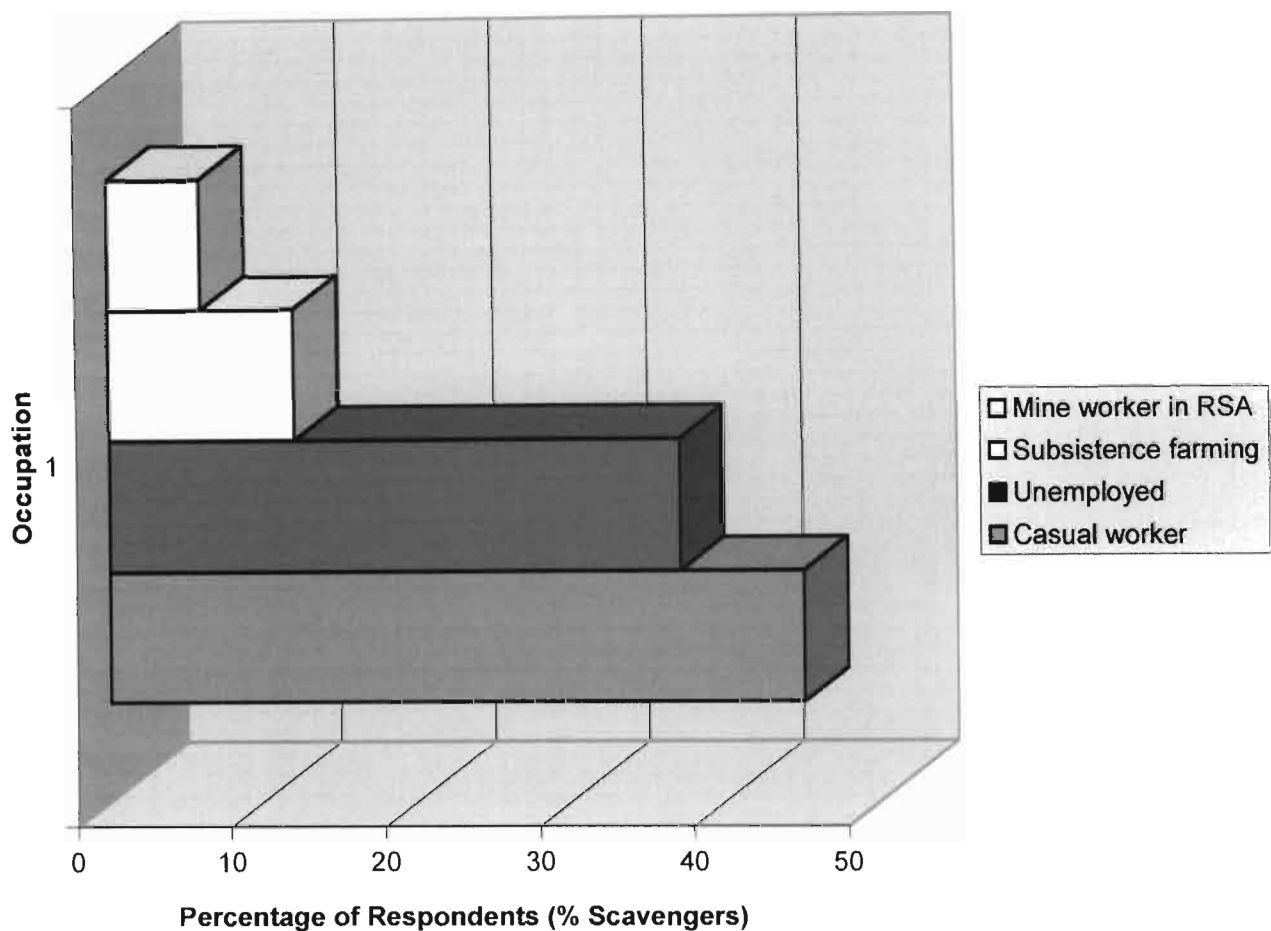


Fig 4.45 Waste Harvesters: Occupation before Engaging Waste harvesting activities

Undoubtedly, these results underscore the existence of unemployment problem in the country. The results in Fig 4.45 also point to the contribution of rural-urban migration, as already demonstrated through Maps 2.6 and 2.7 of Chapter 2. There were 12% who had left subsistence farming in the rural areas and were now involved in waste harvesting activity in town. There has also been migration from the mines in South Africa into the towns of Maseru and Maputsoe in Lesotho. This has contributed another 7%. These facts prove beyond doubt

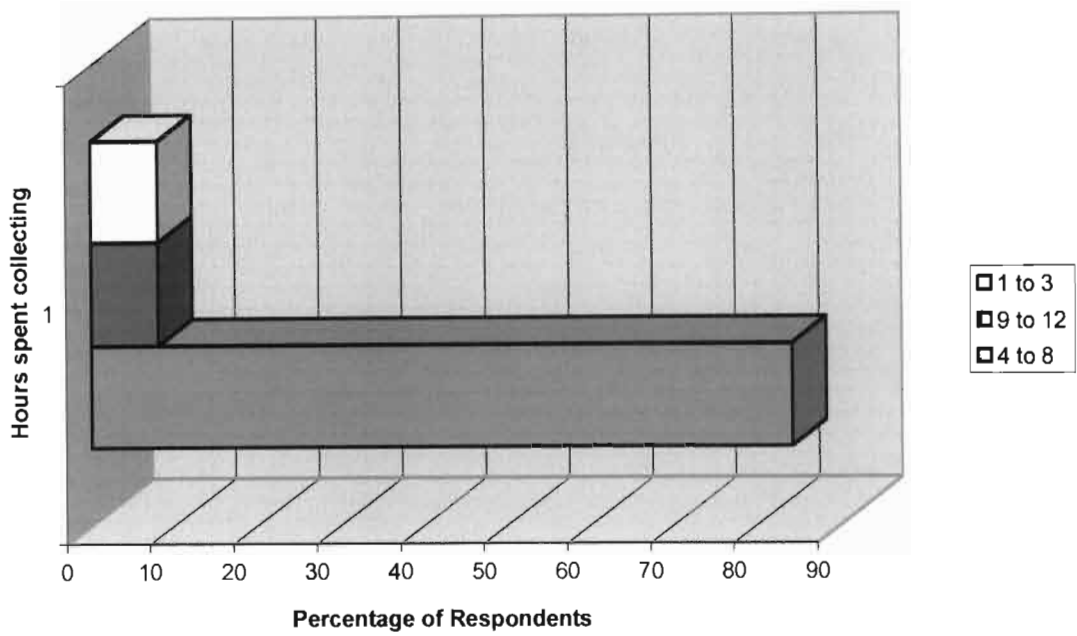
that Maseru and Maputsoe have been growing at a fast rate, as recorded by Otieno (1995), that the growth rate of Maseru was at 7 %. This growth rate means pressure on the job market and hence a need to create more jobs. Waste management could prove to be another avenue through which jobs could be created.

#### 4.8.4 Source of Collectibles and the Hardship experienced by Waste Harvesters

In this study, it was revealed that the scavengers collected their commodities from more than one source. The highest percentage (53%) collected their waste from the HaTsosane dumpsite as shown on Map 4.1, and other illegal dumpsites. The other highly patronized places were the city streets, followed by bars and offices. Households did not much form part of source of waste for scavengers.

From the results, it has been observed that most of the waste harvesters spent many hours per day searching for the commodities. As shown in Fig.4.46, 84% of them spent between 4 to 8 hours per day, 8% spent between 9 to 12 hours, while the other 8% spent between 1 to 3 hours. Similarly, these scavengers spent days searching for their commodities. As indicated in Fig 4.47, 62% spent 5 days per week, 25% spent 6 days, 9% spent 7 days 2% spent 4 days and 2% spent 3 days. In addition to long hours per day and several days per week that they spent searching for commodities, these scavengers also transported these commodities themselves. In this case, a good number (65%) used vehicles as their means of transportation, 32% carried out their business on foot, while 3% used donkeys.

These points illustrate how strenuous the waste harvesting activities could be and the hardships the waste harvesters endure. This is even the more reason why the Lesotho government should intervene and make this waste scavenging informal sector an enjoyable one.



**Fig 4.46 Waste Harvesters: Hours spent on Waste harvesting per day**

Several conclusions can be made from these facts. Waste harvesting is a labour-intensive activity with relatively poor returns. This in itself is a hardship. It has been observed that some of the waste harvesters worked abnormally long hours (between 8 and 12 hours) per day and laboured 6 or 7 days per week on end. This also signifies hardship. Working under such conditions may lead to serious negative impacts on human health. Proof of the negative impacts on human health is shown through the trends in labour relations issues. In fighting for 8 working hours per day, and 5 working days per week, is not just a mere commitment by the labour movement to the right of humanity or a chauvinistic tendency, but the right to good health.

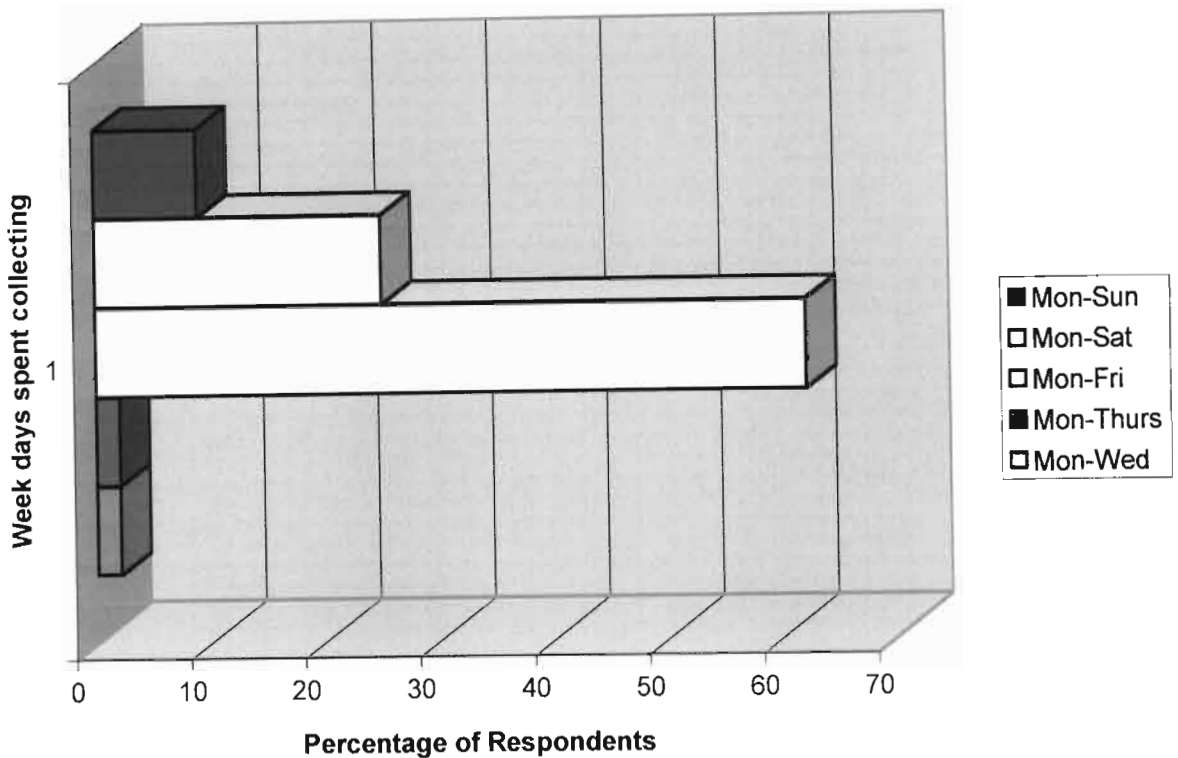


Fig 4.47 Waste Harvesters: Number of Week Days spent Collecting

#### 4.8.5 Types of Collectibles and Economic Benefits of Waste Harvesting

Sections 4.7.5 and 4.8.4; Table 4.25 and Map 4.1 show scavengers collection points and type of collectables. Of interest to this study is that the waste collected is not only utilized for recycling, but most of the combustibles are utilized as a source of biomass energy, as indicated in Section 4.9. It has been observed that 60% of scavengers collected the combustibles for biomass energy purposes.

In Lesotho, refuse scavenging at dumpsites is an open-entry business. This is conducive for the poverty alleviation efforts, because every person in need would enter into this business. The exact number of scavengers is not known. But for those interviewed at Ha Tsosane dumpsite (see Map 4.1 for estimated location in Maseru), the total number was 36. Some of them also move to other illegal dumpsites and the streets of Maseru. Mhlanga and Gulilat (1997) estimated that there were about 230 scavengers in Lesotho. The information obtained from the waste recycling companies in Section 4.7.6 revealed that they received waste from a total of 282, of which 230 were unskilled and 52 skilled. Most of these are in Maseru and



some in Maputsoe. This signifies job creation potential of solid waste management in Lesotho. There is enough evidence that the many informal waste harvesters could, therefore, make a valuable contribution to the long-term waste management activities in these towns.

It would be advisable for both the National Government and Local Authorities to take advantage of these activities. Some form of recognition of these waste harvesters by the Government authorities would be an encouraging development. It has been recorded somewhere else that the perception among waste harvesters that their activities were beneficial to the country or town they serve, goes beyond simply generating income for themselves (McLean, 1999). For many waste harvesters, a sense of identity and belonging make them feel a functional part of the society and community they serve. Therefore, incorporation into an integrated solid waste management of Lesotho would add value to the system. To this effect, identifiable clothing, like simple uniform or dust-coats as practiced in Lagos, Nigeria where uniform labelled “High-way-Manager” was given to the waste harvesters which boosted their morale (see Section 2.6).

Furthermore, results in Fig.4.48, show the income distribution per week for the waste harvesters (scavengers). From this figure, 72% of the waste harvesters earned between M11-50 per week, while 14% earned between M51-100 per week, the other 9% earned above M101 per week, and 5% earned between M1-10 per week. Meanwhile, the data collected on the income gave the average income per person per week of M45.00, amounting to M180 per person per month (or M2160 per annum). This figure of M180 is close to the figure of M210 from Mhlanga and Gulilat (1997) study. Assuming the average number of scavengers is 36, this means that at the dumpsite in Ha Tsosane alone, scavenging activities generate a total income of M6,480 per month (M77,760 per annum), while all the identified dumpsite scavengers in the country (282) would earn about M50,760 per month. This excludes those who operate elsewhere at the other illegal dumpsite, dustbins and other different sources.

