

Potential for Improving Municipal Solid Waste Management in Cameroon

Case study Limbe municipal council

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ABSTRACT

Several African cities exhibit the burden of waste management. Poor disposal of waste, lack of regulatory bodies and in general poor waste management services continue to cause several life threatening and life changing effects across cities and towns in Cameroon. Proper planning of waste management from generation to disposal can, therefore, ease waste management in the future. This research examines and assesses the type and quantity of waste generated in the Limbe municipality, as well as the problems faced by the stakeholders in waste management in the Limbe municipality in an attempt to underline the lack of enforcement of waste management services in Cameroon.

In addition, this thesis examines the factors and constraints surrounding the waste management policies and regulations in Cameroon, including the method positioned in the delivery of a sustainable waste management solution. The results indicate that the national policies for the management of waste have contributed enormously to some of the key problems both at governmental level and at that of the local councils. This study reaches this result using the primary data that was collected from the stakeholders and some council officials. Secondary data was collected from the internet from such sources as science direct, also as a research method a literature review was carried out by consulting some articles and reports relating to solid waste management in Cameroon and other African countries.

Keywords: Cameroon, Limbe city council, solid waste management, disposal, HYSACAM.

Table of Contents

1	INTRODUCTION	4
1.1	Overview of Cameroon.	4
1.2	Waste Management	5
2	RESEARCH METHOD	7
1.3	Waste Hierarchy	7
1.3.1	Reduce	8
1.3.2	Re-use	9
1.3.3	Repair	9
1.3.4	Recycling	9
1.3.5	Disposal	10
1.4	Statement of problem	10
1.5	The objectives of the study	11
2	RESEARCH QUESTIONS	12
2.1	The importance of the study	12
2.2	The significance of GIS modeling in waste collection and transportation	13
2.3	Interviews	15
2.3.1	Administration Questionnaire	16
2.4	Types and Quantiy of Solid Waste generated in Limbe	17
2.5	Quantity of Municipal Solid Waste Generated in Limbe from 2010 to 2014	19
3	WASTE MANAGEMENT PRACTICES IN LIMBE	23
3.1	HYSACAM work schedule	26
3.2	Street Cleaning	30
3.3	Market Cleaning	31
3.4	Cleaning of Green Belt	31
3.5	Beach Cleaning	31
3.6	Transportation of Waste	32
3.7	Disposal	33
4	THE ROLE OF PLANNING IN SUSTAINABLE WASTE MANAGEMENT	35

4.1	Problems and Community Perception of Municipal Solid Waste Management in Limbe Municipality	38
4.2	Public perception on services provided by HYSACAM	38
4.3	Perception on Health	40
4.4	Perception about the environment	42
4.5	CONSTRAINTS	43
4.5.1	Institutional factors	44
5	RESULT	48
6	CONCLUSIONS	50
6.1	Implications for further research	54
7	SOURCES	55
8	APPENDICES	63

1 INTRODUCTION

Today, a sustainable solid waste management stream is very important in order to reduce environmental and public health risks around the world (ISWA 2002, Fletcher & Read 2003, Ball 2006). whereas in some development countries, this is not the case, as there are better ways of delivering sustainable waste management, which is well organized, established and functional, see a UK perspective 1999. In countries like Cameroon, waste handling is so different. For instance, the methods concerning issues like the collection, the recovery and disposal of waste management in the country do not exist or are very rare, making the task difficult in analyzing and evaluating the immediate remedy or comparing its performance with other nations.

When looking at the means of increasing the efficiency in solid waste management, it is evident how stakeholders like waste generators, waste processors, private and public sectors, formal and informal sectors, parastatals financial bodies, other institutions like Non Governmental Organizations (Band et al 2001, Palczynski 2002) all have important roles to play in making sure the systems and services become stable to ensure that sustainable waste management services are developed and positioned for a maximum outcome. This paper discusses some of these roles/duties in the Cameroon context with specific references made to a case study by the Limbe Municipal council.

1.1 Overview of Cameroon.

Cameroon is a low income country with a population of about 21.7 million people. It is located in central Africa, and shares a boundary with Nigeria, Chad, Central African Republic, Equatorial Guinea and Gabon. Cameroon is made up of 10 regions. Cameroon is enriched with significant natural resources such as oil and gas, high value timber species, minerals and

agricultural products like coffee, cocoa, cotton, maize and cassava. Presently, the country is experiencing an increased rate of urbanization, and statistics estimated shows that its growth is at 2.7% (World Bank 2002). The increase rate is evident at a time where the aspect of socio-economic growth and financial resources has become a major problem and a cause for concern. Since The 1980 when the prices for oil dropped drastically, followed by the National Structural Adjustment Programs in the early 90s. Due to these, government investments were reduced and it was more evident in the urban sector from that period till now that the living conditions have taken a negative turn and deteriorated. This is very evident and visible in the domains of health and education. According to the World Bank Census 2010, Limbe, formerly known as Victoria, has a population of about 120,000 inhabitants with an estimated percentage of 2.9% growth rate. The city is divided into four local councils namely; the Limbe councils managed by the Government Delegate, then Limbe I, Limbe II and Limbe III, managed by Mayors. For instance, a growing night life culture, and tourism and motels/bar life will generate waste of a certain category, principally plastic and seasonal domestic waste. The fishing industry of historical significance has environmental connotation linked with public sanitation and pollution from increasing fish smoking. These activities increasingly generate interest for research and studies on environmental protection and it was from this background that the motivation for this study is developed.

1.2 Waste Management

Solid waste management in municipalities has been and is one of the major calls for concern. Solid waste management poses a big problem to public health and to the environment as they are uncollected, illegal and not well disposed of (Wilson & Whiteman 2003, Olley & Wilson 2006). The presence and prevalence of parasites, tetanus, malaria, hookworm, cholera and other diseases in developing countries is as a result of poor sanitary conditions of waste disposed on the streets and cities (Mc Michael 2000) in some countries, especially in Africa, incidents of flash floods,

always occur due to poor waste management practices (Paczynski 2002, Yongshengz 2006).

Past studies on waste management in Cameroon are centered only on waste collection and waste disposal methods practices and thus pose implications to the environment (Vermande and Ngnikam 1994, Ngnikam, 2000) with little or no consideration of the legislative and regulatory aspects. However, in order to get the waste management system in asustainable and successful waste management service, a baseline level of data will be needed from which better informed waste management and policy decisions will be taken. In this study a critical analysis of present day waste management condition in Cameroon is presented with specific and particular references to the policy frame work and the enhanced duties of those in charge (stakeholders) in attaining specified waste management outcomes. Relying solely on observational data constraints linked with solid waste management in Cameroon although this work.



FIGURE1, Map of Cameroon and its borders

2 RESEARCH METHOD

In carrying out this research, three principle approaches were used. The first was a desk study where several official reports were studied and investigated, articles and legal documents (decrees) about solid waste management in Cameroon. This was done so as to acquire background data which helps in the building or molding of a conceptual model of solid waste management in Cameroon

Interviews were another method used as they were carried out with the main stakeholders in different sectors, such as hygiene and sanitation, urban development, the environment community and other representatives of private domains directly linked with waste management activities.

Furthermore, a field trip was carried out in which HYSACAM explained more relevant matters, since it is a waste management company in the municipality. The motive to follow their waste management trucks was to find out about getting a good plan/model and to consider different ideas with regard to municipal waste management policy and service delivery.

Thirdly and lastly, a visit was made to the sites where the company used to dump waste collected in the Limbe municipality and its surroundings. A Preliminary waste compositional analysis was carried out.

1.3 Waste Hierarchy

Waste hierarchy is a way to encourage people to have an understanding not only on how waste needs to be managed and taken to landfill, but also how waste produced by them can be reduced. The hierarchy of waste management follows the order; reduce, reuse, recycle and disposed as illustrated in Figure 2 below



FIGURE 2: Waste Hierarchy from the most significant order to the least preferable option.

1.3.1 Reduce

In the waste hierarchy, this is the segment which describes the behaviors of the consumers and the producers. Talking about the consumers they are advised to purchase products of less package weight instead of those of high package weight in order to reduce the recycling processes. (Dacorum Borough Council 2010)

In Limbe municipality, this aspect or initiative does not exist or if it does, then it is rare because the majority of the inhabitants have limited knowledge about the reduction of environmental waste and seldom pay attention on environmentally sound products. As an example, the purchasing of refill items like softeners can be mentioned.

Manufacturers on their part should use more perishable and sustainable materials in packaging their goods. For example, products which weigh less like paper bags and containers should be package, rather than plastics and metals.

1.3.2 Re-use

As the word itself implies, this means making use of an item more than once. More environmental benefits are achieved when items are reused than when they are disposed of after a single use. For example using a plastic bag for shopping and then re-use it again reduces the volume of waste in the society (Dacocum Borough council 2010).

This practice was introduced in the Limbe municipality by the Government and its local council, in them, the majority of the people do this but in practice they do not. Just a minority is involved in this as few are educated and conscious about it. Therefore, education and knowledge could help to make the inhabitants more aware.

1.3.3 Repair

These is changing something which was not functioning to a better state thereby making it functional. When our objects get deteriorate we just dispose of them and get new ones. An example is electronics, as soon as they get deteriorate we throw them away since we think repairers can never bring them back to our taste.

In an area like Limbe in this study, more sensitization has to take place so as to make people repair rather than discard their spoilt goods

1.3.4 Recycling

Recycling is very important in the waste hierarchy. It is the most important aspect here because it deals with management and economy. This is because it uses the objects no longer useful and processes and transforms them to be more useful. By doing this, it reduces the cost of obtaining new materials and also reduces the energy for creating new materials. It plays a very vital role as it helps in reducing the quantity of refuse that is dumped and reduces emissions from methane gas, which is

a major factor in causing climate change (Dacorum Borough council 2010).

Though in Cameroon nowadays many people and companies are working on enhancing recycling, there ought to be more efficient ways to be developed so that better recycling can be done.

1.3.5 Disposal

Any waste which cannot be recycled or used for energy must be disposed of in an appropriate manner. Both of the hierarchies are correct and all of the concepts are widely used. Limbefealls under this section which is disposal as there is little or none of the above methods being practiced on a bigger scale.

1.4 Statement of problem

Waste management is an exercise that has move from manual to scientific operation. Such include when planning collection routes, siting processing facilities, as well as choosing locations for landfills and planning. what will become of landfill once it is full as many waste managers will attest, planning routes for garbage, yard-waste and recycling collection is complex and incldes many factors such as planning collection routes, including the number of stops, fuel efficiency of the collection vehicles, as well as measuring each load of garbage into the trucks.

To this effect, efforts have been made to enhance solid waste management from urban agglomeration like HYSACAM in Limbe, yet many problems persist and this is the focus of this study. Such problems include the measure of collection/week, the distance and zonal mapping of the collection routes as well as inappropriate dump site. Furthermore, there is the problem of a very ineffective process of meansuring the volume and weight of each truck load of collected waste. Although these challenges could come from multiple sources such as the lack of political will from the government to allow local councils to autonomously handle

the waste management, local councils themselves need to develop effective and sustainable system and implement sound practices and policies for sustainable waste management. This study therefore, examines the way forward for the Limbe City Council in matters of waste management in partnership with HYSACAM by asking the following questions:

1.5 The objectives of the study

The general objective of this study is to assess the practices, problems and prospects of municipal solid waste management the Limbe municipality.

2 RESEARCH QUESTIONS

In order to achieve the research objectives, the following research questions are raised:

- *What quantity of municipal solid waste is produced in Limbe and what kind of waste is produced?*
- *How is this municipal solid waste managed?*
- *What problem do the key actors who take part in waste management face or come across in carrying out of their tasks?*

2.1 The importance of the study

The main reason for this work is the fact that solid waste management is moving from manual to using more scientific and technologically improved methods. From this study, we can see the practice and problems of solid waste management in Limbe. There can be more advanced ways and means to manage waste in the municipality if more intense research and community involvement is introduced and undertaken. Thus the municipality will benefit from more efficient management models in the long run. This will enhance the sanitation and livelihood of the town and its people.

Presently in the Cameroon, many other areas are still struggling with the problem of solid waste management, and therefore, the study aims at introducing the concepts of GIS in the waste management as a means to welcome, adjust and ease the process of waste management in areas which are experiencing urbanization, increasing commercialization and population growth. GIS is a geographic information system designed to capture, store, manipulate, analyse, manage, and present all types of spatial or geographical data.

2.2 The significance of GIS modeling in waste collection and transportation

More advanced and scientific methods or techniques of disposal, collection and transportation of municipal solid waste are very important for an environmentally friendly approach as well as a cost effective means of solid waste management. The entire process needs a geo-database of the study area; that is the difficulties encountered in vehicle routing, since every vehicle ought to travel throughout the study area, paying visits to every trash bin in the community in a way that will reduce or incur less travel cost. This is as a result of them being defined by the distance, time, fuel consumption, the amount of waste from each truck and also, CO₂ emissions. It should be noted that the problem of seeing things to be better in the future, while talking about route system of solid waste collection network is not conventional.

For the decision making process to be effective, proper processing of the data presented to the authorities concerned must exist. In so doing GIS is used as supporting instrument that has gained currency as a result of technologies maturation and increase of quantity and complexity of information handed. Following this, researchers (Santos et al, 2008) came out with some route development tasks organised towards waste collection in both advanced and advancing countries in the process they united and brought together their environment and transport minimization through better siting of transfer stations and also treatment installations for integrated regional waste management.

According to (Johansson and Kassim, 2006, SM & Ali 2006), the optimization of waste collection and transportation involves the novelty of spatial modeling techniques and GIS. If we look at these models from the perspective of letting us have better and sustainable economic and environmental savings in reducing travel time, distance and fuel consumption and pollution emissions none exist and even HYSACAM which is a partner of the council in carrying out waste management does not possess such as well.

Tavres et al (2006) have had different views, thereby arguing that, for decision making to be effective in the waste management systems there must be the use of routing vehicle techniques as a means of new technologies or ideas like the geographic information systems. For example, GIS 3D modeling used in the Island of Santo Antao in the Republic of Cape Verde, in a challenging topographical area, which gained up to 52% fuels as compared to the shortest distance, even travelling at 34% longer distance.

Looking at another study in the US (Sahoo et al 2005), a better idea of route management system, for optional arrangement of about 26000 collection and transfer vehicles collects over 80 million tons of refuse per annum for more than 48 states in America. The implementation of waste routes from March 2003 at the end of 2003 saw that they gained 984 fewer routes, thus saving 18 million Dollars.

On his part, Alvarez et al (2008) brought up a method for designing routes based on a bin to bin collection in relation to paper and cardboard waste in five shopping areas of the city of Leganes Spain. In this study, the authors Alvarez et al proposed system was based on GIS technology and optimized urban route according to different barriers from comparison of their system with the previous situation they concluded that the proposed `bin to bin` system improved the quality of the papers and cardboard in the containers and avoided overflows thereby reducing the percentage of rejected materials.

Nourtes et al(2006) developed a GIS-base method for the optimization of waste collection routes in Eastern Finland. They estimated an average route improvement in comparison with the existing practice of about 12%. Moreover, they suggested a combination of routing and reprogramming optimization, this combination in some cases introduced extremely significant savings (-40%). they concluded by letting reprogramming as it is possible to clearly increase the improvement rate.

Apaydin and Gorrullu (2007) came up with an integrated system of merging GIS and GPS technology as a means to optimize the routing of municipal solid waste collection in Trazon city, North East Turkey. The difference between the suggested optimized routes with those which are existent shows saving of 4-59% in terms of distance and 14 – 65% in terms of time, with a benefit of 24% in total cost.

Karadimas and Loumes (2008) brought up a method for estimating waste generated in the municipality, the collection and the calculation of the optimal number of waste bins and the areas where they are placed. This technique makes use of a spatial collection of data integrated in GIS areas for the testing of waste in the area of Athens, result to a positive solution to save distance and collection time.

Chalkias and Lasaridi (2009) establish a new model network analysis as a means to improve the waste collection and transport system in the municipality of Nikaia by introducing containers and vehicle routing development in distance areas so as to save time that is used when travelling. The results show that the estimated resources brought about different savings from those which existed in terms of both collection times (savings of 3.0%- 17.0%) and distance of (5.5% 12.5%).

Finally, Kanchanabhan et al (2011) attempted to design and develop a better storage collection and routing system for the Tambaram Municipality in South Chennai, India using GIS. The optimal routing was investigated based on the population density, the level of waste generated, the storage bins and collection vehicles, roughly estimated 30% cost saving when using this model.

2.3 Interviews

The interview targeted their main respondents namely; the waste management company HYSACAM, ministry of Urban Development and The Limbe City Council were interviewed as part of the study. The table

below Table 1 shows a list of those interviewed and their dates. The Interviews were conducted as a key method for acquiring data, and obtaining quantitative information to be used to explain the existing solid waste management system, and also the factors that may affect public participation and the overall success of waste management in Cameroon.

TABLE.1 Interviews with main stakeholders their positions and interview dates

Institutions	Position of respondent	location	Level	Date of interview
Hygiene of salubrite du Cameroon (HYSACAM)	Limbebranch manager, chief of exploitation, driver head of technical division	Limbe	Private	28/12/15
Limbe City Council	Head of hygiene and sanitary department	Limbe	Local	15/12/15
Ministry of housing and urban development Limbe city council 2	Divisionoal delegate	Limbe	National	22/1/15

2.3.1 Administration Questionnaire

Households were selected from five different residential areas in Limbe using the systematic sampling technique. Starting with the number of people living in the house at the timethe study who had an actually making

use of the trash bin as a requirement to determine the per capital waste generation.

However, these five residential areas can be grouped into two: high income residential areas and medium residential areas. High income residential areas are made up of high level of building infrastructures and occupancy with no gardens nearer to shopping center district, in assisting those surveyed who had little or no educational background and to build a trust worthy relationship. The areas covered include Ngeme, Newtown, Mile 1, Cite Sic GRA, and Cite SONARA and Mile 4 which are peripheral neighborhood of Limbe.

Questionnaires rely on self reported information which states in assumption that the data provided by the respondent is accurate for their solid waste practices and concerns. In an effort to increase the questionnaires credibility for the respondent, the survey was pre faced with briefing, explaining the rationale for which the questionnaire was made and how the responses will be of help to the municipality.

In pursuing the study, a field trip was conducted with HYSACAM, which entailed following their waste collection. Their daily tasks and activities as well as working conditions because it permitted actual and active participation and made it possible to survey the opportunities and difficulties open to the HYSACAM team and employees in the week covering HYSACAM trucks and also the timings to follow the patterns to waste disposal in the various zones. All the given areas could not be covered.

2.4 Types and Quantity of Solid Waste generated in Limbe

In Limbe municipality several kinds of waste are produced and are made of the following: household waste, industrial waste and waste from the construction sites. Nonetheless, this study is focusing on municipal solid waste illustrated in table 2

TABLE 2 Composition of household waste in Limbe

Categories	Food waste	Garden waste	Plastics	Metals	Papers	Glass	Textiles
Sub-categories	Food remnants	Fresh and decaying leaves, vegetation and other garden waste	Plastic bottles and packaging	Cans, bottles caps, ferrous metal and aluminum items	Newspapers, Magazines, Office papers, Junk mails and envelopes	Glass Bottles and jars	Clothes and shoes

Table 2 shows how solid waste produced in Limbe is complex and diverse. The waste type depends on the area of location in the city. However, since the waste demands identification of the various waste systems or better means of categorization, the study further divides the city into five zones of categorization and zonal location of such waste produced.

- 1) **Zone A:** this zone is comprised of Down beach, Mbongo man of war bay and Dock yard the area is spatially populated and partly generates house hold refuse Seasonal fining waste, this area also has an increasing tourism rate, might lift and has offices as well. Due to this, the discussion according to the information obtained and also enhancing socio-economic advancement requires a pilot project.
- 2) **Zone B:** this area is composed of New town, which according to evidence statistics, is the largest and most populated area in the Limbe municipality from a historical point of view, the zone embraced the rapid advancement of urbanization and population with characteristics of poor housing. The area is densely populated and composed primarily of household refuse
- 3) **Zone C:** this zone represents the central business district of the municipality and comprises of mile one Garden, Mbende, Cassava farms and half mile the area has a dense population and comprise

principally of house hold waste. According to Brain Tracy, communication and inter personal skills can be of great importance and importance to increase collection and facilitation disposal of waste.

- 4) **Zone D:** The zone includes Bola land, Isokolo, Mukundabge, Ngeme, Limbola and Batoke. The environment has a great level of urbanization as well as tourism and hotel infrastructures. This area has companies like National oil refinery (SONARA), CNIC chantier naval ET industrial du Cameroon; its waste is both industrial and domestic. The collection routes are faced with a major problem, which is traffic caused by existing oil and petroleum tankers, and also poor roads, not leaving out the rough terrain that is effective and timely collection of waste.
- 5) **Zone E:** This zone covers mile four which is an area of increasing commercialized activities and also urbanization as well as increase in population. Waste in this area is composed of domestic waste mainly. HYSACAM are facing a problem of time management. Fuel consumption and the poor nature of the terrain is an uphill task for the collection of waste.