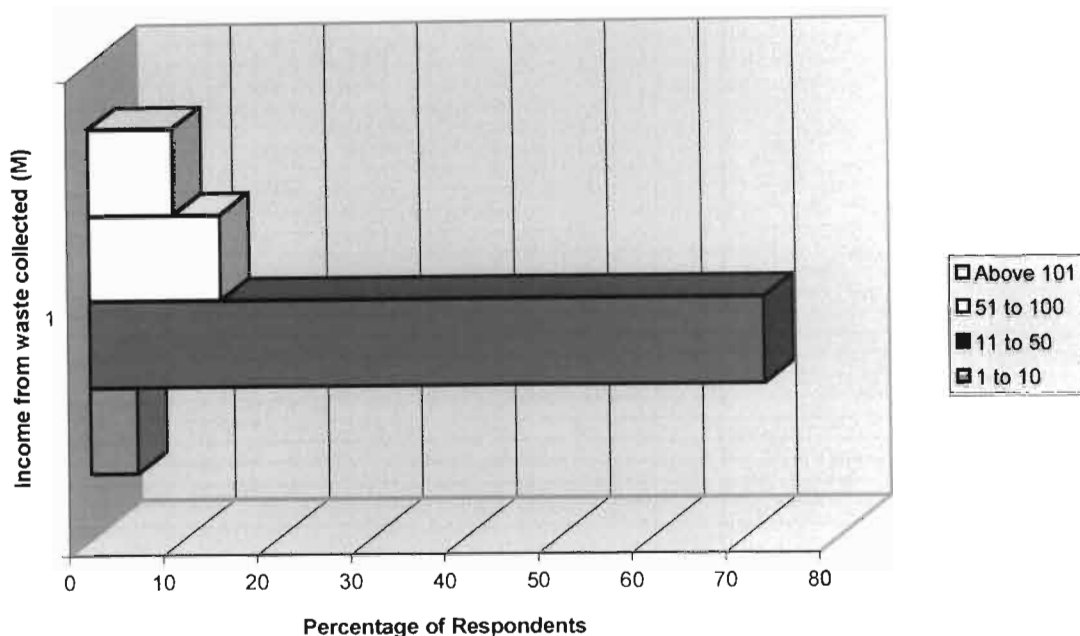


Figure 4.48 Weekly Income Range of Waste Harvesters (M)

The study also revealed that the majority of these scavengers in Maseru (78%) go about doing their activities on foot, only 22% use public transport. Those who use public transport spent an average of M3 per person per day. This adds up to M24 per day for the 22% scavengers who use public transport. Since it was not known who among the 22% worked for 7 days a week or less than that, therefore, difficult to make an accurate estimate of the transport cost. However, if the normal five working days per week was assumed, as also evidenced by Figure 4.47, then the total cost on transport per month for the 22% scavengers would be M480. If a similar assumption was made for the 282 scavengers, the estimated cost on transport alone would run into approximately M16,920. The total profit the scavengers would make per month, excluding food and other expenditures, would amount to M33840.

#### 4.8.6 Options for Waste Collection and Recycling Schemes

Among those interviewed, 62% indicated the need for establishment of satellite waste collection points which involved the communities. The means of transportation of the waste to the satellite collection points was 66% for use of personal vehicles in the communities, followed by 14% human drawn carts, then bicycles and horses. This indicates high inclination to support of the establishment of the community-based waste management system.

#### 4.8.7 The Indicative Impacts of Waste Harvesting Activities on Human Health

As indicated in Section 2.1.4, rotting heaps of solid waste provide breeding ground for rodents and insects, and thus a transmission route for many disease endemic in developing countries. This poses a high-risk health hazard to those who handle waste on a daily basis. For this reason, this study covered the issue of Human Health impact on the scavengers resulting from waste handling. The first step to assessing the risk of infectious diseases contraction was to find out about the protective clothing available. The 50% of scavengers used gumboots and overalls, 28% used gloves, 3% used helmets and 6% used mask covers as a measure of protecting themselves when handling waste.

These results in Fig. 4.49 have shown that even though there was a certain level of usage of protective clothing, this element still lacked in this informal waste activity. This posed a problem to the scavengers and their likelihood of contracting infectious diseases.

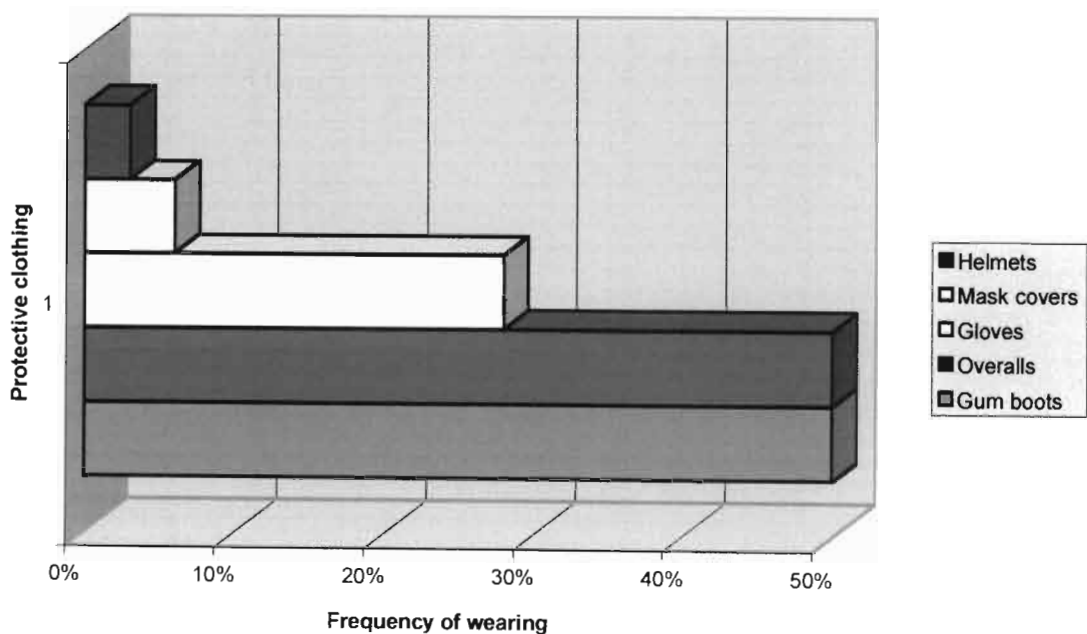


Figure 4.49 Frequency of Protective Clothing usage

Figures 4.50 and 4.51 clearly give the indicative likelihood of health deterioration of waste harvesters because of waste handling. The results indicate that more people suffered from respiratory problem, skin rash, eye irritation and severe stomachache or diarrhoea, after engaging in scavenging business, than before they were involved in these activities.

In certain cases, for example respiratory disorders, these respiratory occurrence rose from 0 to 70%, a very significant indeed. In general, about 90% of the scavengers attributed their ill-health to their being involved in scavenging activities, especially body harmfulness, skin rash, diarrhoea and respiratory problems. The scavengers supported mitigating these problems by provision of protective clothing and medical check-ups. These measures would be possible if their scavenging activities were recognized and formalized.

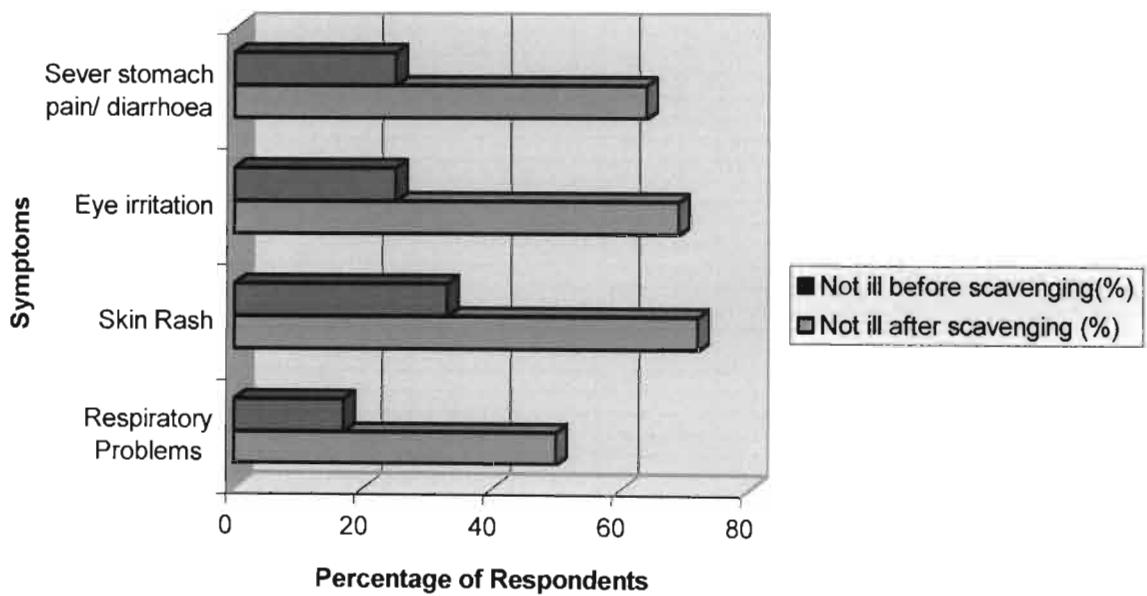


Figure 4.50 Diseases Non- occurrence before and after engaging in waste harvesting activities

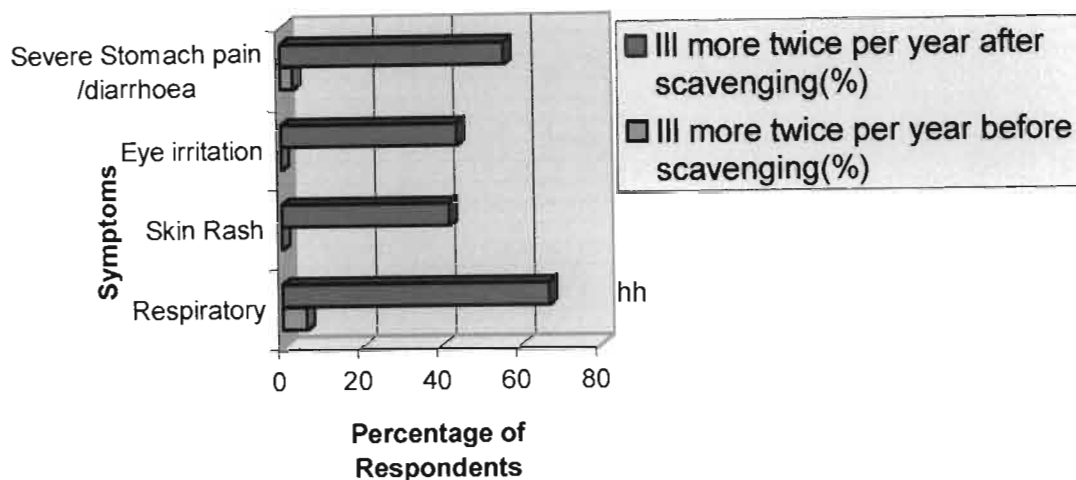


Figure 4.51 Diseases occurrence before and after engaging in waste harvesting activities

The responses regarding the impacts on the human health resulting from waste handling correlated with our initial perception that the lack of protective clothing poses a general problem to the human health of the waste harvesters. It must be noted that verification with medical records of the waste harvesters was not possible because of the complexity of the situation and the subject matter. It was difficult to establish data from the Health Care Centres, which they visited and received treatment. Most of them indicated they did not visit the clinics. They mostly treated these ailments by buying medications from shops and local chemists. Nevertheless, it is not reasonable to brush aside their views and concerns because of this shortfall. It is very important and worthwhile to take their concerns into account and respect and trust their views. If the waste harvesters indicated that they suffered from these ailments more frequently after getting involved in waste picking activities than before; this should be taken into account as a genuine indicative occurrence attributable to waste handling activities. To strengthen this point, Khan (1996) demonstrated in the Western Cape, South Africa that the integration of waste harvesters into the formal waste management process

provided a stark illustration of how poverty, health and environmental issues were enmeshed (McLean, 1999). It was demonstrated that the integration of this informal sector into the local authorities waste management activities greatly improved SWM issues and uplifted the welfare of waste collectors.

In summary, the results of the study concerning waste harvesters at the HaTsosane dumpsite in Maseru (see Map 4.1) showed that several important issues warrant consideration and best lessons could be drawn from them. From this study, it has become apparent that the waste harvesters would want to be formally recognised for the service they provide and the contribution they make to the economic growth of the country. It has also become clear from this study that unemployment, the causes of which are many and varying, is probably the most contributor to growing poverty, and that concomitant with urban influx (see Maps 2.7 and 2.8) and the decline in formal job opportunities (see Tables 1.3 and 1.4) has resulted in an increasing number of persons entering the informal sector. These evidences point out that for sustainable development to be realised in Lesotho, and elsewhere in the developing world, the welfare of the poorest communities (people) have to be addressed. All too often, the importance of job creation in the informal sector is overlooked.

In this study, it has been shown that the activities around informal sector of solid waste, help to play a role in addressing the plight of the poor, by creating informal jobs and uplifting the welfare of these poor people. For example, in this instance, it has been established in this research that approximately 36 jobs have been created at the Ha Tsosane dumpsite alone as a result of informal waste harvesting activities. This study has established not only that jobs have been created through waste harvesting activities but also that the waste harvesters generate monthly income of M180 per person. This amount may allow them to exist above the generally agreed poverty line (Sechaba, 1999; UNDP 2000; GOL, 2001) as defined in Chapter 1, taking cognisance that most of these waste harvesters support many dependants in providing their basic requirements. This leads to the conclusion that they contribute to the welfare of the people and thus contributed to the growth of the country such as supporting children to go to school: human capital being one of the important components of sustainable growth of a society. The story of benefits of waste harvesting does not end here. The study has further revealed that 58 % of waste harvesters have been engaged in this business for

more than 10 years. This substantiates the limitedness of available formal employment in Lesotho, thus increasing the reliance of informal sector for income generation. There could be other factors to the causes of some of these waste harvesters having been in the business that long, but taking into account that the majority indicated they would leave scavenging if an opportunity in a formal sector arose, provides evidence that for many, it is a matter of survival.

Perhaps further a field, away from direct benefits of waste harvesting, are the socio-economic benefits. For example, amidst the soaring problems of crime in Lesotho, solid waste activities that create job opportunities could contribute to reduction in crime rate. In addition to this, the clean environment that results from waste harvesting activities creates a more enabling environment for tourism, of which the city of Maseru and Maputose, and Lesotho in general would rely on, taking into account that Lesotho is touristically being iconed as the “Roof of Africa”.

The research has on the contrary identified that, besides the numerous benefits realised from waste harvesting activities come along some hardships and the negative impacts on the human health. This study has revealed that 78% of waste harvesters interviewed performed their duties on foot (walking). Taking into account that waste harvesting is labour-intensive in nature, walking while doing this business adds the high price of this business on the human health. In addition, some of the harvesters were above the age of 55, thus more strenuous work on their side. Concomitant with the walking hardship was the high risk of exposure to transmittable diseases through handling of waste. In this case, the study results revealed that their ailments were exacerbated by waste handling activities. The contribution to this problem was evident in the general lack of protective clothing and awareness of the adverse impacts of the improper handling of these wastes. Therefore, formalising this sector through government interaction would alleviate these problems.

#### 4.9 PHYSICAL AND CHEMICAL PROPERTIES OF SOLID WASTE

The physical properties of solid waste characterization is done by the proximate analysis. On the other hand, chemical properties that are relevant to solid waste characterization include ultimate analysis (i.e. carbon, hydrogen, oxygen and nitrogen), metals and toxic compound analyses. Typically, these types of analyses support design of processes and pollution control systems, and are used to monitor the performance of waste processing and conversion systems. However, as already indicated in Section 3.10.4, the latter are not considered in this study as Lesotho has a low industrial setting, and hence contribution of toxic metals contamination from solid waste would be minimal.

Chemical property information can be collected for individual waste components (e.g. newspaper, food waste, plastics, etc) as well as for the potentially dangerous materials (e.g. discarded chemical containers). The collection of chemical properties by component is advantageous because the chemical characteristics of a mixture of waste components can be estimated by summing up the products of the estimated mass fraction of each component and the respective chemical concentrations measured for each of the components. Using this method, the chemical contributions of halogenated compounds entering solid waste facilities in the form of wastes containing solvents in one USA location was estimated to be about 100mg per kg of solid waste delivered (Liu & Liptak, 2000).

Chemical properties are of substantial relevance to composting mixtures of components derived from solid waste. In particular, the carbon and nitrogen content and metal concentrations of potentially compostable materials are important in optimizing the composting process and producing an acceptable compost product.

According to Snel (1997), the solid waste generated in developing countries has high organic content. In a tropical climate, this becomes a major health hazard because rotting waste serves as a breeding ground for disease transmitters. On the other hand, properly handled organic waste is good for composting, fuel pellets, biogas or other useful products. Snel (1997) further notes that the solid waste in developing countries has generally low calorific value, (less than 1,500 Kcal per kg), thus rendering it unsuitable for incineration as a means of disposal.



In Lesotho, energy issues are a critical factor to consider in relation to waste management issues. Virtually all of Lesotho's non-traditional energy is imported from South Africa. An estimated 90% of the electricity is consumed in Maseru (IUCN, 1993). Since there is no national grid, much of the population relies on traditional fuel sources (biomass) like wood, animal dung combustible waste and agricultural residues. It is estimated that 75% of energy consumed comes from these sources. In rural areas alone, about 1.2 million tonnes of biomass are consumed. Therefore, the utilization of combustible solid waste in Maseru and Maputsoe become an important component of a municipal solid waste management plan. In this case, the estimated values of proximate composition, ultimate composition and heat values for the waste components in these towns have to be considered. Efforts have been made to generate these values from literature.

#### 4.9.1 Proximate Composition

According to Liu and Liptak (2000), the elements of proximate composition are moisture, ash, volatile matter and fixed carbon. The moisture content of solid waste is defined as the material lost during one hour at 105°C. Ash is the residue remaining after combustion. Together, moisture and ash represent the non-combustible fraction of the waste.

Liu and Liptak (2000) further elaborate that volatile matter is the material driven off as gas or vapour when waste is subjected to a temperature of approximately 950 °C for seven minutes, but is prevented from burning because oxygen is excluded. Volatile matter should not be confused with volatile organic compounds (VOCs). VOCs are a small component of typical solid waste. In proximate analysis, any VOCs present tend to be included in the result for moisture. Conceptually, fixed carbon is the combustible material remaining after the volatile matter is driven off. Fixed carbon represents the portion of combustible waste, which must be burned in the solid state rather than as gas or vapour. The value for fixed carbon reported by the laboratory is calculated as follows:

$$\% \text{ fixed carbon} = 100\% - \% \text{ moisture} - \% \text{ ash} - \% \text{ volatile matter.}$$

Table 4.15 shows a representative proximate composition for MSW. The values in the table are percentages based on dry (moisture free) MSW. Representative moisture values are also provided. These moisture values are MSW and components of MSW, as they would be received at a disposal facility (Liu & Liptak, 2000). It must be borne in mind that the value of proximate analysis is limited because of the following reasons:

- It does not indicate the degree of oxidation of the combustible waste; and
- It gives little indication of the quantities of pollutants emitted during the combustion of the waste.

In this case, ultimate analysis supplements the information provided by proximate analysis. A combination of both of them becomes useful for decision making in the planning of waste management systems and means of disposal.

#### 4.9.2 Ultimate Composition

Moisture and ash, as previously defined for proximate composition, are also elements of ultimate composition. In standard ultimate analysis, the combustible fraction is divided among carbon, hydrogen, nitrogen, sulfur, and oxygen. Ultimate analysis of solid waste should also include chlorine, because of the tendency to form toxic polychlorinated compounds on combustion.

Carbon, hydrogen, nitrogen, sulfur, and chlorine are measured directly; calculating oxygen requires subtracting the sum of the other components (including moisture and ash) from 100%. Table 4.28 shows a representative ultimate composition for MSW.

#### 4.9.3 Heat Value

Table 4.29 shows the heat value of typical MSW based on the results of laboratory testing of MSW components (Liu & Liptak, 2000). The heat value shown for solid waste and conventional fuels in the USA, Canada, and the UK is typically the higher heating value (HHV). The HHV includes the latent heat of vaporization of the water created during combustion. When this heat is deducted, the result is called the lower heating value (LHV).

According to Liu and Liptak (2000), the as-received heat value is roughly proportional to the percentage of waste that is combustible (i.e. neither moisture nor ash) and to the carbon

content of the combustible fraction. The heat values of the plastics categories are highest because of their high carbon content, low ash content, and low-to-moderate moisture content. Paper categories have intermediate heat values because of their intermediate carbon content, moderate moisture content and low-to-moderate ash content. Yard waste, food waste and disposable diapers have low heat values because of their high moisture levels.

**Table 4.28 Representative proximate and ultimate composition of MSW**

Waste Category	Proximate composition – Dry Basis			Ultimate Composition – Dry Basis <sup>a</sup>						
	Ash (%)	Volatile Matter (%)	Fixed Carbon (%)	Carbon (%)	Hydrogen (%)	Nitrogen (%)	Chlorine (%)	Sulfur (%)	Oxygen (%)	Moisture (%)
Organics/Combustibles	7.7	82.6	9.6	48.6	6.8	0.94	0.69	0.22	35.0	32.5
Paper	6.3	83.5	10.1	43.0	6.0	0.36	0.17	0.17	43.8	24.0
Newspaper	5.2	83.8	11.1	43.8	5.9	0.29	0.14	0.24	44.4	23.2
Corrugated & kraft paper	2.2	85.8	12.1	46.0	6.4	0.28	0.14	0.22	44.8	21.2
High-grade paper	9.1	83.4	7.5	38.1	5.6	0.15	0.12	0.07	46.9	9.3
Magazines	20.4	71.8	7.9	35.0	5.0	0.05	0.07	0.08	39.4	8.6
Other paper	6.9	83.8	9.3	42.7	6.1	0.50	0.22	0.14	43.3	28.7
Yard waste	9.6	73.0	17.4	45.0	5.6	1.5	0.31	0.17	37.7	53.9
Grass clippings	9.7	75.6	14.7	43.3	5.9	2.6	0.60	0.30	37.6	63.9
Leaves	7.3	72.7	20.1	50.0	5.7	0.82	0.10	0.10	36.0	44.0
Other yard waste	12.5	70.5	40.7	5.0	5.0	1.3	0.26	0.10	40.0	50.1
Food waste	11.0	79.0	10.0	45.4	6.9	3.3	0.74	0.32	32.3	65.4
Plastic	5.3	93.0	1.3	76.3	11.5	0.26	2.4	0.20	4.4	13.3
PET bottles	1.3	95.0	3.6	68.5	8.0	0.16	0.08	0.08	21.9	3.6
HDPE bottles	2.4	97.4	0.2	81.6	13.6	0.10	0.18	0.20	1.9	7.0
Polyethylene	1.8	97.8	0.4	86.3	7.9	0.28	0.12	0.30	3.4	10.8
Other Plastic	4.2	94.1	1.7	72.9	11.4	0.45	5.3	0.24	5.5	10.5
Other Organics	11.3	77.8	10.9	46.2	6.1	1.9	1.0	0.36	33.3	27.3
Wood	2.8	83.0	14.1	46.7	6.0	0.71	0.12	0.16	43.4	14.8
Textiles/rubber/leather	6.6	84.0	9.4	50.3	6.4	3.3	1.8	0.33	31.3	12.4
Fines	25.3	64.7	10.0	37.3	5.3	1.6	0.54	0.45	29.5	41.1
Disposable diapers	4.1	87.1	8.7	48.4	7.6	0.51	0.23	0.35	38.8	66.9
Other organics	31.3	58.8	9.9	44.2	5.3	1.8	2.2	0.81	14.4	8.0
Inorganics/Noncombustible <sup>b</sup>	100	0	0	0	0	0	0	0	0	0
<b>Overall</b>	<b>24.9</b>	<b>67.2</b>	<b>7.8</b>	<b>39.5</b>	<b>5.6</b>	<b>0.76</b>	<b>0.56</b>	<b>0.18</b>	<b>28.5</b>	<b>28.2</b>

<sup>a</sup>Also includes ash values from first column of proximate analysis.

<sup>b</sup>Values assumed for the purpose of estimating overall values.

Source: Modified by the Author from Liu & Liptak 2000.

**Table 4.29 Representative heat values of MSW<sup>a</sup>**

Waste Category	Dry-Basis Heat Value (HHV in Btu/lb)	Moisture Content	As-Received Heat Value (HHV in Btu/lb)
Organics/Combustibles	9154	32.5	6175
Paper	7587	24.0	5767
Newspaper	7733	23.2	5936
Corrugated & kraft paper	8168	21.2	6435
High-grade paper	6550	9.3	5944
Magazines	5826	8.6	5326
Other paper	7558	28.7	5386
Yard waste	7731	53.9	3565
Grass clippings	7703	63.9	2782
Leaves	8030	44.0	4499
Other yard waste	7387	50.1	3689
Food waste	8993	65.4	3108
Plastic	16.499	13.3	14.301
PET bottles	13.761	3.6	13.261
HDPE bottles	18.828	7.0	17.504
Polystyrene	16.973	10.8	15.144
PVC bottles	10.160	3.2	9838
Polyethylene bags & film	17.102	19.1	13.835
Other Plastic	15.762	10.5	14.108
Other Organics	8698	27.3	6322
Wood	8430	14.8	7186
Textiles/rubber/leather	9975	12.4	8733
Fines	6978	41.1	4114
Disposable diapers	9721	66.9	3222
Other organics	7438	8.0	6844
Inorganics/Noncombustible <sup>b</sup>	0	0.0	0
<b>Overall</b>	<b>7446</b>	<b>28.2</b>	<b>5348</b>
<p><sup>a</sup>Values shown are HHV. In HHV measurements, the energy required to drive off the moisture formed during combustion is not deducted.</p> <p><sup>b</sup>Values assumed for the purpose of estimating overall values.</p>			

Source: Modified by the Author from Liu & Liptak 2000

The details spelt out in the foregoing paragraphs and Tables 4.28 and 4.29 are very critical if solid waste management planning is to incorporate waste as source of energy. In addition, the information is vital, for composting programmes, whether for purposes of agricultural manure or for energy as biogas. If paper is used for making briquettes as a source of biomass energy supply in Maseru and Maputsoe the estimated 71,858.5 tonnes of paper generated per annum in these towns would yield 6.3% of ash (4,527 tonnes per annum of ash), 83.5% of volatile matter (60,002 tonnes of volatile matter), and 10.1% of fixed carbon (7340 tonnes of fixed carbon). For ultimate values the fixed carbon content of 7340 tonnes in paper, would yield 43.0% of carbon (3156 tonnes of carbon), 6.0% hydrogen (440 tonnes hydrogen), 0.36% nitrogen (26 tonnes of nitrogen) 43.8% oxygen (3215 tonnes of oxygen), 0.17% sulphur (12 tonnes of sulphur), and 0.17% chlorine (12 tonnes of chlorine).

Therefore, it is now very clear that the knowledge of such values is essential for the proper planning, designing and implementation of solid waste management systems. Energy values can be derived from this information for the purposes of using an incinerator as the means of disposal of waste or making of briquettes for biomass energy supply. In this case, of waste paper alone generated in Maseru and Maputsoe, the composition percentage by mass of critical elements of fixed carbon (carbon, oxygen, hydrogen, nitrogen, sulphur and chlorines) and others, especially ash, become important factors to consider in the overall waste management practices. Figure 4.52 indicates the waste composition by mass and hence the energy content, which can be derived from the waste.