2.5 Quantity of Municipal Solid Waste Generated in Limbe from 2010 to 2014

The per capital generation for Limbe was lesser than those of some developing countries which have a low income. (WorldBank, Country assessment report, 2000), A way was derived to obtain the daily average of waste generated in Limbe and figures show that as of the time the study was carried out average daily waste generation in Limbe stood at 1.5 kg perday. This is a very significant increase in 14 years. The World Bank report of 2000 which gave low income countries a per capita generation of waste of 0.68 kg is therefore outdated, because if we take into account the rapid economic growth, the changing income levels and life style, the

adoption of new technologies and a population boom this figure will be higher. The figure below shows that 56% of the population reported their average daily waste generation between 0-5 kg and 37% laid their figure between 5-10 kg per day. Evidence proves that, Limbe has increased significantly in the per capita generate. Other studies like Abu-qdais et al, (1997) found a negative relationship between waste generation and household size in Abu Dhabi ($R^2=0.11$) which has raised arguments that the size of household and level of waste generation are strongly attached and linked.

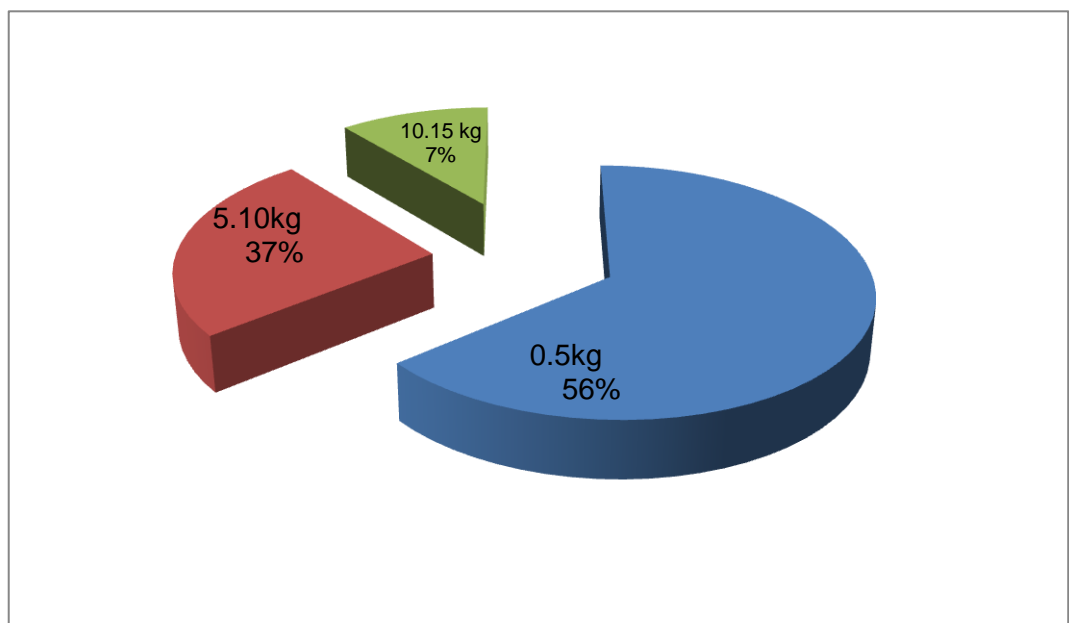


FIGURE 3: Estimated amount of waste generated in Limbe

When we observe Figure 4, it shows a total of 33.002 tons of waste was collected in 2010, 30246 tons in 2011, 450.03 tons in 2012, 27.527.92 tons in 2013 and 13941.86 tons by mid 2014. This was a drift in the amount of tonnage collected from 2012 and many factors led to the waste company, HYSACAM being prevented from attaining the tonnage per day which stood at 100 as fixed by the legal frame work and terms of contract with the municipal council.

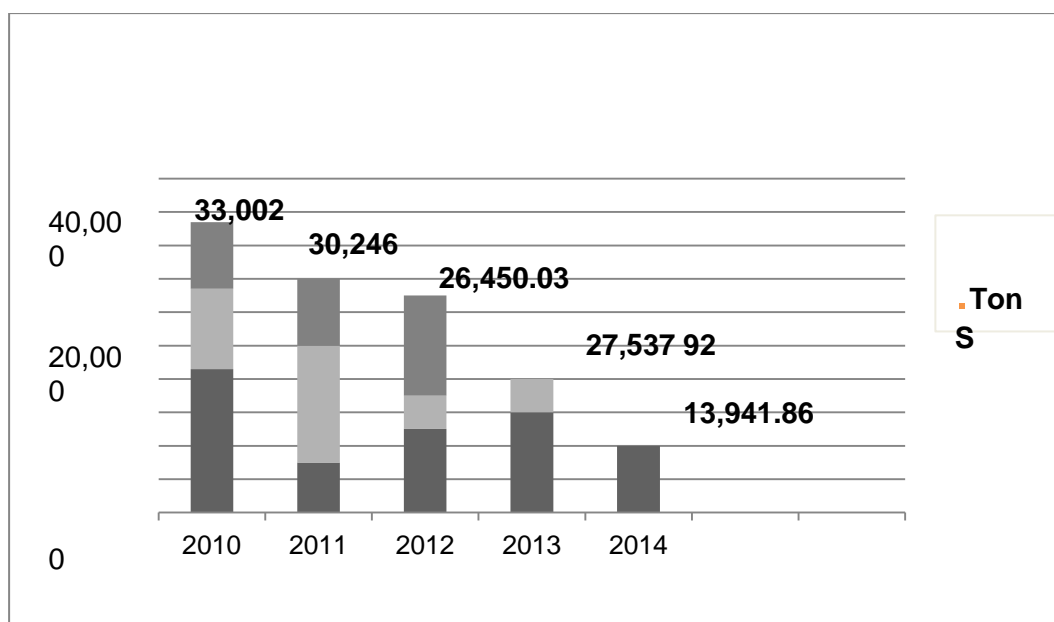


FIGURE 4 Total distribution of yearly collected waste in Limbe municipality. **SOURCE:** HYSACAM

An in depth examination of the data from HYSACAM is displayed in Table 3 with monthly collection figures covering four years in the Limbe municipality. The irregular nature in the tonnage collected monthly is caused by frequent depreciation of trucks as well as a shortage in the number of these trucks present at that time, to combat the rising waste generation level in the municipality.

TABLE 3 Amount of Waste Collected from 2010 to 2014 in tons by HYSACAM in Limbe.

Year/tons	2010	2011	2012	2013	2014
Month					
January	2932	2166	2430	2150.12	2799.80
February	2725	2123	2346	1670.38	2576.92
March	3179	2676	2318	2237.12	3293.36
April	2686	2575	2086	2353.54	2829.58

May	2959	2600	1988.16	2007.72	2442.2
June	2762	2450	2119.96	2305.28	
July	3050	2664	2119.96	2401.18	
August	2475	2599	2252.46	2583.82	
September	2662	2663	2172.68	2583.82	
October	2489	2551	2591.52	2548.34	
November	2759	2611	2205.15	2361.48	
December	2324	2568	1804.06	2524.74	

Source:HYSACAM Limbe

3 WASTE MANAGEMENT PRACTICES IN LIMBE

Collection, Transportation, and Disposal of waste in Limbe

HYSACAM is a private company created in 1969 and has been in partnership with the Yaounde and Douala City Councils to collect and dispose of household waste. It is found in almost every council in the country, except for those like Bamenda that decided not to get into any form of contract with the company. Its activities are grouped into three: sensitisation in a move to create awareness and to provoke a change of the mentality of the population, the collection and removal of household waste which calls for the creation of waste collection points and routine emptying of waste containers in homes and quarters, the sweeping of streets and markets; and the transportation and processing of waste at discharge sites. It has approximately 1500 employees, some of whom are permanent staff. To the Limbe city council, the contract stated that, HYSACAM is to dispose of at least 100 tons of waste from the streets of Limbe Daily. In Limbe, the company boasts of 105 employees, 34 of who are female.

In carrying out their functions in the municipality, they make use of instruments like brooms, wheel barrows, rakes, mobile trash bins and trucks for gathering waste from points at indicated areas in the town. Below are pictures of some waste management practices in the Limbe Municipality.

Figure 4 portrays a couple of pictures with block drainage occupied by poorly discarded waste in an open dump in a residential area and waste piling up some days before it is collected by HYSACAM in Limbe. Due to poor waste management habits, there is the presence of mosquitoes and also bad odour emitted from the waste as they are wrongly discarded. This means that, the present manner of discarding waste in the Limbe municipality are not sustainable and require a better strategy to improve the unsustainable waste management practice to a better sustainable waste management system.



FIGURE 4 Unsustainable Waste Management Practices in Limbe

The Table below makes us aware of the amount of vehicles in circulation and the various models employed by HYSACAM as of May 2014 in Limbe. In total, there were 8 vehicles in circulation. This was due to the fact that others were either on repair or they had a break down. Also, the tonnage is portrayed so as to know the capacity of each truck, the company has a small amount of vehicles that makes it difficult for them to fully execute their various mandates. That is why waste is piled for many days before collection, as the little number of trucks ought to carry out more rotations so as to meet up with the demand. These practices cause the trucks to depreciate quickly and easily thereby leading to frequent breakdowns and repairs.

TABLE 4 Number of vehicles in circulation by HYSACAM Limbe

	tonnage	Number of vehicles
Compactortrucks (10 tons)	10	4
Paris-model trucks (maximum 5 tons)	5	2
Dustin carrier (2 tons)	2	2

Source: HYSACAM limbe



FIGURE 5 Show Acompactor truck and a Dustin carrier operated by HYSACAM in Limbe

3.1 HYSACAM work schedule

Regarding HYSACAM's work plan, this company operates in two different work intervals, from 6:00 am – 2:00 pm and from 4:00 – 10:00 pm. The work day begins at 6: am and just two trucks are permitted to leave the company headquarters in Bota. The collection of waste commences from unity quarters which further proceeds through the use of door to door mode of collection, not forgetting to follow the collection route. In addition to this daily routine, there are fixed collection points where trucks pick up waste and they have been strategically placed in various points of the town.

In all, facilitated by 6m³ green plastic and metallic containers. The inhabitants are expected to drop their waste there. Unfortunately do not possess markers to separate the various kinds of waste been deposited in

them in actual fact, some areas in the municipality have double containers which ought to be used to encourage waste collection such as plastics bottles or other hazardous waste and especially waste generated from the hospital, Table 5 below shows the 25 collection points according to the HYSACAM classification.

In an effort to re-classify the collection points we have in this study, it has been grouped in respect to the five zones made mentioned earlier in the study.

TABLE 5: HYSACAM'S fixed collection points in Limbe

Zonal Location of HYSACAM's 6 m ³ green collection containers in Limbe	
1 Zone A	Dock Yard 1, Dock Yard 2, Fish Area, Man O War Bat,
2 Zone B	Mawoh Bridge, Lifanda city, Sabis Prince, Main Garrage New Town, Cemetery New Town, Snail Area, Tomatoe Market
3 Zone C	Cocount Island, Embassy Bay, Mbende, Cassava farms
4 Zone D	Ngeme New Lay Out, Da Crown Hotel, opposite fini hotel
5 Zone E	Mile Four Market, Mtn Antennae, unity quarters,

Source: HYSACAM

From the above it is seen that the city is segmented into sectors and is further partitioned into zones. The company makes use of 6m³ containers, 0.770 and 0,360 plastic containers in addition to these 120 litres plastic containers is used for manual cleaning, as well as sweeping, enhanced with wheel barrows. In the past, the municipality was equipped with 59 waste paper baskets, but after they got destroyed, they have not been replaced.

Out of the great number of containers reported in the survey, the most widely used storage method by the households is closed containers with lids. As portrayed in Figure 6, the study found out that 52% of the population utilizes this form of storage. The second mode is the use of plastic bags with 34% of the community.

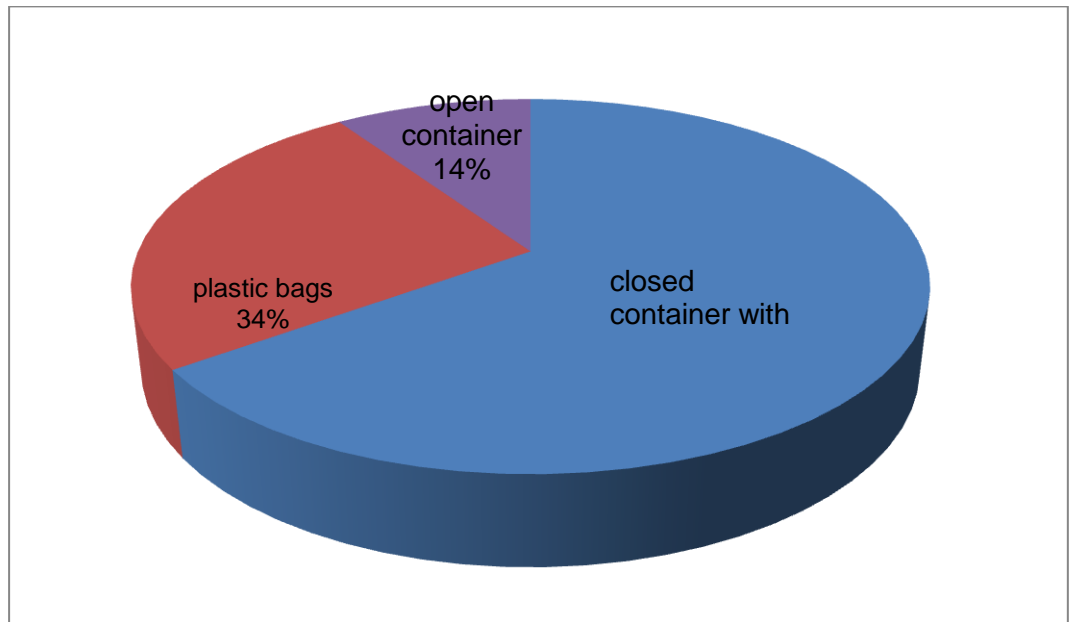


FIGURE 6: Household storage of waste according to the Survey in Limbe

In terms of household waste disposal methods, which are widely in use, the Table below brings out the most used disposal method. By the respondents, we can conclude that they use garbage trucks for paper, plastic, metals, and glass and 90% of the population indicated that they use this method and only 2% of the community identified as small scale farmers do make use of composting and recycling.

TABLE 6: Most preferred Disposal Methods by the population of Limbe

	Food waste	Yard trimming	Plastic	Paper	Metal	Glass
	%	%	%	%	%	%
Burn		10	4	16	1	
Bury	3					2
Dump in yard	1	1	1	1	1	2
Dump in river	2	2	1			
Dump on the road	8	2	2	2	2	2
Garbage	53	54	90	81	94	96
Recycle	17	23	2		2	
Reuse	15	6				
Compost	1	2.0				

Regarding the above table, we can deduce that, there is some awareness and knowledge concerning waste management. 25% of the community recycle their garden waste and 20% recycle their food items. From this attitude, we can see that there is some hope because such behaviour encourages sensitization and will be an advantage to future programs regarding recycling as well as other waste reduction strategies source separation of waste from commencing of the chain or life cycle is vital

when consideration is given to the final recycled or composted products quality.

TABLE 7 Sustainable Waste Management Methods used by Respondents in Limbe

	Food items	Plastic	Paper	Metals	Glass	Garden waste
	%	%	%	%	%	%
Reuse	18	4	5	1	1	16
Recycle	20	1	2	5		25
Reduce	11	23	17	19	22	10
None above	51	73	76	75	77	49

3.2 Street Cleaning

The main streets in the metropolitan area of Limbe are swept daily, while the secondary streets are cleaned twice a week. Unpaved roads in the neighbourhoods and villages are part of these sweeping programmes and waste collection is not organized by a standard calendar. Due to this, unpaved roads and areas characterized by poor roads or terrains are always filled with trash. Thus, there is a nuisance of finding dirt everywhere and poor odour from abandoned and rotten waste. The rate at which water ways have been blocked by trash, is also a major setback faced in the municipality.

3.3 Market Cleaning

In the Limbe municipality, markets follow the same routine for clean up, which is a day after the major market days Wednesday and Saturday. When we look at the way the cleaning calendar of the streets is scheduled, it does not conflict with the cleaning of the markets. Therefore, all these were put into consideration.

3.4 Cleaning of Green Belt

This is a practice employed by the Limbe city council. Evidence shows that other councils around the country practice it. This practice is all about the council, taking extra time and effort to clean its public areas and rehabilitation of its green environment and habitat. An example is the common field area at the round about found at the black and white junction, the area opposite the central police station presently occupied by the Limbe Botanical Garden.

3.5 Beach Cleaning

Beaches in the municipality like the mile six beach and down beach are cleaned on daily basis as well as general public sensitization carried out. The cleanup campaign is a method employed by municipal authorities to keep Limbe clean and is delivered by the Hygiene and sanitation.

The Department of the Limbe City council cleans up business premises and other surrounding twice every month from 8:00am – 12:00 noon, and during these hours, all building offices and business centres are closed to respect the exercise and enhance commitment from the public. However, taxis who don't want to partake in this program pay exemption fee of 500 FRS. Many people use this as a way of exempting themselves.

3.6 Transportation of Waste

Table 6 below shows 25 main collection points operated by HYSACAM in Limbe. Trustbin carriers are the waste collectors used in most of these areas. In selecting these collection points access is the first thing to consider. There are located in areas where collection trucks can get to with little or no stress. The manner in which the town is embracing urbanization and sprawling, there is the need to increase the number of collection points so as to serve and accommodate those neighbourhoods which are not served.

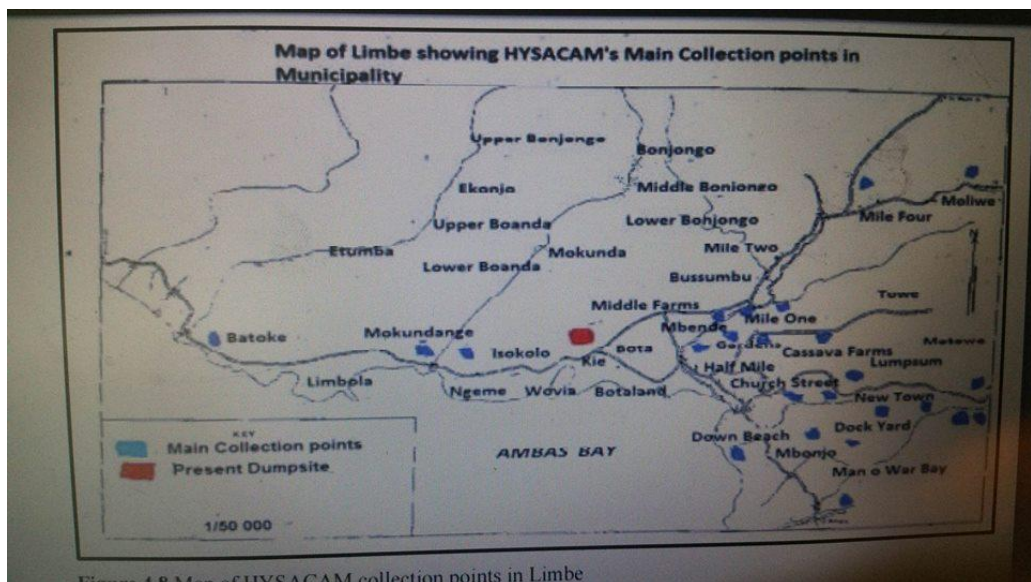


FIGURE 6: Map of HYSACAM collection points in Limbe

Table 6 shows the frequency of waste collection by HYSACAM in the months of January, February and March 2013 in Limbe, in terms of transportation and the organizational sense of it in carrying out this task. The number of trips made by HYSACAM trucks and the number in the operation during each outing and the Weight of the truck is indicated to facilitate understanding of the process.

Statistics from the above figure provided by the Limbe City council, show that in January 2013 an average of 82.69 tons per day was collected by the company, and, in February of the same year, 64.24 tons were collected with the availability of 7 vehicles. The tonnage was because of frequent break down of collection vehicles. Consequently, HYSACAM could not meet the collection stipulations. In March, when many trucks were included after repairs there was an increase in the amount of tons transported.