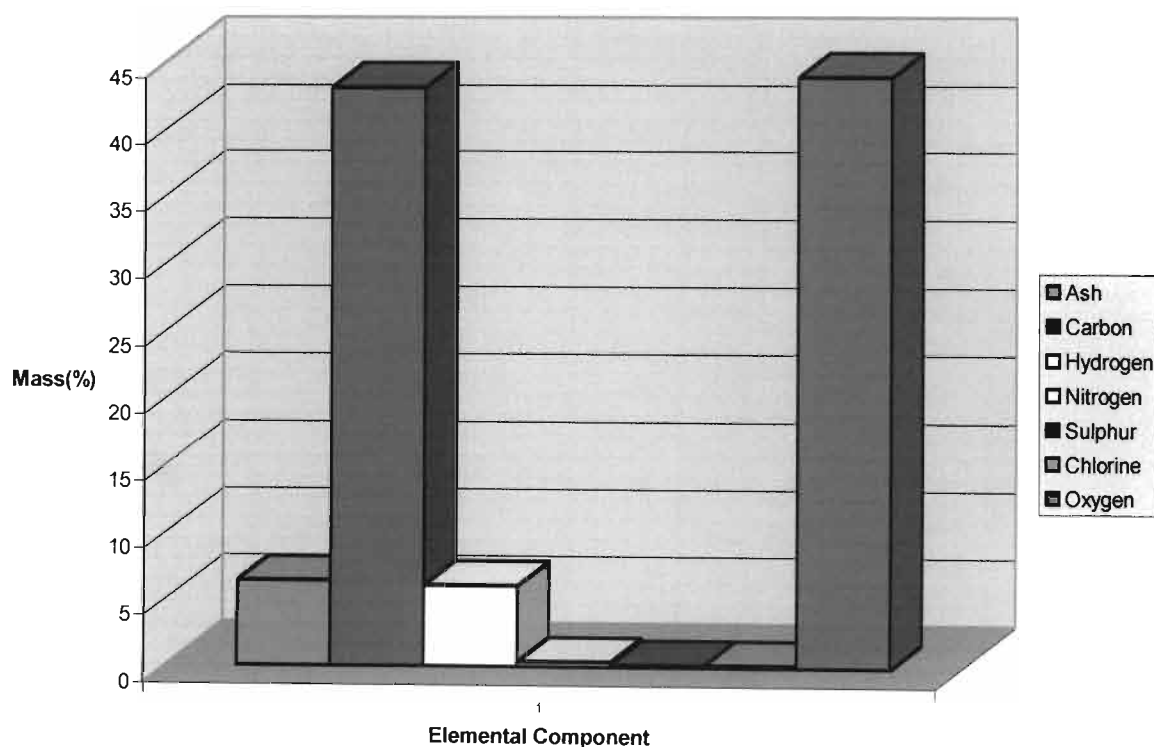


Figure 4.52 Elemental Annual Composition of waste paper in Maseru and Maputsoe (% Mass)

## CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

### 5.1 CONCLUSIONS

It may be worth emphasising that the results of this study would, in most cases serve as source of information and data vital for designing and implementing the Municipal Solid Waste Management (MSWM) systems, not only in Lesotho, but in many countries in the SADC region that are currently grappling with the issues of waste management problems. Most importantly, those cities and towns in the region following the route of community-based type of waste management approach when developing their municipal solid waste management systems may find the results of this study very useful for their inputs. Following this route would, in the end, result into developing systems that would contribute to achieving sustainable development principles. This in turn, would produce measurable improvements in the quality of lives of the people in those cities or towns that would adopt the system. The specific issues of critical importance in this case are the waste generation and socio-economic benefits of community-based waste management systems and recycling/re-use. More importantly, is the key point: “ how the MSWM activities could benefit the communities and the poorest of the poor in the country.

Therefore, this chapter presents a summary of the conclusions that have been drawn from the research. From Section 2.8.2, specific research objectives were stated as: -

- To investigate the appropriateness and relevance of existing environmentally related policies and regulations regarding addressing real problems of solid waste management.
- To gauge the people’s understanding of the “polluter-pays principle” and awareness of solid waste management related issues.
- To assess the community’s perceived level of existing solid waste management services and their preferences and attitudes towards these services.
- To gauge people’s willingness to pay for the waste services and level of affordability.
- To determine the solid waste generation rate (per capita per person for households) and establish the types, and quantities from selected generators.
- To investigate whether waste generators separate waste at source.

- To evaluate the economic benefits of the solid waste harvesting activities in terms of establishing the profits the recycling companies make per annum and income generated by waste harvesters per month.
- To establish how many jobs are created in the solid waste management activities as an informal sector.
- To establish the demographic characteristics of the waste harvesters (scavengers), their families, and activities at the dumpsite.
- To investigate the hardships the waste harvesters experience in their day-to-day waste collection career and the likelihood of adverse impacts on the human health, resulting from handling the wastes and their by-products.

These objectives should be examined within the overall goal of the research, which was to generate data and information useful for designing appropriate and sustainable solid waste management systems in a country. The means having waste management system that would improve the delivery of solid waste collection services with communities involvement and job creation being the major focus. Achieving this would contribute to the economic growth, and environmental and health benefits of the people in Lesotho. This would indirectly meet the objective of umbrella environmental policy of Lesotho: “ To secure for all Basotho people a high quality of environment to enhance their health and well-being”.

In this case, the research study conclusions have been drawn concerning the appropriateness and relevance of existing environmental-related policies and regulatory instruments, and the institutional settings concerning understanding and awareness of these policies and regulatory instruments. Conclusions have also been made on issues concerning data and information gathered from residential, industrial, commercial establishments in terms of waste generation and the willingness to pay for waste service and affordability of the waste service. In addition, conclusions have been drawn on the socio-economic benefits of recycling in relation to job creation; and waste harvesting in line with the profitability of the career and its hardships. Since the physical chemical composition is an integral part of the integrated waste management system, conclusions have also been made concerning the proximate/ ultimate, heat values and the possible emissions expected from the generated waste in Maseru and Maputsoe.



### 5.1.1 Desk-top study on Regulatory Framework and Policy

From the research findings, it has been established that the present environmental related regulatory instruments and the policies in Lesotho are generally bogged down with problems of inadequacies and inappropriateness. These have been highlighted under specific headings.

#### **Legal Instruments – Environment Act 2001:**

The research has revealed that:

- The entire regulatory framework formulated in the early times up to the 1980's did not address the real issues of waste management: minimisation, separation at source, recycle or re-use, description of waste disposal/treatment (where and how) and human health impacts.
- The laws were only clinical in nature: only addressing matters of offensiveness.

This means that if these offensive objects were buried, without regard to consideration of ground water pollution and adverse impacts on human health, all was well as they were covered and hidden from sight.

- However, it was only the 1979 Act that addressed the waste management facilities, but then excluded agriculture: pesticides were not an issue and hence their impact on human health was not an issue, either.

On the other hand, the Environment Act 2001, though it generally addresses the issue of the “Right to Clean and Healthy Environment” in its Part II, Section 4 (1) (a) the issues of human health and environment are less emphasised in the actual content of the Act. For example, Part VI, Section 38 (a) mentioned the formulation of Standards and Guidelines for Waste Classification and Analysis and methods of disposal, without going into depth of the issues of waste management: including health impacts, recycle/re-use and minimization and polluter-pays principle. The health impacts aspects, is only slightly mentioned in (c) of the same (Section 38), where it addresses identification of materials and processes dangerous to health and environment. In terms of emphasis on issues specific to solid waste, it is devoid of information needed. It only appears in Section 44 (a) (iv), under small Sub-section of other standards formulation. The virtual absence of specific waste management regulations has some implications. Mostly, regulations for waste collection and disposal are embodied in the waste Management Act. In this case, there is no such Act in Lesotho. The Act that draws closer to the issues of solid waste management is, as

already indicated: the Environment Act 2001. This means that care must be taken to ensure effective regulations are formulated which specifically address the issues of solid waste management. Such regulatory instruments should include assigning the roles and responsibilities to department and Ministry to take charge of waste management issues. In addition, the regulatory instruments on waste management should spell-out the appropriate prescribed fee for the waste service and highlight the need for waste minimization, recycling and re-use through community participation. In this case, it must be emphasised that the process of formulation of waste management standards and guidelines should carefully consider the issues of imposition of levy, separation of waste at source, consumer leaving packing materials to the shop Keeper, establishment of satellite waste collection and drop-off points, waste collection service fee and affordability of the waste collection service. Effort should be made to link these with the polluter-pays principle and its awareness. As is the case now, the study has established that there is a low level of awareness on regulatory instruments.

#### **Environmental Policy:**

The research has established that the Umbrella Environmental Policy of 1996 sets a good platform for Lesotho to address problems of waste management issues, more especially, issues of solid waste, and in particular, Sections 4.3 and 4.17. These are very specific to solid waste management. For example:

**Section 4.3:** - Addressed issues of proper waste disposal and better waste treatment.

**Section 4.17** - Took care of the concerns on promotion of safe collection, handling and disposal of wastes based on established guidelines.

- It also concurred that community involvement and private sector was essential for cost-effective waste collection, processing and disposal.

The strategies under Section 4 of the Environmental Policy also clearly emphasised the importance of waste management systems. For example:

**Strategy 4:** Talked about prescription of regulations for safe waste disposal of waste.

**Strategy 7:** Mentioned putting in place economic incentives for encouraging proper waste management systems.

**Strategy 8:** Addressed the issue of encouragement of recycling and re-use of bottles, cans and other recyclables by use of deposits, local collection points and incentive for private sector household and community involvement.

### 5.1.2 Policy -Related Questionnaire Results Analysis

The research has revealed that there was a low level of awareness by members of Government on most policy issues such as:

- Separation of waste at source.
- Consumer leaving packaging materials to the shopkeeper.
- Values of solid waste management.
- Imposition of waste levies.

These facts signify the absence of clearly defined policies on these issues. Those who were aware had taken personal initiatives. This calls for rigorous campaigns to raise the awareness on waste - related policy issues, especially when the waste management policy has been formulated and put in place.

### 5.1.3 Socio-Economic Related Questionnaire Results Analysis

The research has revealed that generally, on average:

- Low-income households of Ha Tsoane and Maputsoe had a high number of inhabitants per household, while high-income households of Maseru-West and Hillsvie had low number of inhabitants per household.

However, what was encouraging was that, generally, there was a good level of willingness to pay for the waste collection service. The affordability of these waste collection service was also reasonably good in most cases. For example, a high proportion of Government Institutions and parastatals indicated they would afford in the range of M21-50, those of households indicated the range M1-5, the industries M100 and above, while the commercial establishments would be comfortable with the M6-20 range, and to some extent, the M51-100 range. As to whether these values would be good for sustainable solid waste management remained to be seen. Especially the favoured low value range of M1-5 by the households would be impractical to sustain an effective and efficient waste management system.

#### 5.1.4 Waste Generation Issues in Maseru and Maputsoe

The research has established the following in connection with waste generation in Maseru and Maputsoe. These findings are:

- Generally, paper was the most abundant item in most sources of waste, followed by plastics. This result differed with that of Mhlanga and Gulilat survey. The reason has already been given in Chapter 4.
- The high- income households generated more waste than low-income households did. Furthermore, the per capita for the high-income households in the surveyed areas was higher than low-income ones. In addition, the average generation rates of household solid waste for different socio-economic categories were found to be as follows: -
  - High-income: 0.16 Kg per capita day<sup>-1</sup>
  - Middle-income: 0.10 Kg per capita day<sup>-1</sup>
  - Low-income: 0.05Kg per capita day<sup>-1</sup>
  - **The weighted average household waste generation rate for all the households in the surveyed areas in Maseru and Maputsoe was found to be equal to 0.13 Kg per capita day<sup>-1</sup>.**
- The commercial establishments contributed the largest proportion of municipal solid waste in Lesotho, followed by households and the industries.
- Maseru, by far, generated more waste than Maputsoe. For example, Maseru generated an estimated quantity of 157,552 tonnes per annum while Maputsoe generated 19,107 tonnes per annum. It must be borne in mind that larger portion of this waste is recyclable or re-usable and Compostable, or could be utilised as a source of energy (potential for briquette production).

### 5.1.5 Cost Recovery from Waste Services in Maseru and Maputsoe

In Section 4.7.2, it was shown that the current waste collection service in Maseru and Maputsoe was not performing efficiently and effectively. One of the contributing factors to this underperformance was cost recovery.

The research has revealed that if the service performed efficiently and effectively, including servicing households in the peri-urban areas, considerable cost recovery could be realized in Maseru and Maputsoe. The breakdown is indicated in Table 5.1. From this table, it has been concluded that using the current fee charges, revenue from waste service in Maseru, including peri urban areas, would be estimated at M 1,517,510 per month, while that of Maputsoe, also including peri-urban areas, would be M316, 260 per month. This would be a substantial amount to enable the Local Authorities to run the waste management service well.

**Table 5.1 Revenue collected from Waste Service by Entity per month in Maluti (M)**

Source	Households			Institutions			Industries			Commercials			
	Category	No. hh	C/H (M)	Cost (M)	No. Inst.	C./Inst (M)	Cost (M)	No. Ind.	C/Ind (M)	Cost (M)	No.Co	C/Co (M)	Cost (M)
Maseru		137837	10	1378370	184	100	18400	93	800	74,400	4634	10	46340
Maputsoe		27951	10	279510	96	100	9600	26	800	20,800	635	10	6350

Source: Computed by the Author from survey data

C/H=Cost per household, C/Inst=Cost per institution, C/Ind= Cost per industry, C/Co= Cost per commercial establishment

### 5.1.6 Willingness-to-pay and affordability-to-pay for waste service – cost recovery

Willingness to pay for the full cost of a particular service is a clear indication that the service is valued and therefore would most likely be used and maintained. It would be able to generate the funds required to sustain such a service.

The research has revealed several anomalies concerning gauging affordability and willingness to pay. These anomalies are: -

- The starting point bids used in the affordability to pay questions was seen as an anchor point.

- The respondents were biased by the amounts they were confronted with for valuing the solid waste system.
- While there was a general expression of willingness to pay for the waste service, the affordability for households showed a large number of respondents in household not willing to spend more than M5, which was the fee charged at the time of the study (now it is at M10).
- The residents of areas which did not receive formal waste collection service were not able to compare the affordability values to any other fee charged, hence the smallest value bid of M1-5 was appealing to them.

These anomalies brought about the identification of gaps, which would require to be filled in order to have a meaningful gauging system for affordability and willingness to pay. The tools necessary to fill such gaps would be: to find out the reaction to the suggestion that the local authorities should cover all the cost for waste collection service. This would have gauged the general impression that only those who receive the waste service were to pay for the service. There may be a need to try this route when implementing the integrated waste management systems in Lesotho.