3.7 Disposal

This is the end point in the life cycle or chain in solid waste management and usually brings forth the main difficulties, due to its long effect on the immediate surrounding environment after waste is collected; it is transported into dump site at Karata, a camp around Kie village in Botoland area. It should be noted that, this is the only dumpsite in the municipality. It is an open one and from the look of things there is no form of recycling, except for organized action by scavengers, who look for valuable items like metals, to sell to companies who recycle them and reproduce them. Laterite is used to cover any section of the waste, when it is full as this helps in the natural decomposition process. Figure 7 brings out clearly the process in which waste disposal is done at the dumpsite in Karaa. This is not a landfill, but an open dumpsite which is filled with soil in order for natural decomposition to take its course.



FIGURE 7 Disposal process by HYSACAM



FIGURE 8 Pictures showing the practice of open dumpsite, at the municipal dumpsite at Limbe- KarataBotaland.

4 THE ROLE OF PLANNING IN SUSTAINABLE WASTE MANAGEMENT

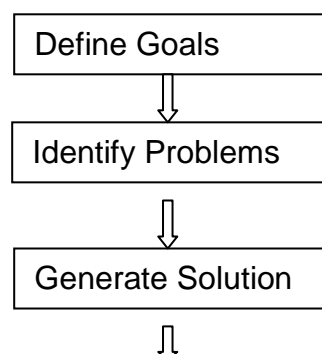
All the practices mentioned above are unsustainable and entail a new approach for waste management in Limbe and other municipalities.

Besides the customary or traditional way of thinking that waste management begins from generation, another approach will probably be very effective if we commence from the actual process of production.

The study carried out by FobilETAli, (2002) examined, the waste stream generated from three residential groups in Ghana (High, middle and low residential areas). He and his colleagues realized that the waste stream generated by the various groups is made up of entirely different proportions of waste components. The writers were of the opinion that, different waste management schemes ought to be embraced as regarding the various residential areas.

This brings to our notice the relationship which lies between proper urban planning and waste management, because the cities are arranged to play a role in the type of waste they generate. Industrial zones will not produce the same nature of waste like residential homes.

Looking at the above data, it is realized that the road network in Limbe also has a vital cote to play in the collection rate in the city while the high residential areas enjoy frequent collection, low residential areas do not, because the nature of roads here are very poor in these areas. The illustration below gives a rational planning process which will assist in making waste management better and hence lead to efficient processes in the community.



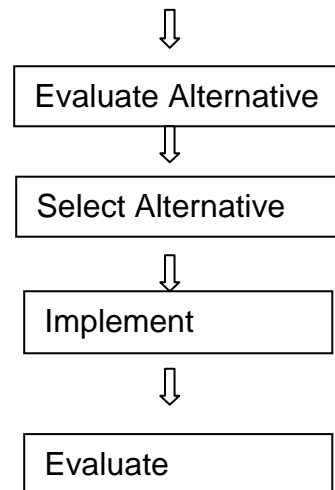


FIGURE 8: Rational planning process.

The involvement of city planners in waste management has been only towards infrastructure sitting, planners possess a huge potential in adding positively to sustainable waste planning regarding both practice and research.

First and foremost, they have a special focus on spatial implication of policy creation and have familiarities with local and regional demographic attributes, not leaving out the built environment, which lays the basis for waste and material flow analysis and community – specific waste policy design (Heigh et al., 2007) there is a giant potential for planners in particular to bring about material flow via urban systems, land use and occupation of the people in the community determines the differences of material inputs and source of waste generation.

In addition, planners have diverse means as well as access, they are in position to influence infrastructural planning; this could comprise of not only landfill, but also recycling centres, drop-off sites as well as re-manufacturing facilities found/existing in urban centres. Strategic plans like the location of waste management facilities in Greenfield can make environmental consequences less serious in terms of material flows;

advance closed – 100 production systems in urban areas, and therefore, fosters advancement in economic opportunities for those inhabiting urban residents (Leigh et al., 2009).

Planners keep on making use of local data for dynamic estimates of infrastructure and community planning; waste management planning programs may have a great involvement in the possible future plan. Therefore, planners by nature have the initiative as well as techniques for long term management planning. A possible manner in which waste management can be integrated over a long possible time involve designing urban sustainability indicators from system points of view and promoting regular gathering of information in consistency.

. Furthermore, planners possess a real vision and knowledge of region, thereby making them equal to the task of controlling the highly inter – disciplinary aspects of waste management. A better comprehension of the difficulties involved in waste management assists in reducing the conflict in waste planning, from the commencement of material extraction and production, rather than a minute focus on its final destination.

A fifth point reveals that, planners obtain powers to interfere in business advancement strategies forward. They can uphold the business chains that work with one another through exchange or sharing of resources (data, water, equipment, energy, buildings, as well as natural homes and surroundings) to obtain economic and environmental benefits, as the belief of industrial symbiosis suggests.

Sixth, a better way than the free one discussed above for planner is to demand and fight for federal legislations and organized and coordinated regional efforts for management. Even continuous powerful modes ought to be developed in order to kill waste export to different regions, ease advancement and welcome the green technology, and also, enhance self reliance of waste management for every urban region.

In conclusion, planners need to merge and enhance public education and help change the way the population deal with waste. In specific, public

education needs to talk about the life cycle effects of consumption as well as risks in the long run, which are immediately visible and are at our disposal. Economic factors and advancement in technology still need the encouragement of public education for efficient waste reduction, since it appears to be the first and most important prerequisite for urban sustainability.

4.1 Problems and Community Perception of Municipal Solid Waste Management in Limbe Municipality

Looking at the present situation of MSWM in Cameroon and Limbe to be specific, two basic questions ought to be addressed immediately;

1. How effective have the present schemes been meeting the desired objectives?
2. What challenges need to be overcome to change the present situation into sustainable ones?

4.2 Public perception on services provided by HYSACAM

Regarding survey executed for this study, the population shows that, there existed waste disposal difficulties in the Limbe municipality. 79.4% the people accept that, there is a waste collection and disposal problem (figure 9) Nonetheless, they had different responses. When the interviewer sought to find out why they thought, there exist waste management problems in the community.

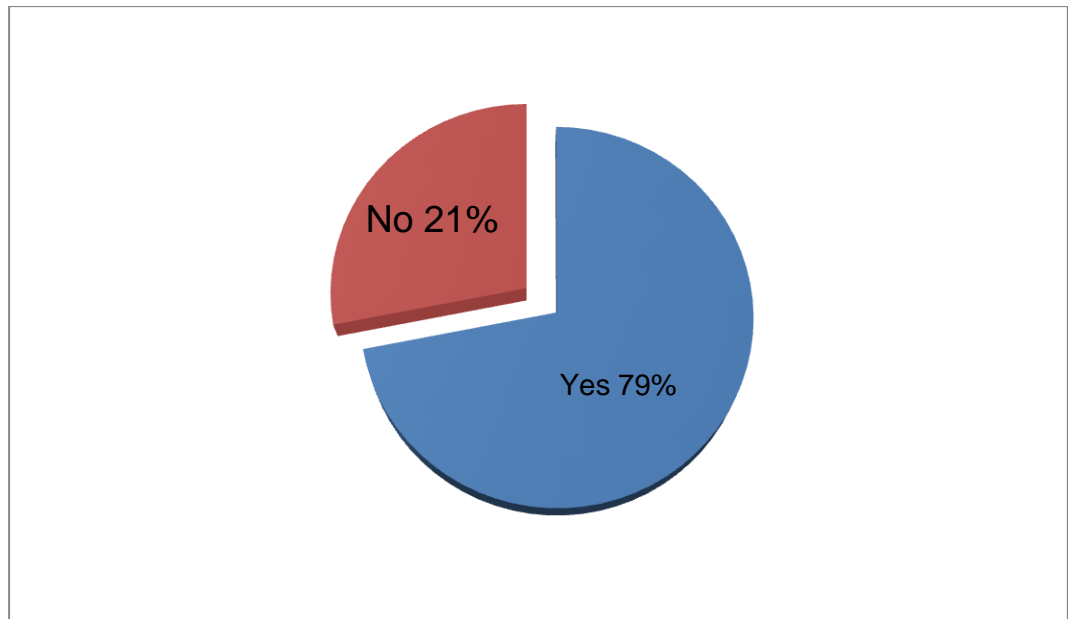


FIGURE 9: Community participation in waste Disposal Methods

Table 8: makes us aware of the fact that, the distribution of waste problems in specific communities in the city is in three fold.

Initially, communities found in Ngeme in Zone D, New Town in Zone B, Mile 4 in Zone E and Mile 1 in Zone C base their argument for poor waste management on the frequency service HYSACAM provides.

Secondly, the same areas talked of litter and also the lack of waste bins to empty their waste. Those in residential areas never had negative reasons on the manner in which waste is managed in the municipality. Since the Zone experience timely collection carried out through door – to door services, their point can be considered. The diagram beneath brings out the position of the communities.

TABLE 8 Communal categorization waste management problems

District	Name of the problem reported				
	Pile of garbage	Litter	No containers	Garbage regular collection	No litter
New town	53%	10%	33%		
Ngeme	75%	2%	15%		
Cite SONARA				95%	2%
Cite SIC				85%	10%
Mile 1	63%	12%	25%		
Mile 4	79%	11%	5%		
GRA				93%	4%

4.3 Perception on Health

Based on field statistics, 98% of the people reported they were aware and concerned about illnesses linked to poor waste management, meanwhile only 2% never responded. This implies that the greater part of the population are aware of the negative characteristics and aspects of waste on their health if thrown any how without any doubt, serve as breeding grounds for parasites which lead to diseases like malaria. To add, we can conclude that, the flood which occurs always in areas like down beach is due to the fact that the drainages are blocked. This really ties with the

research of Lambi (2001), who postulated that, most parts of Bamenda and Yaoundé are partially or really blocked by solid waste considering the views of Raymond (1968), the problem of solid waste is difficult, since most of the waste is produced by industries. The released nutrients found in them give room for blooms of algae which is unwanted. Nowadays wood or paper have been burnt together and this causes serious air pollution. Many people in the Limbe municipality turn to burn their wastes, but others dump theirs in water bodies causing environmental hazards as the carbon monoxide or CO_3 emitted from them is not good. The picture below (figure 9.1) illustrates the prevalence of plastic bottles and papers along major streets in the Limbe municipality.