It has been apparent from the research that for households, the indicated questionnaire starting with the point of affordability (M1-5) in Maseru and Maputsoe was too low and not practical for cost recovery. Therefore, as a benchmark, it would be useful to utilise the expenditure approach in addition to monthly incomes, based on facts that:

- It has been established that between 0.7 and 2.5% of monthly expenditures for living can be contributed to the cost of SWM services by households in low-income countries <sup>1</sup> (Cointrean and Levine, 1994; Alfa and Dashazo, 1996; Pfammatter and Schertenleib 1996; World Bank 1992).

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<sup>1</sup> Low-income countries are defined as those with average annual per capita of US \$ 350.

This internationally accepted figure could be used for assessing people's affordability to pay for SWM services and like wise, to verify over or under-estimation of the willingness to pay results. Hence, estimations and conclusions based on the income-generated data should be approached with caution and validated by means of data on cost of living expenses.

This is another gap that may need to be corrected before implementing the solid waste management system in Lesotho. An assessment of average monthly expenditure per month may be needed in order to estimate close sustainable affordability-to-pay expenses for solid waste collection.

From the research, it has also become apparent that in addition to the expenditure as a means of gauging affordability, there are other factors to consider. In this case, it would be worth noting that:

- Although less reliable, the affordability-to-pay for SWS, could also be verified through elicitation of household income. The lower reliability comes in because income questions are susceptible to arbitrary answers of the respondents.

From the data on socio-economic results under section 4.2.5, the income bracket has monthly average of M220, middle income M1020 while the high income M5600. In this case, the average monthly income for all categories of household would lead to a suggestion that payment of between M20 and M30 per month per bin would be a good proxy for determining the affordability, unlike the prevailing M10 per bin per month.

The research has further painted a picture that:

- Other approaches such as charging different rates according to category of the residential areas, unlike a blanket fee charge are viable.

. This signifies the point that, before implementing the waste management system, the affordability and willingness to pay for waste service should be additionally carried out and the best route would be taking into account the monthly household incomes and expenditures of households.

#### **5.1.7 Waste Recovery Re-use and Recycling Issues in Maseru and Maputsoe**

The research has established that the recovery, recycling and reuse of solid waste materials from Maseru and Maputsoe in Lesotho have the potential as an important source of income for the

poorest inhabitants in these towns, and that for some, it is a matter of survival. Against a backdrop of soaring unemployment, as indicated in Section 1.5.3 of Chapter 1, the urban municipal solid waste management through the creation of job opportunities (*albeit* mainly informal) would contribute to poverty reduction in Lesotho.

The research has revealed that in Lesotho, the motivation factors for recycling and re-use were based on major issues of:

- Environmental concerns.
- Income generation and job creation.

These revelations are important because they point to the ethics of sustainable development principles of Agenda 21. The fact that the recyclers showed the intrinsic motivation factor of environmental services is an encouraging development, because it points out the domains of morality in the minds of these people: a paradigm shift from not only considering the economic gains, but the ethics of what is right or wrong. Thus demonstrates a commitment in the behaviour of the recyclers that they should carry their business in an environmentally friendly manner.

The research has also discovered that, in addition to the direct benefits that waste recovery re-use and recycling have on the cleanliness of the environment, reduced impact on the waste being land filled and creation of job opportunities, this sector could also have indirect benefits such as:

- Enhancement of the tourism industry, taking into account that Lesotho is being dubbed in tourism as "*The Roof of Africa*".
- The good quality of life of the Basotho resulting from clean environment.

Furthermore, this research has established that Lesotho has the potential for job creation through waste recycling and reuse activities. In summary: -

- Out of an estimated 3,891 tonnes of waste collected by recycling companies annually, a profit estimated at M 0.7 million was generated annually, and
- The activity employed an estimated number of 282 people, thus jobs were being created in the process.

This study has also revealed that the waste recovery sector did have its own problems, among them:

- Hindrance due to lack of awareness of the benefits of recycling by the communities,



- Lack of the necessary infrastructure for separation at source (albeit rudimentary) for curbside collection during which waste collectors could easily find recyclables.
- Non-existence of satellite waste collection drop-off stations.
- Lack of deliberate policy by the government to encourage recycling activities such as serving as a guarantee to recycling companies when obtaining bank loans.

#### 5.1.8 Waste Harvesting Issues in Maseru and Maputsoe

The research concerning waste harvesters at the HaTsosane dumpsite in Maseru (see Map 4.1) revealed that several important issues warranted consideration and that best lessons could be drawn from them. From this study, it has become apparent that:

- The waste harvesters would want to be formally recognised for the service they provided and the contribution they made to the economic growth of the country.
- Unemployment, the causes of which are many and varying, is probably the biggest contributor to growing poverty, and that combined with urban influx (see Maps 2.6 and 2.7 of Chapter 2) and the decline in formal job opportunities (see Tables 1.3 and 1.4 of Chapter 1), have contributed to an increasing number of persons entering the informal sector.

This evidence points out that for sustainable development to be realised in Lesotho, and elsewhere in the developing world, the welfare of the poorest communities (people) has to be addressed. All too often, the importance of job creation in the informal sector is overlooked. In this study, it has been shown that the activities around the informal sector of solid waste help to play a role in addressing the plight of the poor, by creating informal jobs and uplifting the welfare of these poor people.

To enhance the findings in the waste informal sector, this research has established that:

- Approximately 36 jobs have been created at the Ha Tsosane dumpsite alone, because of informal waste harvesting activities.
- The waste harvesters, on average generated an estimated income of M180 per person per month or M2, 160 per person per annum. This income puts the waste harvesters well above (more than double) the Lesotho's generally agreed upon

definition of poverty: “ *those poor people with monthly income of below M80*” (Sechaba, 1999; UNDP 2000; GOL, 2001).

- The study has established that this activity provided income to some of those who could not find the means of raising income for their daily use.

It has become apparent from the research findings that besides the numerous benefits gained from waste harvesting; this informal sector has some hardships and the negative impacts on the human health. For example, the study has revealed that:

- An estimated 78% of waste harvesters interviewed performed their duties on foot (walking). Taking into account that waste harvesting was labour-intensive in nature, walking while doing this business added to the high burden of this business on the human health, especially the elderly who were above 55 years of age.
- Concomitant with the walking hardship was the high risk of exposure to transmittable diseases through handling of waste. Moreover, the study revealed that ailments were exacerbated by waste handling activities.

Some scavengers indicated that before engaging in waste harvesting activities, they never suffered from certain ailments for more than once a year or so, but after engaging in these activities, they suffered from the same ailments, more than four times over the same period: *an indicative litmus for the negative impacts of waste harvesting activities*. Although there was no verification against the medical records of these people because of the complexity of the matter, the views of the waste harvesters have to be respected. A general lack of protective clothing and awareness of the adverse impacts of the improper handling of these wastes also contributed to the problem. Therefore, formalising this sector through government interaction would alleviate these problems.

The research findings indicated that the waste harvesters perceptions concerning their activities go beyond a mere need for income generation. It was revealed in the study that many waste harvesters believed their activities were beneficial to the country and would therefore be proud to be identified with these activities, indicating a perception among these harvesters of being a functional part of the society. This suggested the incorporation of their activities into the integrated waste management system. The example, of this would be the city of Lagos in Nigeria where the waste collectors had uniform labelled “ High-way Waste Managers”. Moreover, the

case of Nigeria had enhanced the success of this informal sector and therefore, should be emulated.

### 5.1.9 Physical/Chemical properties of Solid Waste in Maseru and Maputsoe

The research has established that in Lesotho, energy issues are a critical factor to consider in relation to waste management issues, since some of the waste could be used as source of energy.

To link this relationship, the study has revealed that:

- Virtually all of Lesotho's non-traditional energy (an estimated 90% of the electricity is consumed in Maseru) was imported from South Africa (IUCN, 1993).
- There was no national grid in rural areas of Lesotho. Much of the population relied on traditional fuel sources (biomass) wood, animal dung and agricultural residues. It was estimated that 75% of energy consumed came from these sources.
- In rural areas alone, about 1.2 million tonnes of biomass were consumed per year.
- In low-income households of urban and peri-urban, combustible solid wastes serve as source of biomass energy.

Therefore, the utilization of combustible solid waste in Maseru and Maputsoe should become an important component of municipal solid waste management plan. In this case, the estimated values of proximate composition, ultimate composition and heat values for the waste component in these towns have to be considered. Whichever method would be applied in the utility of the waste, either as a source of energy (in form of briquettes) or compost for biogas and manure or disposal via incineration, it has to be borne in mind that out of 71859 tonnes of waste paper generated in Maseru and Maputsoe per annum, this would yield:

- 43.0% of carbon (3156 tonnes of carbon);
- 6.0% hydrogen (440 tonnes hydrogen);
- 0.36% nitrogen (26 tonnes of nitrogen);
- 43.8% oxygen (3215 tonnes of oxygen);
- 0.17% sulphur (12 tonnes of sulphur); and
- 0.17% chlorine (12 tonnes of chlorine).

Therefore, these values reveal the need to take into context the physical and chemical properties of the waste in question when designing a waste management system in Maseru and Maputsoe.

## 5.2 RECOMMENDATIONS

The research came up with several findings on the municipal solid waste management in Lesotho in relation to its potential for job creation and poverty reduction in the country. These findings were presented in Section 5.1 of this chapter. In these findings, the various policy/regulatory weaknesses and inadequacies in relation to addressing solid waste problems in Lesotho were identified. The findings on lapses in policy/regulatory instruments with regard to solid waste management in Lesotho were backed by the prior sentiments on this subject by the citizenry. For example, according to a number of authors, they have observed an unprecedented anthropogenic pressure on arable land in Lesotho (Damane, 1996; GOL, 1989); and have recommended that the implementation of waste management policy and strategy would be crucial in ensuring that the already limited land was not contaminated with waste. Such instruments should not only adopt an end-of-pipe approach, but they should include waste production minimisation or avoidance. Lastly, the findings also outlined the identified gaps and opportunities in the total waste management chain: from generation to re-use, recovery and recycle or disposal in relation to job creation. This Chapter presents recommendations for overcoming the gaps and weaknesses identified and how to position waste management system to leverage socio-economic benefits of job creation through municipal solid waste management.

The thesis thus recommends that: -

- Arising from the findings that there is virtual absence of specific waste management regulations and policy has implications. Mostly, regulations for waste collection and disposal are embodied in the waste Management Act. In this case, there is no such Act in Lesotho. The absence of specific Act on solid waste management could be partly the cause of lack of separation of waste at source. The separation at source of recyclables from non-recyclables would encourage and promote recycling activities and hence, enhance job creation for waste harvesters as they could easily access such materials. To engage in separation of waste at source shall entail formulation of regulatory instruments, specific policy on solid waste management, guidelines and standards. The framework for the policy and regulatory instruments should adopt incentive-driven approach rather than the usual "Command-and-Control"; and correct procedures for selection of a waste

disposal site, which involves environmental impact assessment (EIA) process, should be followed. Furthermore, the formulated policy should ensure that the institutional framework clearly assigns responsibility and roles of solid waste management activities to a specific Ministry, Department, or institutions.

- The research has established that lack of awareness in values of solid waste management is another major problem. This high level of unawareness on the existence of policies and legal instruments related to waste management activities such as imposition of levies, consumers leaving the packaging material to shop keeper to manage, and the polluter-pays principle, signifies the need to have these clearly indicated in the waste management policies and regulatory instruments to be developed. The current environmental policy Section 4.3 and the Act 2001 Section 4.6 do not outline these issues.
- The research concluded that for solid waste management systems to be sustainable they require a proper cost recovery measures in place. The current efficiency of recovery rate is very low. It is estimated that out of the projected M7.12 million revenue to be recovered from waste collection service, only M1.2 million was actually realized, representing minimal 17% efficiency of recovery of the system. It is therefore recommended that an economic instrument of waste levy should be introduced taking into account marginal cost of waste collection and disposal and the external cost culminating from land filling. The focal point of this should be the results of willingness- to-pay and affordability-to-pay values, which take cognisance of household incomes and expenditures, and are based on quantities of waste generated by categories of entities.
- The research has concluded that there is a need to put in place a system which would encourage communities to participate in the solid waste management activities, including introduction of waste satellite collection or drop-off points, use of appropriate means of transport, and the promotion of a sustainable Public

and Private <sup>2</sup> Partnership (PPP) in order to improve waste management delivery.

- As an anti-littering temporary measure, the research recommends that the government should introduce levies on products and packaging wastes that are not easily re-used or recycled, such as those of plastic bags. This levy should be transferred to the consumers, rather than a trader. For example, no plastic would be given to consumer free of charge, as is the current practice and which has a direct bearing on the littering habit. In addition, introductions of “Deposit Refund Schemes” would promote returns of waste bottles to traders by consumers. This extra charge would be an incentive to return the waste to the shops or to the Buy-Back Centres.
- The research has revealed that solid waste harvesting (scavenging) and handling impact negatively on human health. Therefore, there is a need to consider provision of protective clothing for all those who handle waste as well as some form of medical check-up. To achieve this goodwill gesture would require linking the informal waste management activities with formal waste management, which would in turn lead to combating poverty. In addition, even though waste quantities generated seem not enough to support vibrant and competitive recycling, however, with innovative thinking, the recycling and reprocessing would be viable. Hence, there may be a requirement for promotion of small-scale waste recycling industries, especially for paper, plastics, glass and cans.
- The research has concluded that the current waste service rendered covers only a small spectrum of stakeholders. With the introduction of community-based solid waste management system, the research recommends that the solid waste collection service should be expanded to cover more of the low-income

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<sup>2</sup> Care should be taken in the involvement of Private Sector to ensure there are no job losses and no tendency to deploy high-tech means of waste management

location because this would bring more revenue for the collection system if managed properly. However, means of encouragement to pay for services have to be designed.

- The research has concluded that the combustible organic solid waste could be useful to provide biomass energy via manufacturing of briquettes or biogas system. There may be a need to establish such activity.
- The research has identified the gap in data requirements for the formulation of solid waste management system in Lesotho. It is suggested that, before any waste management plan could be implemented in Lesotho, there may be need to supplement this study by extending it to a nation-wide coverage of all ten districts in the country, similar to what was done in South-Africa waste management Policy Options, 1996. This would ensure that representative data and information appropriate for the formulation of policy and guidelines are obtained.
- As an interim measure, the research recommends the development of enough human resource capacity necessary to ensure smooth implementation of waste management plans and programmes and the enforcement of the regulations.
- The research has established that there is generally a low level of awareness on the benefits of solid waste management in Lesotho. This greatly impinges on the principle of sustainable development. Therefore, a comprehensive waste management education and awareness-raising campaign is required. This campaign should be spiced with the “Inform-Educate-Motivate Strategy” (IEMS). Such initiatives would result into a more and well-informed public regarding environmental issues, and particularly waste recycling and re-use. The failure to do so has serious implications for the implementation of sustainable solid waste management system in Lesotho.

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## APPENDICES

### A.1 SELECTED ENVIRONMENTAL RELATED GLOSSARY OF TERMS (DEFINITIONS)

**Air Quality:** The maximum concentration of a human produced pollutant permitted in the atmosphere as prescribed under the law.

**Ambient Air:** The atmosphere of colourless gases enveloping the earth, but does not include the air within an enclosed structure or within an underground space.

**Anaerobic Decomposition:** The breakdown of organic material in the absence of oxygen.

**Anaerobic Digestion:** The controlled process of anaerobic decomposition.

**Blue Box:** A system of kerb-side collection of dry recyclables typically using one or two -50 litre -collection containers.

**Analysis:** An examination or study of a matter, substance or process for the purpose of determining its composition, qualities or its physical, chemical or biological effect on a segment of the environment.

**Authority:** The Agency or Organization entrusted with the responsibility of taking care of a certain sector of the environment.

**Beneficial Use:** Use of the environment in a sustainable manner or on element or segment of the environment in a sustainable manner.

**Bring/Drop-Off Scheme:** A system in which householders bring source. Separated recyclable materials to designated collection points.

**Calorific value:** The energy content of a material or mixture of materials, measured in mega joules per kilogram (MJ/Kg).

**Commercial waste:** Waste arising from premises, which are not private Households, or industrial premises, for example shops and restaurants.

**Composting:** The natural decomposition of organic material in the presence of oxygen.

**Diversion Rate:** The amount of material diverted from disposal by recycling or recovery, measured as a percentage of total waste arising.

**Community-Based Organisation:** Groups of social actors at the level of one or several neighbourhoods, who share an interest in pursuing activities of public interest (sport, festivities, culture, health, hygiene, environment, literacy, water). Based on individual and voluntary membership, they consist of members who are active to various degrees, and take the form of associations.

**Community participation:** The sociological process by which residents organize themselves and become involved at the level of a living area or a neighbourhood, to improve the conditions of daily life (environment, water, sanitation, health, education, etc). It comprises various degrees of individual or collective involvement (financial and /or physical contributions, social and/or political commitment) at different stages of a project.

**Community structures:** Broad designation for management tools and decisions in the framework of a collective project conducted by residents (supervision committees, neighbourhood committee, sector committee, community councils, etc.).

**Disposal:** The last stage of the waste management process; after disposal. Nothing more is done to the waste.

**Dumpsite:** An open space where waste is deposited in an unsatisfactory way. Various hazards, nuisances, and forms of pollution are associated with dumpsites.



**Dry Recyclables:** Recyclable materials comprising paper and board, plastics, metals, glass and textiles.

**Fraction:** A designated proportion of the waste stream.

**Economy of Scale:** An opportunity of reducing unit costs by increasing the size of the operation.

**Entrepreneur:** A person who seeks to set up and operates an activity for the sake of financial gains.

**Employment:** The action of employing to any acceptable activity that is wage employment and self-employment.

**Environment:** The physical factors of the surroundings of the human beings including land, water, atmosphere, climate, sound, odour, taste, biological factors of animals and plants and the social factors of aesthetics and includes both natural and the built environment.

**Environmental Audit:** The systematic, documented, periodic and objective evaluation of how well environmental organisation, management and equipment are performing in conserving the environment and its resources.

**Environmental Impact Assessment:** A systematic examination of a project or activity conducted to determine whether or not that project or activity may adverse impact on the environment.

**Environmental Monitoring:** The continuous determination of actual and potential effects of any project, activity or phenomenon on the environment whether short term or long term.

**Environmental Resources:** It is both the renewable or non-renewable resources of the air, land and water including the living resources of flora and fauna and their aesthetical qualities.

**Environmentally friendly:** Any phenomenon or activity that does not cause appreciable harm or degradation to the environment;

**Formal:** The formal sector is taken to mean employees of government and municipal organizations, and of private companies that are registered and have completed the formalities that are required in terms of licenses and taxation.

**Franchise:** The awarding of a monopoly to undertake a particular task in a specified area. A franchise may be awarded on a competitive basis and involve the payment of a fee by the individual or organisation that is granted the franchise.

**Gross Domestic Product (GDP):** The total output of goods and services for final use produced by an economy, by both residents and non-residents, regardless of the allocation to domestic and foreign claims. It does not include deductions for depreciation of physical capital or depletion and degradation of natural resources.

**Gross National Product (GNP):** Comprises G.D.P plus net factor income from abroad, which is the income residents receive from abroad for factor services labour and capital, less similar payments made to non-residents who contribute to the domestic economy.

**Handling:** Includes production, transportation, use, storage, and discharge of toxic hazardous chemicals.

**Hazardous Waste:** Waste, which is poisonous, corrosive, noxious, explosive, inflammable, radioactive, toxic or harmful to the environment.

**High Density Bring Scheme:** A drop-off scheme with a high density of collection points, density being measured in terms of the number of sites or containers per head of population.

**Household:** A group of persons, who live and eat together and share common living arrangements, usually consists of husband, wife and their children; but also includes other persons such as relatives and domestic workers.

**Human Development Index:** The Human development index measures the average achievements in a country in three basic dimensions human development – longevity, knowledge and a decent standard of living.

**Informal Housing Districts:** Neighbourhoods that are built or occupied by their residents without legal title of ownership or without authorization from local authorities (in shanty-towns, squats makeshift settlements). These are not acknowledged in the legally prescribed, municipal documents and are often not serviced by local authorities.

**Informal Sector:** Different people use this term in different ways. In this thesis, it refers to business activities that are not officially registered as businesses. Therefore, they do not pay taxes; they have no trading license and they are not included in any social welfare or government insurance scheme.

**Integrated Collection:** The separate of both recyclable materials and refuse in a single RCV.

**Kerbside Scheme:** The collection of a range of recyclable materials from individual households following source separation of these materials.

**Landfill Cover:** A layer of inert materials deposited each day to cover waste, which has been landfilled.

**Landfill Gas:** A mixture of methane and carbon dioxide generated within landfill sites because of anaerobic decomposition (also called biogas).

**Landfill site:** A site at which waste is deposited for permanent disposal.

**Leachate:** Liquid generated within a landfill and which requires.

**Line Ministry:** Ministry, Department, Parastatals or Agency in which any law vests functions for the protection, conservation or management of any segment of the environment or whose activities may have an impact on the environment.

**Materials Reprocessing:** The industrial treatment of recyclable materials in which the form of the materials is changed in order to produce recyclable materials.

**Micro-Enterprise:** is a formal entity, comprised of between 3 and 20 employees, which services such as municipal waste management services. Often they operate on profit but sometimes do not and are part of the community. They serve.

**Mixed Refuse:** Refuse, which has not been separated at source and which typically, arises in the traditional dustbin.

**Municipal Solid Waste:** A term referring to waste consisting mainly of household, public parks and streets, commercial and partly industrial waste which is disposed of by or on behalf of a local authority.

**Occupation:** The classification of occupations brings together individuals doing similar work, irrespective of where the work is performed.

**Organic Material:** Kitchen or garden waste of an organic nature, which is suitable for composting or anaerobic digestion.

**Picking Station:** A work place in a processing plant at which material is manually sorted.

**Pilot:** A pilot stage or a pilot project is a trial stage undertaken at a small scale in order to learn about operational and practical points so that correction or improvements can be made in subsequent larger scale operations.

**Pollutant:** A substance whether liquid, solid or gaseous, which directly or indirectly alters the quality of a segment or element of the receiving environment so as to affect any beneficial use adversely or is hazardous or potentially hazardous to human health or the environment.

**Polluter-Pays Principle:** The cost of cleaning up a segment of the environment damaged by pollution, compensating victims of pollution, cost of beneficial uses lost as a result of an act of pollution and other costs that are to be paid or borne by the person convicted of causing the pollution.

**Pollution:** An indirect or direct alteration of the physical, thermal, chemical, biological or radio-active properties of a segment of the environment by discharging, emitting or depositing substances or wastes so as to affect any beneficial use adversely.

**Population Density:** The total number of inhabitants divided by the surface area.

**Poverty Line:** Based on the concept of an absolute poverty line, expressed in monetary terms: The income or expenditure level below which a minimum. A nutritionally adequate diet plus essential non-food requirement is not affordable.

**Policy:** A plan of action adopted to correct behavior, or bring about a desired change, or statement of ideals.

**Primary collection:** If waste is collected in two or more stages-first transported in one vehicle and later transferred to another- the first stage is known as primary collection.

**Post - Consumer Waste:** Waste, which is generated because the product has reached the end of its useful life, that is, products, which have been used and discarded.

**Processing:** The treatment of collected recyclable materials prior to reprocessing.

**Putrescibles:** Organic materials, which decompose into simple organic manure.

**Productivity:** A measure of the amount of work that a man or a machine does in a particular time.

**Public-Private:** The linking of government inputs with private sector inputs for a particular goal.

**Recycling:** The process of transforming recovered and sorted material into intermediate materials.

**Refuse:** Solid waste-unwanted material that is not discharged through a pipe.

**Resource Recovery:** Any productive use of what would otherwise be a waste material requiring disposal.

**Reuse:** Using a product more than once without changing its physical form.

**Recyclable Materials:** Materials, which have the potential to be recycled.

**Recycled Materials:** Materials, which have been recycled either by incorporation into a product or in the form of a secondary raw materials.

**Recycling centre:** A designated collection point in a drop-off scheme.

**Secondary collection:** If waste is collected in two or more stages first transported in one vehicle and later transferred to another- the second stage is known as secondary collection. It is usually accomplished by a motorised vehicle and ends at the disposal site.

**Small Enterprise:** A group of 11 to 20 people working together for financial gain. and operating with a capital investment of under \$50 000.

**Solid Waste:** In general it can be considered as unwanted material that is not discharged through a pipe. Legal definitions vary. Whilst some excreta may be included, mixed in with other materials-excreta itself is not usually regarded as solid waste. Some

**Solid Waste Management:** The collection, transport, dumping, and final treatment (incineration or recycling) of non-liquid waste from households, business, industry, government bodies or public spaces. People use the term garbage to mean waste; but garbage is more precisely defined as a component of domestic solid waste, comprising food waste.

**Source separation:** The separation or separate storage of solid waste at the point of generation so that it is passed to the first collection stage as two or more streams.

**Stakeholder:** Any person or organisation that may be influenced by the issue being considered.

**Soil:** An upper layer of earth and includes sand, rock, minerals, vegetation and soil flora, and Fauna in the soil and derivatives such as dust.

**Standard:** The limits of pollution established under the Act or under the regulations made under Act or any other law of the country.

**Survival Activity:** An activity, which is taken up by an individual as a way of earning some money. It requires very little skill. Capital or experience offers little hope of development and generally provides a very small income.

**Sustainable Development:** Development that meets the needs of the present generation without compromising the ability of future generations to meet their needs by maintaining the carrying capacity of the supporting ecosystems.

**Sustainable Use:** Current use of the environment or natural resources which does not compromise or impose on the ability to use the same by future generations or degraded the carrying capacity of supporting ecosystems.

**Sustainability:** The use and consumption of the Earth's resources in a way, which does, not disadvantage future generations.

**Transfer:** The relocation of waste from one means of transport to another it is a necessary stage between primary and secondary collection.

**Transfer Point:** The place at which transfer takes place. It may be a designated place where waste is unloaded from primary collection carts or where a secondary collection container is placed.

**Transfer Station:** A facility that is specially constructed for transferring waste, i.e. where loose refuse is delivered by RCVs and at which the refuse is transferred to larger bulk vehicles or containers for onward transport, normally for disposal.

**Unit Cost:** The cost of performing an operation for a unit quantity (of waste}. For example, the unit cost of disposal of waste could be expressed as the cost of disposing of one tone of waste.

**Unemployed Persons:** Persons without work, i.e. who are not in paid employment or self-employment of any type and available for work and had taken an active step in a specified period to seek paid employment or self-employment.

**Urban Population:** Percentage of the population living in urban areas as defined according to the national definition.

**Waste:** Any substance that may be prescribed as waste or any matter, whether liquid, solid, gaseous, or radio-active, which is discharged, emitted or deposited in the environment in such volume, composition or manner as to an alteration of the environment;

**Waste analysis:** The analysis of a sample of waste to determine its composition and the weight of the component fractions.

**Waste Arisings:** The quantity of waste generated usually measured in tonnes per annum.

**Waste minimisation:** Techniques to prevent waste being generated, also termed waste prevention.

**Waste Pickers:** Men, woman and children who sort through accumulations of waste and take out any item that they can use-mostly materials that can be sold for recycling. However, sometimes they may take something that they use themselves. Waste pickers may look for materials in piles of waste at storage or transfer points and at disposal sites, or they may pick up wastes that have been scattered on the streets.

**Waste Recycling Plan:** A plan produced by the WCA, detailing how recycling is to be undertaken.



**Waste Reduction:** Any technique, which reduces the amount of waste (once generated), which has to be disposed of. Thus, re-use and recycling are waste reduction techniques. Not to be confused with waste minimisation.

**Wheeled Bin:** A lidded refuse container fitted with wheels. If supplied to households by a WCA the householder is usually required to wheel the bin to the kerbside for collection.

**Willingness to Pay:** is the maximum amount that a household is willing to pay voluntarily for solid waste services, rather than do without the services, i.e. without reducing its welfare.