FIGURE 9.1 Evidence of waste disposed in gutters in Limbe

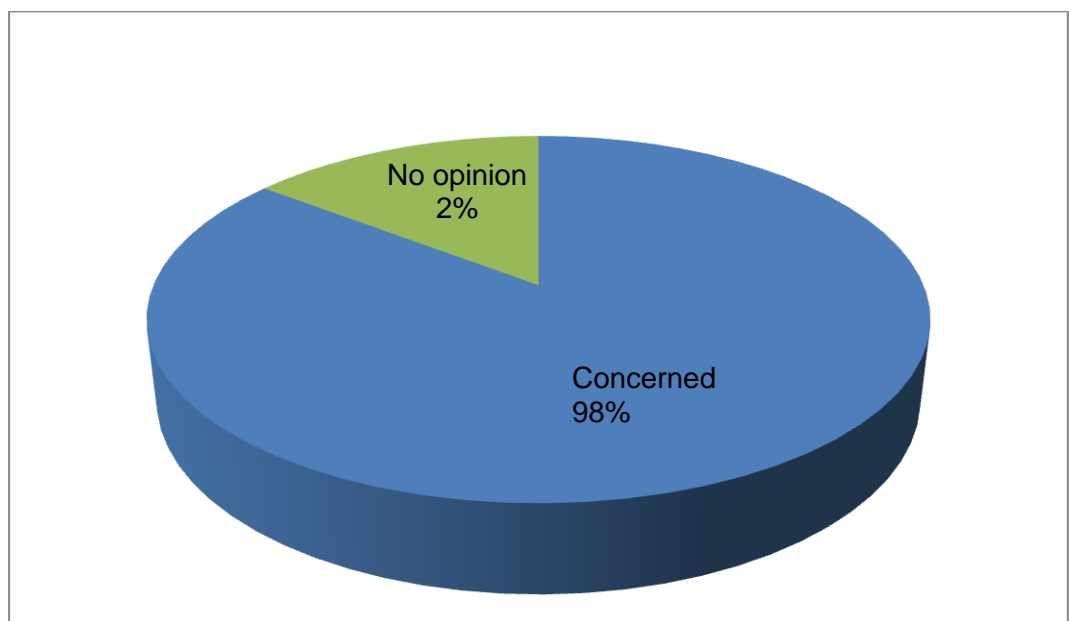


FIGURE 9.2 the views/concern about diseases as a result of improper waste disposal

4.4 Perception about the environment

The data obtained from the field work in Limbe demonstrates that, majority of the people, prefer gutters to throw away their plastic bottles and papers, which remain in the drainages for a very long time. From the diagrams below, despite the fact that this is an unchanging habit, 95% of the people have concerns regarding waste littering on the roads and the environment upholding the beauty of the town making it look ugly. The next diagram also shows that 89% of the people are concerned of the fact that, most floods in Limbe and rivers are caused by waste dumped, which is not a good aspect.

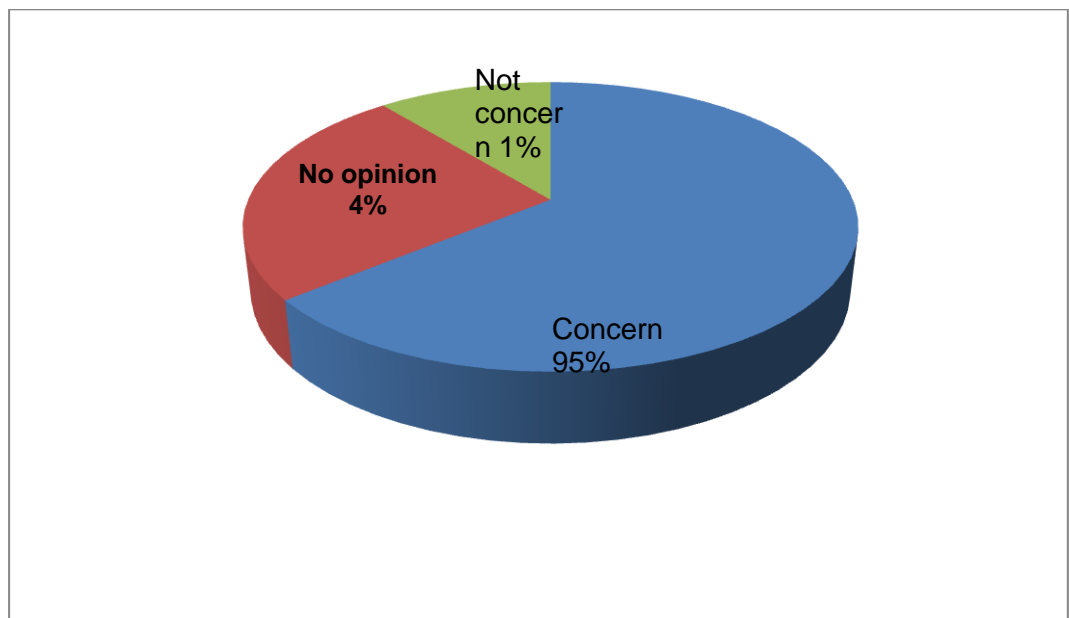


FIGURE 9.3 Concern about litter in the environment and aesthetics in Lmbe

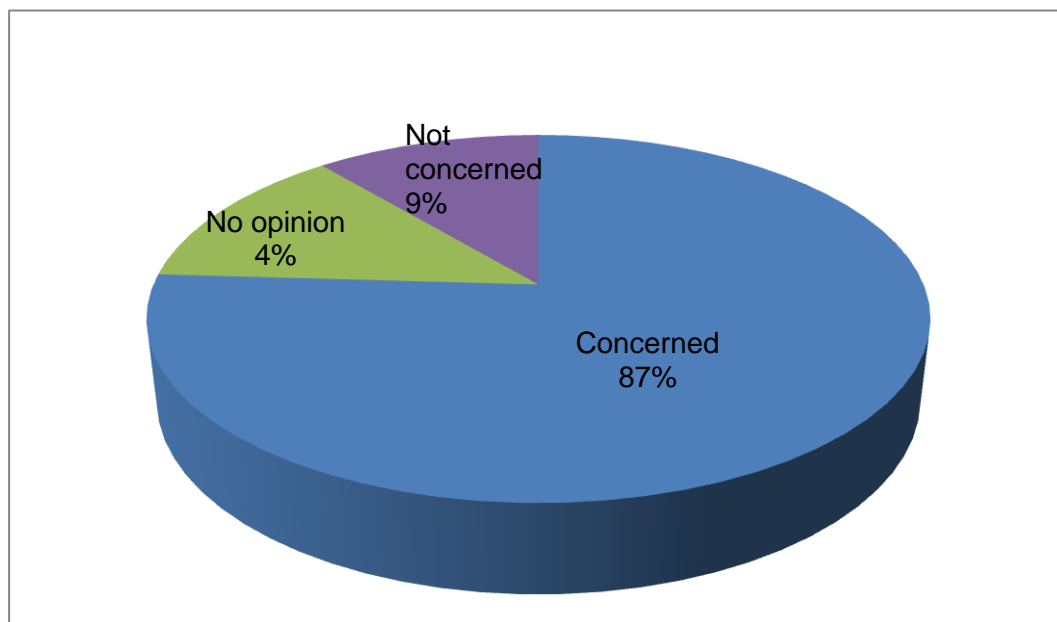


FIGURE 9.4 Concern about dumping of waste in rivers and gutters that arise flooding in Limbe

4.5 CONSTRAINTS

Hoomweg and Bhada – Taa, (2012) argued that annually third world countries spend USD 40 billion on municipal solid waste management are likely to use another 40 billion to take care of the service delivery garbage. Putting the projected increase in Municipal Solid Waste generation, their needs (financial) could exceed 150 billion USD each year by 2025 (Hoomweg and Bhada – Taa, 2012). Here in the country, the evacuation of house hold waste accounts about 25% of the municipal budgets of Douala and Yaoundé making a total of 64 million Euros and 53.5 million.

The cost of the Limbe City Council stood at about 85million cfa (2013) for taking care of household waste (Limbe City Council 2013). The index regarding taxation, for MSW management in the country lies on a system of direct local taxes recognized for the provision and financing of local services like sheet , light, water supplies and waste removal. The government uses 85% of the available finance taking care of the waste in big cities in the country from the budget of the country and this allows the council to come up just with 15%. Due to the advancement in waste production and cost, the greater task and challenges evidently troubles the government .as it bases more than 509% of the yearly budget. The government used 30billion cfa on municipal solid waste management in 2012 and the amount spent is estimated to increase to roughly 95 billion by 2030 (Ymele 2012)

4.5.1 Institutional factors

From the analyses of the study, many regulatory services are present in Cameroon waste management sectors (table can be seen in appendix 1). Problems with enforcement are a reflection of the absence of supportive text for implementing the actual tools, For example, regarding the technical description and special rules on dump disposal law 92\12.

Chapter IV section 1 article 47(2) 5.5.5 lays out conditions for authorizing pollutant discharge into the environment, air, water or soil law 96/12 chaps iv section 1 act 53 also direct conditions for the authorization of discharge pollutant in the air , as well as the soil. As a result of this, regulatory enforcement bodies are forced to implement rules that predate the present law. This is so clear with decree no D6/NS/NN/ST/SG/BMPHP/NNPA of August 11th 1997. Circular letter circular no 69/N6/DMHK/SHPA of August 1980, rather than the previously mentioned decrees, regarding current and recent law (i.e. Act 43(2),47 part 111, sec 1 of law 96/12 of August 96 and in some instance, apply or adopt the final guideline or rules entirely, from above law maker. This does not bring out a vivid regulatory frame work for operating waste management.

In addition, the bulky characteristics of these obligation laid by the state provision limits efficient delivery and enforcement for example, the duties of monitoring and evaluation for regulatory acceptance and this influences enforcement, because of the absence of cleanses and definition of function many of the inspectors interview in this study talk of the lack of power supplied by human labor jurisdiction, finance expects in the domain of waste management, testing equipment and infrastructure as obstructions to the placement of regulations.

Unfinished rules, lack of clearly stated functions and the lack of harmony are proof of poor planning administration.

In as much as the government puts much efforts to bring up and put in place legislation relating to sustainable waste management and environmental protection, the present frame work is not a sufficient, due to lack of effective engagement of industries, commerce and the general population for a better sustainable waste management policies. In Cameroon decisions like this will promise the active involvement of decision makers to esure a successful delivery of sustainable waste management practices. This creates procedures for helping decision makers in actively involving with those who have much interest in the decision making procedure. They have postulated that, the model states about identification of the base time situation for MSWM in town and putting in place a situation for the delivery sustainable waste management outcomes. The SPG, by evidence is a vital document in enhancing economy (Manga et al; 2012).

The main obstacle encountered by the Cameroon government so evident in most developing state as Manga et al; (2007) put it. There is a replication of services and functions in the ministries involved. This cause shortages and misuse of resources. The regulatory system at hand carries out top bottom approach in decision making, where in the department in ministries are able to exercise control over local out come politically interface with decision instead of scientific reality. This is evident in the

provision of technical help from the government and its agencies in the local councils.

The conveyance of waste management is a statutory function for municipal council. They account for providing and upholding infrastructure. For instance waste disposal facilities, financing of all activities regarding waste management, like street sweeping, collection, transportation and disposal of houses hold waste as well as the management of all public spaces and infrastructures councils raise funds from 3 main sources;

- Revenues and Taxes generated by council activities
- supplementary budget from the state through MINEFI
- loan amenities from the management council development funds (FEICOM), additional budgets are subject to close examination by MINEFI, which has a balance sheet for a portion of state funds on the basis of predictable fiscal revenue flows.

The responsibility of waste management is under the jurisdiction of health and safety personels in the hygiene and sanitation department of each municipal council. in each department the overseer is mostly qualified employee as a health worker. The council is responsible for establishing and taking care of these units with partial duties for waste management, or they may sub contract the duties to a private company that is specialized in dealing with solid waste management system for example, (HYGIENE ET CALIBRE DU CAMEROUN) HYSACAM in Cameroon. In this case the council now plays very limited roles in solid waste management since the company now handles part of the waste management program. The Limbe council like any other city in the country opted for this option, to bring HYSACAM into the picture because, like other municipal authorities, the Limbe city council faces the same difficulties the lack of qualified and skilled employees. By this it is evident that in the case of default or an infringement in carrying out the contract, the limbe council will be evaluated. For example the council wants HYSACAM to carry out a daily collection of 100tons of waste. The weighing system at the disposal site dose not gives room for good

measuring mechanism for the council measurement is done by approximately. In order to evade this difficulty, the council is unable to provide to attach weighing technology to the carriage so that the measurement can be made accurate before the truck get to the final dump site.

There is also, the absence of a bottom up for waste management leave the central government to carry out policies not suitable for the local environment and councils. These really obstruct effective waste management in Limbe. In addition the absence of funds limits the project on waste management, since enough finance is needed for effective sensitization forums for a better sustainable waste management. Another reason is the absence of autonomy with problems of finance in the council.

Although a decree talked of decentralization and regionalization, council don't take enough authority to control their finance fully, for instance, finance use for collection and disposing of waste is controlled by the state through MINDUH (Divisional Delegate for Housing and Urban Development, Limbe 2014)

Another problem that arises in the Limbe municipality is the location the present dumpsite, itought to be closed and transferred to the outskirts of the city. Since this area has an increasing population and a rapid urbanization growth.

To this effect, the people in this area will be faced with the problem of odor emanating from the waste as well as related effects. This is also a problem in the US. It poses a serious problem for companies in charge of waste management to even acquire and obtain cleanliness at the level of the environment. Theeffect of waste management to societies is health complications which has given rise to cancer cases.

5 RESULT

1. From the results, conclusion can be drawn by saying different forms of municipal waste are generated in Limbe municipality and the waste generated rises fast like the sources. There were different source of municipal waste which was identified; they were those from health centers like the Regional Hospital, industries like SONARA and also household waste.
2. A present day MSWM activity is made up of an aspect of environmental protection as well as sustainable development. Debates that are currently seeking deserve attention for ages; Limbe municipality has embraced keep Limbe clean as a way of taking care of the town. Thus, more attention is directed on collection and disposal combating these aspect means giving appraisal of the existing levels in MSWM for Limbe and a suggested system to make the current ones up graded.
3. Based on rationale, the study was to look deep or investigate the difficulties linked or related to municipal solid wastemanagementinLimbe and brings forth ways to improve waste management amidst the rapid advancement of urbanization. The research has proven that solid waste management is a great problem in Cameroon. The difficulties and perception which hinders effective waste management and which poses a barrier to management from becoming sustainable includes; infrastructure and logistic, poor urban planning, poor land fill practice, lack of adequate funding, political and other institutional factors. Also, current laws on waste disposal and poor waste handling manner of the people, lack of ability to improve standard on land use and shelter development in the municipality need to be investigated properly. This keeps on frustrating all efforts made by local governments. However, it has been due to poor governance protection in the organization of waste disposal. Municipal stake holders in the country have not been able to promote partnership

with the waste produced by the public and to get them associated in the various aspects regarding waste management which includes needs assessment, financing, waste collection and final disposal.

6 CONCLUSIONS

With regard to the final findings, recommendations are provided for advancing the management of household waste for the citizen's in Limbe municipality. The recommendations are particularly linked to each stakeholder who takes part in the strategic planning of specific interventions. Based on the synthesis of data obtained in the findings, an in depth interview as well as available literature.

A better way for sustainable solid waste management is to bring forth a means by which the life cycle of waste management can be controlled by technology. Today where the world has become a global village, there are models where information concerning waste management is carried out through the use of suitable GIS systems. These systems work in a way that the sorting routes as well as the collection point, or model to specific the tons of refuse generated in the research environment are placed in it (GIS system) to produce zonal mapping that enhance and ease the identification of waste categorization and separation.

In addition, there can be close observation of the trucks from a central point during the collection process. A new land fill should be created in the three outskirts locations in Limbe, so as to save the travel time and save cost for the waste management company. Places like Batoke, Bimbina and Mile 4 ought to be considered for more research. The aim is to create new land fills in order to solve the difficulty of terrain. Muscle powered vehicles should be introduced in areas with poor access so that waste management services should reach the most inaccessible areas in Limbe, particularly areas which have an elevated terrain.

Recycling of goods allows access to recyclable products and this is another strategy employed to reduce waste. Better eco-friendly articles which will ease the reduction of the amount of waste generated, since this material will easily be washed away from the waste streams every time they are used to make other goods.

More to the above, companies starting up on eco-friendly solutions like on the recycling of plastic and other materials should be given incentives by the government of Cameroon. Loans and grants should be at the disposal of these companies to encourage such moves as it will develop the given economy in the country. Rather than beginning waste management from generation, a new model is advanced by the government starting from the production of goods and services that will ease the actual disposal process. Figure 10 gives us a vivid view of the process.

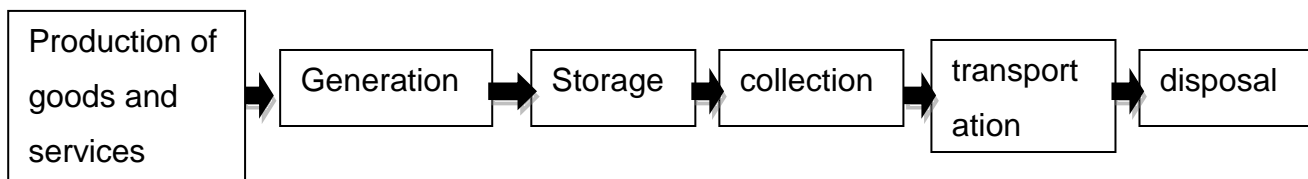


FIGURE10Newapproaches for Municipal Solid Waste Management in Cameroon

Waste management should equally be placed through education and public sensitization system. Literature has a supportive role for public education in a successful solid waste management program. In order to create public awareness and foster behavioral change, campaigns should be part of the strategy including disciplinary measures for violators of the program. The advancement of effective public campaigns is a move in promoting cultural transformation for solid waste management reforms in Cameroon. Despite this, the Limbe council should work in partnership with NGOs to pass out the information to the local population. The main objective should be to enhance public participation in source separation programs, also schemes educating the public about source separation. Table 8 below explains the willingness of the people to take active part in a better waste management scheme; 69.0% reported not willing to pay for recycling pick up; the people never showed any enthusiasm for other schemes linked with an incentive for them. On the other hand, 93% wanted to take part in a program which accounted financially for every bottle returned. In confirmity, incentives will have to be put in place to motivate people to take part in a program of such caliber. Nonetheless, the

whole populations were more interested in information on composing, re-use and recycling with enthusiasm to learn. It is vital to bring in these programs.

TABLE 8 Respondent`s willingness to participate in waste reduction program

	Respondents willing to pay for pick up of these recycling materials from home		Respondents willing to participate in program to compost food and yard waste		Respondents willing to participate in program that pays for each plastic bottles they return		Respondents that will like more information about compost, reuse and recycle	
	count	%	count	%	count	%	count	%
Don't know	7	7.0%	11	11.0%	1	1.0%		
No	69	69.0%	2	2.0%	6	6.0%		
Yes	24	24.0%	87	87.0%	93	93.0%	100	100.0%
total	100	100.0%	100	100.0%	100	100.0%	100	100.0%

Planners should get involved in the waste management planning procedure. This is because planners tend to come up with a better process that can help to obtain better organization. The community's involvement in the planning process will be heavy as they are producers of waste. According Post (2007) communities that participates in a program or project on waste have a 90% success rate. For planning to be effective it involved the mutual participation of the stakeholders and community members in the planning process. Present collection services reaching only a fraction of the research area population and in response to the current collection situation, unsustainable disposal methods are put in place to dispose of non biodegradable object, such as metals, glass and plastics. The low level of services is of high concern to the community and

74% talked of the need to improved services, suggesting frequent collection daily. In the same direction HYSACAM should collaborate with the community to create a collection scheme that satisfies the need of the community by meeting up with the disposal cycle of the inhabitants.

In addition, the amount of plastics containers shared through out the city is not enough regarding the zonal proposition of the research, the number of these plastic containers need to increase.

Appropriate legislation for a comprehensive waste management law should be enacted in Cameroon. Law should gives room for the harmonization of various ministries duties in the waste management sector. The law should also make provision for PPP in waste management and provide the cities with efficient finance to meet up with the growing need to waste management.

The government is doing a good job by constructing new roads in Limbe which has given access once inaccessible neighborhoods to waste truckfrom HYSACAM. Example in the mile 1 Bota Hospital road and the Mbende-Lumpsum road. There are to create more roads in Limbe which is very important.

This is what Ewoko (2010) said in his conclusion in his research on municipal solid waste management in Limbe. In Cameroon; many problems have been arising leading to poor municipal solid waste management. There are very poor formulated legislation responsibilities, poor collection efficiency, infrastructure, finance, population growth, poor education and awareness, poor recycling technologies, high city growth and poor disposable practices are all barriers in the waste management systems in Cameroon. Study shows that the distance to waste dumps has been one of the biggest problems face by waste management systems in Cameroon and Limbe. Furthermore, poor infrastructure has lead to a higher degree of poor collection and transportation efficiency. The number of garbage bins should be increased in many areas around the municipality to improve collection efficiency and should be placed next to paved roads. The

recycling of waste materials should further be developed in order to reduce the quantities of pure waste. Transfer stations should be well established to improve people's efficiency on pre-collection and will significantly improve the waste collection rate. Public awareness is highly needed more especially on household waste by targeting the low level of people who mostly have informal education. The municipality, householders and stakeholders need to come up on a good agreement for the need of proper monitoring and regulations to achieve the waste management objectives. The conclusions base on this study is quite different from my own conclusions.