**Windrow:** An elongated pile of organic material undergoing composting.

## A 2: SOME STATISTICAL INFORMATION ON LESOTHO RELATED TO ECONOMIC STATUS, POVERTY AND JOB CREATION ISSUES

### EVIDENCE OF UNEMPLOYMENT IN THE ECONOMY IN LESOTHO

At Sectoral and Sub Sectoral Level	Causes	Evidence
1. The macro level high rate of unemployment and under employment.	Failure to critically evaluate and consider policy factors, which introduce distortion in the labour market, decisions, which influence employment.	Labour force entrants are 25,000 per annum while formal employment opportunities are only at 9, 000.
2. General Decline in Economy	One of the major sources of employment opportunities is the formal sector. For a quite some time employment, growth has been sluggish because in many cases industrial growth has been negative.	Increased unemployment rate of 32 percent and the unemployed end up frustrated.
3. General Decline in Employment in the RSA Mines	The increased mechanisation of mines, closing down of some of the mines due to escalating costs and relatively high mine wages which now attract Black South Africans in larger numbers than before, falling gold prices, and changing policies within RSA have made Basotho to be retrenched from the mines.	Between 1989 and 1998 the number of Basotho workers employed in RSA mines fell from 126,733 to below 99,000 and end up unemployment and frustrated.
4. Type of Education	In many cases, the education system and the type of education for primary, secondary schools and higher learning institutions have helped to compound the problem of unemployment, underemployment and poverty. The education offered is considered by both students and parents as preparatory for wage employment. The primary and secondary schools' curricula do not provide the skills that are readily applicable in the real world of work.	The education provided by schools does not adequately prepare the youth for the rural life and self-employment and school leavers end up un employed and frustrated.
5. Lack of Skills and Business Training	Generally, when youths complete education, they do not have any skills that can be used to start self-employment activities. For youths who do not get employment, elementary technical skills and simple business training would be critical tool for self-employment.	School leavers added to the labour market each year, lack skills and business training and as a result end up unemployed and frustrated.
6. Dependency on the Government	Instead of looking for gainful self-employment, youths wait for the government to find employment for them. When the government fails to offer employment opportunities, most youths remain unemployed and poor.	Since 1988, government has initiated SAP, retrenchment.

7. Lack of Credit Facilities	Many people who could have gone into employment creation and income generating projects have failed to do so due to lack of capital.	Credit facilities are open to a few individuals but not to the registered Job Seekers or unemployed people.
8. Emphasis on the formal Sector	Over the years, the government has provided supporting policies and infrastructure for the formal sector development.	Rural-urban migration, on the increase formal sector employment is declining and the unemployed end up frustrated.
9. Lack of Business Advisory Services	Some people manage to start income generating activities, but fail to manage them properly. Others who would like to start businesses cannot because of lack of business training.	Business Advisory Promotion Services was established but it was ineffective and was disbanded late in 1998.
10. Non-Attractive Agricultural Sector	Despite the resources that are directed into the agricultural sector, the sector is still not attractive to the youth.	Rural -urban migration, on the increase the productivity of the sector is low, coupled with low acreage, the output is low with subsequent marginal income.
11. September 1998 Political Crisis	After arson and looting acts, a considerable number of people lost their wage employment. Unfortunately, these acts have brought about poverty and exclusion of the vulnerable groups from participating in the labour market.	Before the apex of the political crisis in September 1998, the unemployed rate was estimated at 30 percent, now it stands at about 40.5 percent.

Source: Modified by the Author from Mlosy, 2000

## A 2: CONT.

### TYPES OF ECONOMIC CHANGES FOR INFORMAL SECTOR OPERATORS

Strategy	Tangible Results		Less Tangible Outcomes
	Direct	Indirect	
Financial	<ul style="list-style-type: none"> <li><input type="checkbox"/> Low Interest Rates</li> <li><input type="checkbox"/> High Savings Rates</li> <li><input type="checkbox"/> Ability to Buy in Bulk</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Increased Income</li> <li><input type="checkbox"/> Increased assets</li>   <li><input type="checkbox"/> Safety Net</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Increased Control of Resources</li> <li><input type="checkbox"/> Increased Credit Worth ness</li>   <li><input type="checkbox"/> Reduced Reliance on Money Lenders</li> </ul>
Informal Sector Enterprise Marketing	<ul style="list-style-type: none"> <li><input type="checkbox"/> Upgraded Skills</li> <li><input type="checkbox"/> Improved Knowledge</li> <li><input type="checkbox"/> Introduction of non-traditional Skills</li> <li><input type="checkbox"/> Access to better Quality Inputs</li> <li><input type="checkbox"/> Increased Production</li> <li><input type="checkbox"/> Improved Market Links</li> </ul>	<ul style="list-style-type: none"> <li>Increased Productivity</li> <li>Increased income</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Expanded Awareness</li> <li><input type="checkbox"/> Improved Image</li> <li><input type="checkbox"/> Increased Bargaining Power</li>   <li><input type="checkbox"/> Increased Mobility</li>   <li><input type="checkbox"/> Increased Self confidence</li> </ul>
Organisation	<ul style="list-style-type: none"> <li><input type="checkbox"/> Increased Wages</li> <li><input type="checkbox"/> Improved Working Conditions</li> <li><input type="checkbox"/> Collaborative Production</li> <li><input type="checkbox"/> Collaborative Marketing</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Increased Income</li> <li><input type="checkbox"/> Improved Health</li> <li><input type="checkbox"/> Improved Well-being</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Job security</li> <li><input type="checkbox"/> Increased Bargaining Power</li> <li><input type="checkbox"/> Increased Access to Market</li> </ul>
Support Services	<ul style="list-style-type: none"> <li><input type="checkbox"/> Released Time</li> <li><input type="checkbox"/> Improved Health</li> <li><input type="checkbox"/> Improved Housing</li> <li><input type="checkbox"/> Reduce Risk</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Increased Productivity</li> <li><input type="checkbox"/> Increased Income</li> </ul>	

Source: Modified by the Author from Mlosy, 2000

**A 2: CONT.  
HOUSEHOLD INCOME DISTRIBUTION**

Decile		Quintile		Quartile	
HH	Income	HH	Income	HH	Income
10	0	20	1	25	2
20	1	40	4	50	8
30	2	60	11	75	20
40	3	80	20	100	70
50	4	100	63		
60	6				
70	8				
80	12				
90	18				
100	45				

Source: Modified by the Author from Mlosy, 2000

The Gini Coefficients for rural areas plummeted from 0.223 in 1967/69 to 0.55 in 1993. On the other hand, poverty in 1993 was up 2 percent from its 1986 level of 47 percent.

According to Todaro the ratios for countries with uneven income distributions often lies between 0.50 and 0.70. While those for countries with relatively equitable distribution lie between 0.20 and 0.35. At full (100 percent) equality, one tenth of the employed population will have one tenth of the income and so on. Therefore, the Lorez curve is equal to the equi-line. Gini Coefficient for Lesotho in 1997 was 0.57.

### A.3. ESTABLISHMENTS IN MASERU & MAPUTSOE

#### MASERU COMMERCIAL ESTABLISHMENT

ITEM NUMBER	TYPE OF ENTERPRISE	TOTAL
1	Agent of Foreign Firm	37
2	Broker	75
3	Advertising Agent	6
4	Pharmacy	14
5	Consultant	69
6	Wholesaler	58
7	Supermarket	34
8	Mini-Supermarket	23
9	General Dealer	162
10	General Café	1620
11	Butchery	136
12	Snackbar	64
13	Dairy shop	1
14	Hair and Beauty Salon	129
15	Barber shop	3
16	Dry Clean	3
17	Builder and Contractor	906
18	Motor Dealer	34
19	Petrol Dealer	36
20	Motor Garage	109
21	Dealer in Furniture & Household Articles	142
22	Footwear and Textiles	279
23	Sports Shop	6
24	Music Shop	7
25	Curio Shop	19
26	Florist	4
27	Photographic Studio	9
28	Bookstore	18
29	Domestic Fuel Dealer	34
30	Hardware Store	71
31	Funeral Undertaker	14
32	Workshop	72
33	Specialised Dealer	364
34	Scrapyard Dealer	6
35	Hawker	33
36	Auctioneer	2
37	Street Photographer	20
38	Clearing Agent	2
39	Security Agent	11
40	Tentage Dealer	2
	<b>TOTAL</b>	<b>4634</b>

Source: Ministry of Trade and Industry, Maseru, Lesotho

A.3. CONT.

MAPUTSOE COMMERCIAL ESTABLISHMENT

ITEM NUMBER	TYPE OF ENTERPRISE	TOTAL
1	Pharmacy	3
2	Consultancy Firms	1
3	Wholesales	5
4	Supermarkets	3
5	Mini supermarkets	15
6	General Dealers	72
7	General café'	387
8	Green Grocer	2
9	Butcheries	7
10	Snackbar	3
11	Hair Saloons	7
12	Dry Cleaners	2
13	Building Contractors	5
14	Motor Dealers	1
15	Household Articles	21
16	Motor Garages	8
17	Foot wear and Textiles	35
18	Music Shop	1
19	Photo Studio	1
20	Bookshop	2
21	Domestic Fuel	4
22	Hardware	12
23	Funeral Undertakers	1
24	Scrapyard Dealers	3
25	Bakery	1
26	Milling specialised dealers	12
27	Milling company	1
28	Cell phone dealers	4
29	Tuck shop	1
30	Leatherworks	1
31	Watch repair	1
32	Food distributors	1
33	Agric inputs	6
34	Gas Dealers	2
35	Steel works	1
36	Computer Dealers	1
37	Hotel	1
38	Glass works	1
	<b>TOTAL</b>	<b>635</b>

Source: Ministry of Trade and Industry, Maseru, Lesotho

## **A.4. RESEARCH QUESTIONNAIRE**

**National Environment Secretariat  
UNDP  
Maseru 100  
Kingdom of Lesotho.**

**University of Durban Westville  
Department of Civil Engineering  
P/B X 54001 Durban 4000  
The Republic of South Africa.**

### **Message for House or Premise Owner**

#### **Greetings.**

I am conducting a survey on solid waste management that may lead to recommendations on how best to involve the communities and create employment from such activities.

Please answer the questions. You are also requested to put the food (Organic Kitchen) waste in one plastic bag while the others such as paper, card boards, bottles, cans, plastic carrier bags, plastic milk etc. in the other bags. If the bag is full, tie it and note the date. We will come to collect it after seven (7) days.

We thank you for filling in the Questionnaire.

Thank you very much.

Best regards.

**Mvuma G.G. (Mr)- National Environment Secretariat**



**A.4 CONT.**

**MUNICIPAL SOLID WASTE POLICY AND GENERATION RATE SURVEY QUESTIONNAIRE.**

**ASSESSMENT OF POLICIES ON SOLID AND WASTE MANAGEMENT AND SOURCES OF THE WASTES FROM HOUSEHOLDS INDUSTRIAL AND COMMERCIAL ESTABLISHMENT.**

Please fill in or/tick as appropriate

**A. SOLID WASTE SOURCES FROM DOMESTIC, INDUSTRY AND COMMERCIAL**

**For Government Institutions, Companies and Households**

1. Name of Respondent: .....

Location (Full Address): .....

.....

.....

2. When was the company established or When did you occupy this house?

3. What type of waste do you generate, and how much in tonnes per day/week/month/year or indicate number of items.

Primary Classification	Secondary Classification	Weight of Waste Recorded, (if possible)		
		No. tonnes/day tonnes/year		tonnes/month
Paper	(a) Office paper	(a) .....	.....	.....
	(b) Newspaper/Magazine	(b) .....	.....	.....
	(c) Cardboard	(c) .....	.....	.....
	(d) Other packaging(specify)	(d) .....	.....	.....
Plastic	(a) Carrier bags/wrapper (soft)	(a) .....	.....	.....
	(b) Soft drinks/milk bottles	(b) .....	.....	.....
	(c) Other plastics (specify)	© .....	.....	.....
Organics	(a) Kitchen waste foods	(a) .....	.....	.....
	(b) Other organics (specify)	(b) .....	.....	.....
Beverages/ Cans/Foils	(a) Beer/mineral drink cans (aluminium or steel cans)	(a) .....	.....	.....
	(b) Other metal/foils	(b) .....	.....	.....
Textiles	(a) Cloth/off-cuts	(a) .....	.....	.....
	(b) Fittings	(b) .....	.....	.....
Potentially hazardous Wastes (PHW) for Households (PHHW)	(a) Small Batteries	(a) .....	.....	.....
	(b) Medicines (Specify)	(b) .....	.....	.....
	(c) Paint	© .....	.....	.....
	(d) Dust Sweepings or clay fall-offs	(d) .....	.....	.....

### Socio Economic status of households

Number of inhabitants per HH.	Number of inhabitants working per HH.	Estimated income per month			
		Below M600	Between M600-1,500	Between 1,500-3000	Above 3000
-----	-----	-----	-----	-----	-----
		Exact figure	Exact figure	Exact figure	Exact figure
		-----	-----	-----	-----

4. Do you separate (sort) your waste at source? Yes: ..... No:.....
5. Indicate what items you separate.: .....
6. Would you be willing to sort the waste if you were provided with black plastic bags or if other containers were readily available? Yes: ...No.: .....
7. Are you aware of the value of waste you dispose of? Yes: ...No: ....
8. Do you sell some of the wastes to waste companies or scavengers? Yes:...No:.....
9. If you do not sell the waste that you generate, indicate the type, amount and their monetary value that you think is a loss per year.
  - (a) Type .....M..... (b) Type.....M..... (c) Type.....M.....
10. Is waste collected from your place? Yes:..... No:.....
 

If yes, indicate who collects it and how often: .....
11. If waste is not collected, how do you dispose of it? .....
12. Do you pay for the waste collection services? Yes:..... No:.....
13. Would you be willing to pay for waste collection services if there are not offered at the moment? Yes:..... No:.....
 

Reason. If yes, indicate how much would you be willing to pay per month: M..... per month.
14. Would you support the idea of establishing waste pre-collection by communities and setting up of satellite waste collection points? Yes:.....No:.....
 

Briefly, indicate how this idea would be implemented .....
14. The current trend of integrated waste management involves use of appropriate means of transport. Indicate in order of priority (1,2,3,etc) which ones you would prefer.
  - (a) Animal drawn carts .....
  - (b) Human and drawn carts .....
  - (c) Use of horses .....
  - (d) Use of Bicycles .....