6.1 Implications for further research

The study looked into the issue of municipal solid waste problem in Limbe, especially the problems of waste management efforts in the country. In the course of the research, however, a number of key factors have been identified which seriously influence the organization of solid waste management in Limbe. These include appropriate technologies for solid waste management, the funding and governance of waste management, urban land used and house planning, waste stream studies for data generation, liquid waste disposal medical waste and E waste disposal. There are other factors that should benefit from further studies so as to comprehend and plan a sustainable urban development.

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8 APPENDICES

Appendix 1

Policy Documents

A key responsibility of ministerial department related to waste management in Cameroon

Ministerial department	Key responsibilities related to waste management in Cameroon	Statutory Order
Ministry of Territorial Administration and Decentralization (MINTAD)	Follow-up and implement regulations for organization and functioning of Councils; Oversees the execution of the budget of the government's council support fund (FEICOM); Restoration of hygiene and public sanitation; Supervises Urban Councils which are responsible for follow-up and control— industrial waste management, management of all public spaces and infrastructure; Sweeping of streets, collection, transportation and treatment of household waste	Circular letter No. 0040/LC/MINAT/DCTD of 04/04/00, Order No. 00072/MINAT/MINVILLE of 21/05/00, Law No. 714/23 of 5/12/74, Law no. 2004/18 of 22/07/04
Ministry of Mines, Industries and Technological Development (MINMITD)	Develop strategies for industrial development and the control of Classified and commercial installations for pollution, security, hygiene and industrial nuisance; Define norms for industrial pollution; List of dangerous, obnoxious and polluting facilities in order to inform the public; Develops regulations governing installation and exploitation of facilities classified as dangerous, obnoxious and polluting	Decree No. 99/818/PM of 9/11/99, Order No. 13/MINMEE/DMG/SL of 19/04/77, 02/MINMEE/DMG/SDAMlof 4/01/9

Ministry of Economy and Finance (MINEFI)	Financial control of organizations benefiting from supplementary budgets and autonomous public establishments, i.e. Councils; Responsible for managing the Finance Law as enacted by Parliament	Constitution Decree No. 2004/320 of 08/12/04
Ministry of Urban Development and Housing (MINDUH)	Develops and implement urban restructuring, management strategies, sanitation and drainage; Defines and enforces norms of hygiene/sanitation, collection and/or treatment of household waste; Liaises with international agencies for urban development	Order No. 00072/MINAT/MINVILL of 21/05/00

Ministerial department	Key responsibilities related to waste management in Cameroon	Statutory Order
Ministry of Environment and Nature Protection (MINENP)	Collaborates with other agencies to define measures for the rational management of natural resources; Effective control of investigation and pollution in the field; Specifies the criteria (project specific) and supervises environmental impact	Decree No. 2005/0577/PM of 23/02/05 7], Order No. 006/MINEP of 08/03/05

	assessments	
Ministry of Public Health (MINPH)	Creates Hygiene and Sanitation Units in Councils; Renders technical support to the Hygiene and Sanitation Units of Councils, Proposes norms for collection, transportation and treatment of industrial, domestic waste and emptying of septic tanks; Designs and implements public education campaigns on hygiene and sanitation	Order No. D67/NS/NN/ST/SG/BMPHP/NNPA of 11/08/87, Circular letter NoD69/N6/DMHK/SHPA of August 1980

Source: Ebot et al. (2007)

B statutory order of key legislative elements related to waste management in Cameroon

Legislation	Key elements related to waste management in Cameroon	Statutory Order

<p>Law relating to Environmental Management (No. 96/12 of 5/08 1996)</p>	<p>National Environmental Management Plan related to the protection of the atmosphere, marine and continental waters, soils, sub soils and human settlements; Regulates installations that pose dangers to the public; Stipulates modalities for the conduct of Environmental Impact Assessments (EIA) and categories of operations subject to EIA; Specifies air emission and waste water discharge standards; Sets conditions for issuing authorizations for allotment and management of land for uses, i.e. industrial, urban etc; Conditions for waste handling (e.g. collection, storage, recycling, etc.); Prescriptions relating to waste elimination by persons producing or treating waste; Stipulates the terms of reference for the supervision of municipal dumps by the competent authorities</p>	<p>Decree No. 2005/0577/PM of 23/02/05, Order No. 006/MINEP of 08/03/05</p>
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<p>National Environmental Management Plan</p>	<p>Five year amendable plan; set up environmental information system; Preparation of bi-annual reports on the state of the environment in Cameroon, e.g. identifying problems arising from urban pollution and devising suitable micro-projects to mitigate the problems</p>	
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Law relating to the installation of Classified establishments (Law No. 98/15 of 14/07/98)	Stipulates two types of Classified establishments (Class I and Class II). Dump sites are classified as Class II establishments for which operation and management must follow prescribed guidance. It sets out the regulations governing the installation and exploitation of facilities classified dangerous, obnoxious and polluting;	Decree No. 99/818/PM of 9/11/99, Order No. 13/MINMEE/DMG/SL of 19/04/77, 02/MINMEE/DMG/SDAMIC of 04/01/99
National Water Code (Law No. 98/005/of 14/04/98)	Provides framework for the exploitation of water resources including waste disposal, Specifies modalities for the protection of surface and groundwater from pollution (including from dump sites).	Decree No. 2001/165/PM of 08/05/01
New Urban strategy, 1999	Partnership among the state, local council authorities and civil society in urban intervention in areas such as solid waste MG	

Source: Ebot et al. (2007)

Appendix 2

Table of Monthly Data for January 2013: Daily collection of 82.69 tons/day

	Number of trucks in operation	Number of trips	App. Weight at dumpsite (tons)
Compactor trucks (tons)	3	99	1026.56
Parts-model trucks (maximum 5 tons)	2	105	564.18
Dustin carrier (2 tons)	1	145	559.40
Total	6	506	2,150.12

Table of Monthly Data for February 2013: Daily collection of 64.24 tons/day

	Number of trucks in operation	Number of trips	App, weight at dump site (tons)
Compactor trucks (10 Tons)	3	88	739.52
Paris-model trucks (maximum 5 Tons)	2	133	396.74
Dustin carrier (2 tons)	2	170	534.74

Total	7	494	1670.38
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Table of Monthly data for March 2013 Daily collection of 86.04 tons/day

	Number of trucks in operation	Number of trips	App.weight at dumpsite (tons)
Compactor trucks (10 tons)	4	97	916.16
Paris-model trucks (maximum 5 tons)	2	99	434.50
Dustin carrier (2 tons)	2	226	886.46
Total	8	565	2237,12

Source: Limbe City Council

Appendix 3

Questionnaires

Do you think your community has a waste collection or disposal problem?

Yes No

Why or why not, please explain.....

The following questions, please respond with either YES, NO, Don` t know

Have you ever heard about composition?

2 Have you ever heard about recycling?

	1	2	3	4	5	6	7	8	9	10
Food waste										
Yard trimming										
Paper/cardboard										
Plastic										
Metal										
Glass										

How far do you agree with each of this statement? Please tick one box per row.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Public education about proper garbage management is one way to fix the garbage crisis					
Correct garbage management should not be taught in schools					
The purchase decisions that I make increase or decrease the amount of garbage in my household must get rid of					
People throw garbage on the streets and drains due to lack of alternative in doing a way of trash.					

The recent government bin on plastic bags from shops and general usage					
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Describe how you store household garbage. Select any choice below

1	Closed container, describe;
2	Open container, describe
3	Plastic bags
4	Pile in the yard
5	Other
6	Don't know

In your opinion what is the best method to dispose of waste.

Recycle	
Burn	
Increased collection frequency waste truck	
Restore	
Reuse	
Reduce	
Compost	
Don't know	

Authorities and Waste Management Agency Survey questions

Who are those responsible for solid waste management in Limbe? And where this agency does takes power from (constitution, acts and regulations)?

Is the agency having enough right to formaulate rules, laws or policies pertaining to solid waste management in Limbe?

Solid waste management is finances by whom in theLimbe municipality? Is it the local municipality, or the central government? What are the financial provisions? Is it the local municipality that collects taxes, levies for solid waste management?

What is the current population being catered by the waste management agency?

What is the situation in terms of infrastructure (number of waste collection vehicles, personnel employed for waste collection and management)?

How is waste collected and transported in Limbe municipality? What method of collection is use in limbe, is it pick-up by tractors/trucks; individual drop-off, transfer station and frequency of collection.

What is the major component of solid waste management currently practiced?

What are the problems with the system dumping along the access road.

Are there any reductions or reuse programmes? Describe in details if any.

Is there any compositing of organic wastes? Is there any centralized or backyard composting? How many households participate? Is there any institutional composting activities?

Describe any barriers to participation in composting activities

Are there any recycling schemes? Describe if any does programs for paper, glass, metal, cardboard and plastic, Gives details of collection and separation.

Is there any barrier to participation?

Do abandoned dumps exist? What is the distance from the town? Is there any household in the vicinity of these dumps?

Do abandoned dumps exist? Where are they located?

What is the any supervision during operation for this dump site?

Who manages dumps operation?

Does supervision take part during operation hours?

Is the controlled access to the site (fenced, locked)?

What are the kinds of waste accepted in this dump site?

Do they separate the wastes? If yes how is it done?

What method is used for filling, trenching, burying, and dumping down a hillside, pilling, compacting, and covering?

What are the problems with this site?

Questions on nature of waste composition

What is the major constituent of waste (organic, biodegradable, non-degradable, inorganic, plastics)?

How has waste composition changed over the years?

What has been the key area of focus in terms of waste composition (particular article/item, changing nature of composition)?

Are present policies good enough to enhance sustainable waste management? If not, what are the policies that need urgent attention?

Who is the main player? How to bring them to a common platform? What are the possible road maps in this regards?

What areas need more attention in terms of waste management (reduction, composting, source separation, improving collection and transportation of waste)?

Should the private sector be involved in sustainable solid waste management?

What role can the general people, local solid waste management experts, community, non-governmental organization, development agencies, government at various levels play in promote sustainable solid waste management?