- (e) Other (specify) .....
16. Are you aware of the “Polluter Pays Principle”? Yes:..... No:.....
17. What steps have you/your company Institution) taken to minimize generation of solid waste and promote re-use/recycle.
- (a) .....
- (b) .....
- (c) .....
18. Are you aware of the effects on the health of people who handle the waste that you generate? Yes:..... No:.....
- If yes, specify the waste type and its effect .....
19. Do you have any suggestion on what the government should do in order to improve solid waste management in the country? .....
20. Briefly describe policies or legal instruments that are in conflict
- (a) .....
- (b) .....
- (c) .....
- (d) .....
21. Are you aware of Government’s or your company’s policies/legal instruments pertaining to the issues outlined below. If your answer is yes, indicate the instrument.
- (a) imposition of levies and fees for waste generated (such as cost of disposal of scrap vehicles, tyres, engine oil) and others
- Yes:.....
- No:.....
- If yes, .....
- (b) the kind of waste collection services recommended to be offered.

(c) instruction of the consumer to leave the packaging materials to the shopkeepers to store or dispose of?

Yes:.....

No:.....

If yes, .....

(e) introduction of systems for separation of solid waste at their source and their classification.

Yes:.....

No:.....

If yes, .....

(f) Encouragement of establishing solid waste satellite collection points, by use of appropriate means of transport, and involvement of communities and NGOs in waste management activities.

If yes,.....

**A.4 CONT.  
MUNICIPAL SOLID WASTE COLLECTION RECYCLING SURVEY  
QUESTIONNAIRE**

**INVESTIGATION OF EMPLOYEMENT GENERATION THROUGH MUNICIPAL  
SOLID WASTE MANAGEMENT BY RECYCLING COMPANIES AND LOCAL  
AUTHORITIES**

**Please fill in or tick where necessary**

**BACKGROUND INFORMATION**

1. Name of Company/Local Authority.....
2. Location (full address).....  
.....
3. When was the company /Local Authority established?.....
4. What do you collect and tonnage per week/year?

MATERIAL	Tonnage per week	Tonnage per week
(a) Plastic		
(b) Paper and paper products		
(c) Beer & soft drinks cans		
(d) Bottles/glass (specify)		
(e) Textile cloth/off cuts		
(f) Food left over		
(g) Scrap metal		
(h) Used motor oils		
(i) Other (specify)		

5. Do you recycle any material you collect? Yes..... No.....  
If yes, list items .....
6. If answer in 5 is No, do you sell directly any waste material you collect?  
Yes..... NO.....  
If yes list your clients.....

SOURCES AND ECONOMICS OF WASTE MATERIALS

7. Where do you obtain the material from? (tick where appropriate)

(a) Scavengers	
(b) Dumpsites	
(c) Companies	

(d) Other sources (specify).....

If you are a Local Authority, what percentage of your population receive regular collection services.....

8. Do transport costs influence the selection of suppliers of your waste material or the collection of solid waste from the location in the city (Local Authority)?

Yes..... No.....

If yes, explain how.....

.....

9. Suggest any appropriate means of transport that would contribute towards making your business affordable.....

.....

and also if there is need for introduction of satellite collection points

.....

10. How often do you collect the waste materials?

(a) Every day	
(b) Once a week	
(c) Once a fortnight	
(d) Once a month	

(e) Others (specify).....

11. How do you quantify the materials for buying?

(a) Use of Scale	
(b) Count into units	

(c) Others (specify).....

12. What is the buying price per unit of material? .....

13. Do you pay a fee to the local authorities for access to dump sites or your business?  
 Yes..... No.....  
 If yes, how much per year? .....

14. Does your company import waste raw materials?  
 (a) Yes..... (b) No.....  
 If yes, indicate countries, items and how much you spend per year

Countries	Item	Expenditure Per year

15. Do you recycle or use any materials you collect?  
 (a) Yes.....(b) No.....  
 If yes, specify which ones.....  
 .....

16. Why did you decide to opt for recycling/reuse? (a) Cheaper.....  
 (b) Environmental reasons.....(c) Save foreign exchange.....  
 (c) Other (specify).....

17. If you sell the materials directly, what is the selling price per unit material .....

18. Which industries do you sell to? (Please also indicate city and country if out side the country.....  
 .....

19. In your view, is the supply of waste material adequate?  
 (a) Yes..... (b) No.....  
 If No suggest how it could be improved.....  
 .....

20. What would be the effect of introduction of waste incineration on your company?  
 (a) Close down..... (b) Use virgin materials.....  
 (b) Look for alternative materials.....  
 (d) Others (specify).....



21. What problems are you facing as a waste recycling/collecting company/local authority?  
 (a).....  
 (b).....  
 (c).....  
 (d).....
22. What changes in current solid waste disposal practices would benefit your company/Institution?.....  
 .....
23. If you are a local Authority, describe monthly cost of collection per house, frequency of collection, existing landfill operations, and role of community/NGOs in waste management.....  
 .....
24. List things which the Government could do to improve the performance of waste recycling company or waste collecting institution  
 (a).....  
 (b).....  
 (c).....  
 (d).....

EMPLOYMENT OPPORTUNITIES

25. How large is your Labour force (regular)?.....
26. What kind of people do you employ?  
 (a) Skilled workers..... (b) Semiskilled.....  
 (b) Unskilled.....
27. Do you sometimes employ casual workers?  
 (a) Yes..... (b) No.....  
 If yes, how many times per month or year or any other (specify)  
 .....
28. What percentage of your labour force constitute the casual workers?  
 .....
29. Do you supply all your workers with protective clothing?  
 (a) Yes..... (b)No.....  
 If yes, specify the type.....
30. Have you noticed any health changes in your workers that could be as a result of poor protection when they handle the waste?  
 (specify).....  
 .....

A.4 CONT.

MUNICIPAL SOLID-WASTE COLLECTORS SURVEY QUESTIONNAIRE

INVESTIGATION OF EMPLOYMENT GENERATION THROUGH MUNICIPAL SOLID-WASTE MANAGEMENT AND HEALTH IMPACTS RELATED TO WASTE SCAVENGING.

A : DEMOGRAPHIC CHARACTERISTICS OF WASTE PICKERS / COLLECTORS

Please fill in or tick as appropriate

1. Gender/sex : a) Female..... b) Male.....
2. a) Age..... b) I don't know my age.....
3. Marital status : a) Single.... b) Married..... c) Divorced.....
4. Home of origin : a) Village.....b) District.....
5. Highest level of education attained.....
6. How many dependents do you have.....
7. Where do you stay : a) Town..... b) Location.....
8. What kind of accommodation do you have :  
a) Renting..... b) Stay with family/ friend ..... c) Self-owned.....  
d) other specify.....
9. How long have you lived in this town .....house/premises .....
10. what were you doing before engaging in your present activity?  
a) Subsistence farming..... b) Rural unemployed.....  
c) casual-worker..... d) urban unemployed.....  
e) Formal sector worker (specify).....
11. If you were unemployed, how did you survive :  
a) Farming ... b) Relatives' handouts...c) Assistance from friends.....

**B : PICKING ( SCAVENGING) ACTIVITIES AND ECONOMICS**

- 12 What items do you usually collect and how much do you make from the sales per week:
- a) Paper/ cardboard M..... per week
  - b) Plastics..... M..... per week
  - c) Beer/soft drinks /food cans... M..... per week
  - d) Bottles/ glass..... M..... per week
  - e) Textile/ cloth- off-cuts M..... per week
  - f) Food leftovers..... M..... per week
  - g) Scrap metal ..... M..... per week
  - h) Used motor oils..... M..... per week
  - i) Others ( Specify).... M..... per week
13. Do you collect some of the material in 12 above for use as source of energy to cook in your house? Yes..... No.....
- If yes, state what material do you collect.....
14. Where do you usually collect your waste from? Street..... Offices..... Bars.....
- 15 Do you only collect recyclable materials? Yes... No....
- If yes, state what you usually collect .....
- 16 Do you sometimes find some valuable articles?
- Yes ..... No.....
- If yes, what type of valuables.....and how many times? a) .....per week b).....per month
17. How much do you make from the sales of these valuable items
- a) M.....per week b) M.....per month c) M.....per year

- 18 How much do you spend on transport ?:
- a) M.....per day                      b) M.....per week                      c) M.....per month
- 19 Which company or organisation buys or collects the material that you collect  
.....and  
how many time are the materials collected / delivered to them .....times per  
week .....times/month
- 20 If you transport the items yourself what means of transport do you use  
.....  
Name other forms of transport which could make your work easier.....
- 21 What would you want the Government to do for you in order to have a good living  
.....
- 22 Would you leave your present occupation of collecting wastes for formal sector job?
- Yes .....                      Why .....
- No.....                      Why .....
- 23 What collection and recycling schemes do you think communities prefer, and what  
means of transport?
- a) collection..... b) Recycling..... c) Means of transport.....
- 24 What do you think the Government should do to help you? .....  
.....and  
suggest how your waste collecting activity could be incorporated into a normal  
Urban economy.....

C : HARSHIPS AND HEALTH IMPACTS.

25. How long do you take to travel to work? :

- a) Less than 1 hour.....                      b) 1-2 hours ..... c) 2-3 hours.....  
 d) 3-4 hours .....                      e) More than 4 hours.....

26. How long have you been engaged in business /activity of collecting waste .....

27. How many hours do you work a day.....hours, and how many days do you work per week.....days

28. Do you wear protective clothing when collecting wastes? Yes.... No.....

If yes, what type? .....

29. Indicate how many times have you suffered from the diseases stated below, per year.

Disease	Number of times per year before waste collection	number of times per year after starting waste collection
Respiratory diseases(cough)		
Skin/ Rash		
Eye irritation		
Severe stomach/ diarrhoea		
Any other (specify) .....		

30. Do you think the solid waste collection activities have contributed to your ill health?

Specify in which way....., and suggest how your working conditions could be improved.....

## A.5 LIST OF COMMITTEE ON WASTE MANAGEMENT (COWMAN) MEMBERS.

<u>Name of Member</u>	<u>Institution</u>	<u>Telephone Number</u>
1. Ms. N Majara	DWA	314569/8842942
2. Mr L. Thamae	Science&Tech	313632
3. Mrs. M Williams	Science & Tech	313632
4. Mrs M. Thamae	NEYC	311767
5. Mr L. Molapo	NES	311767
6. Mr M. Damane	NES	311767
7. Mrs. B. Puling	NES	311767
8. Mr. T. Ts'asanyane	NES	311767
9. Mr. Nkalai	LHDA	314324
10. Mr M. Thokoa	LHDA	311280
11. Ms. P. Sebotsa	LHDA	313830
12. Mr. S. Mohale	MoH & SW (EHS)	316605
13. Mr M. Hlabana	MoH & SW (EHS)	316605/854891
14. Mr K. Rantso	Lerotholi Polytechnic.	323873/852397
15. Mr. M. Ts'ehlo	LCN	317208
16. Ms. L. Thamae	MITM	317454
17. Ms. M. Maliehe	WASA	323761
18. Mr M.L. Lesemane	WASA	313943/86366
19. Mr. S. Thamae	MCC	325953
20. Mr. P. Giefers	Agric.Faculty (NUL)	322484
21. Dr. K. Khalema	Chem. Dept (NUL)	340601
22. Mr. M. Nkotsi	OSHU	317859
23. Mr. Monyau	Mines & Geol.	323750
24. #	MoLG	325331
25. #	LNDC	312012

# These institutions are yet to designate officers as COWMAN members

## A.6 VITA

GODFREY GANIZANI KWANTHA MVUMA

DOCTOR OF PHILOSOPHY

**Dissertation:** Urban Poverty Reduction through Municipal Solid Waste Management (MSWM): A Case Study of Maseru/Maputsoe in Lesotho.

**Major Field:** Municipal Solid Waste Management

### **Personal Data:**

- Born to the late Fallow Mvuma and Dyles Mvula of the, then, Mzimba District in Nyasaland, who by earthly standards were considered very poor, but rich in the spirit of God.
- During certain times of childhood, I raised funds for my school fees by working as a Herd Boy, House Servant (Washing Nappies) and Security Guard.

### **Education:**

- Went to Primary School at Mzamu in Mzimba, Phoka and Kambulu in Kasungu (Malawi); and Mkomba in Lundazi (Zambia), 1972.
- Completed Cambridge Overseas Education at Hillcrest Technical Secondary School in Livingstone, Zambia, 1977.
- Graduated in Bachelor of Science, the University of Zambia, Lusaka, Zambia, 1982: *with Chemistry Major and Biology Minor.*
- Received Masters Level in Environmental Science and Technology, IHE, Delft University, Holland. 1991: *with field work exposure to Hanover coal power generation, Munster water work and Hull coal mine rehabilitation in Germany, Basel Sandoz, Geneva UN Systems and Zurich water works in Switzerland; London paper & pulp, Swansea coal mine rehabilitation, Birmingham sewage works and Leister water works in the UK.*
- Received Advanced Certificates in: Mining & Environment from Lulea University, Sweden, 1993; Hazardous Waste Management from MiljoKonsulterna, Nykoping, Sweden, 1994; Climate Change from Hawaii University/US Country Studies, Honolulu, Hawaii, 1995.

- Graduate Fellow of Leadership for Environment & Development (LEAD) International, New York, USA, 1997, after a two-year sandwich training course held in Harare (Zimbabwe), San Jose (Costa Rica) and Okinawa (Japan).
- Completed the requirement for Doctor of Philosophy in Environmental Management with emphasis on Municipal Solid Waste Management and Job Creation, the University of Durban~Westville, Durban, South Africa, May 2002.

***Professional Experience:***

- Chemist with the Zambia Consolidated Copper Mines Limited, Nchanga Division, Chingola, Zambia from 1982 to 1986.
- Chemistry Lecturer at Evelyn Hone College, Lusaka, Zambia, from 1987 to 1988.
- Senior Lecturer in Environmental Science and Chemistry at the University of Malawi, Blantyre, from 1989 to 1995.
- Environmental Specialist with the United Nations based in Maseru, Lesotho, from 1995 to 1998, with short Resource Person assignments at the United Nations Head Quarters in New York, USA and Geneva, Switzerland.
- Consultant with the Danish companies under DANCED programme: Carl Bro (Solid Waste Management) and NIRAS (Environmental Capacity Building), Denmark in 1999.
- Environmental Specialist/Manager: International Projects and Business Development with the Council for Scientific and Industrial Research (CSIR), Pretoria, South Africa, from 2000 to date.

**ALL THIS IS GOD'S WISH**