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DOMESTIC WASTE MANAGEMENT AND ITS EFFECTS ON THE ENVIRONMENT OF YAOUNDE II

A dissertation submitted in partial fulfilment of the requirements for the award of a Master's Degree in Geography

Specialty: Marginality, Strategies of Development and Globalisation

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DEDICATION

To my parents; Mr. Wainkain Christopher Ndabuf and Pr. Wainkem Prasidis Nain

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ABSTRACT

Domestic waste management is one of the environmental challenges resulting from rapid population growth and diversification of socio-economic activities in many developing countries such as Cameroon. Poor domestic waste management has become a daunting task for municipal authorities who seem to lack the capacity to tackle the mounting waste situation. In order to strengthen waste management policies in Cameroon, the state has created a legal framework and the institutions to put the defined strategies into practice. Despite the presence of these tools, the insufficiencies of the public waste services continue to be felt in Yaounde II especially on the environment and public health.

This work sets out to investigate the effects of poor management practices on the environment of Yaoundé II. Three hypotheses were established to guide the study. The research methods and techniques that were adopted and used led to the collection, processing and analysis of data. A mixed methodology was used which combined the use of questionnaires and interview data with observations and field complemented the data. Additional data was obtained through field surveys where a total of 137 respondents from the 14 quarters of Yaoundé II actively responded.

The outcome of the data collected, treated, analysed and interpreted revealed that the increasing sources of waste management are as a result of an increase in population and household activities 46% and diversification of socio-economic activities 54%. Also, all respondents believe that the waste produced has surpassed the management capacity in Yaounde II. The study also reveals that 83% of the respondents do not think that the policies and institutions involved in waste management are efficient as opposed to just 17% who believe they are. In the assessment of the environmental effects, it was realized that air pollution swarm the study area representing 39% followed by aesthetic pollution (26%), blocked drains (18%), water pollution (10%) and lastly, soil pollution (7%). The study equally found out that the sector is not entirely negative as waste is used in the agricultural sector (27%), it has led to the creation of jobs (30%), it has given the rise to some innovations (16%) and the promotion of collaboration between stakeholders (21%). Based on these findings, it has been argued that the solution to the worsening environmental conditions in Yaounde II lies in the prioritization of collaborations not just between state stakeholders but also with the populations involved which should be backed up by inputs of financial resources.

Key word: Domestic waste, domestic waste management, environment, health, effects, public awareness. Yaoundé II.

RESUME

La gestion des déchets domestiques est l'un des défis environnementaux de la croissance démographique rapide et de la diversification des activités socio-économiques auxquels sont confrontés de nombreux pays comme le Cameroun. La mauvaise gestion des déchets domestiques est devenue une tâche ardue pour les autorités municipales qui semblent ne pas avoir la capacité de faire face à la situation croissante des déchets. Au Cameroun, pour renforcer les politiques de gestion des déchets, l'État a créé un cadre juridique ainsi que les institutions pour mettre en pratique les stratégies définies. Malgré la présence de ces outils, les insuffisances des services publics de gestion des déchets continuent de se faire sentir à Yaoundé II notamment sur l'environnement et la santé publique.

Ce travail vise à étudier les effets des mauvaises pratiques de gestion sur l'environnement de Yaoundé II. Trois hypothèses ont été établies pour guider l'étude. Les méthodes et techniques de recherche qui ont été adoptées et utilisées ont conduit à la collecte, au traitement et à l'analyse des données. Une méthodologie mixte a été utilisée qui combinait l'utilisation de questionnaires et de données d'entrevue avec des observations sur le terrain complétait les données. Des données supplémentaires ont été obtenues grâce à des enquêtes de terrain où un total de 137 répondants des 14 quartiers de Yaoundé II ont répondu activement.

Les résultats des données recueillies, traitées, analysées et interprétées ont révélé que les sources croissantes de gestion des déchets sont le résultat d'une augmentation de la population et des activités des ménages de 46% et d'une diversification des activités socio-économiques de 54%. Ils affirment aussi que la production des déchets a dépassé la capacité de gestion des déchets à Yaoundé II. L'étude a également révélé que 83 % des personnes interrogées ne pense pas que les politiques et institutions impliqués dans la gestion des déchets sont efficaces contre seulement 17% qui pensent qu'elles le sont. Dans l'évaluation des effets environnementaux, il a été réalisé que la pollution de l'air essaime la zone d'étude représentant (39%) suivie de la pollution esthétique (26%), des drains obstrués (18%), de la pollution de l'eau (10%) et enfin, de la pollution des sols (7%.) L'étude a également révélé que le secteur n'est pas entièrement négatif car les déchets sont utilisés dans le secteur agricole (27%), il a conduit à la création d'emplois (30%), il a donné lieu à certaines innovations (16%) et la promotion de la collaboration entre les parties prenantes (21%). Sur la base de ces résultats, il a été soutenu que la solution à la détérioration des conditions environnementales à Yaoundé II réside dans la priorisation des collaborations non seulement entre les parties prenantes de l'État, mais aussi avec les populations impliquées, qui devraient être soutenues par des apports de ressources financières.

Mots-clés : Déchets ménagers, gestion des déchets ménagers, environnement, santé, effets, sensibilisation du public, Yaounde II.

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LIST OF ABBREVIATIONS AND ACRONYMS

BUCREP : Bureau Central de Recensement et d'Etude de la Population
CAMWATER : Cameroon Water Utilities Corporation
CSA : Civil Society Actors
DTC : Decentralized Territorial Communities
DW : Domestic Waste
DWM : Domestic Waste Management
ERA : Environnement, Recherche, Action
ESO : Espaces et Sociétés
FEICOM : Fond Spécial d'Equipement d'Intervention Intercommunale
HYSACAM : Hygiene and Sanitation Cameroon
IDP : Internally Displaced Persons
IMF : International Monetary Fund
MINDMIDT : Ministry of mines, Industry and Technological Development
MINEPDED : Ministry of Environment, Nature Protection and Sustainable Development
MINHUD : Ministry of Housing and Urban Development
MINPH : Ministry of Public Health
MINTAD : Ministry of Territorial Administration
MSW : Municipal Solid Waste
NGO : Non-Governmental Organizations
NIC : National Institute of Cartography
NIS : National Institute of Statistics
NSA : Non-State Actors
PWC : Public Waste Container
UC : Urban Council
UN : United Nations
UNEP : United Nations Environmental Program
UNFPA : United Nations Fund for Populations
WB : World Bank
WHO : World Health Organization
WM : Waste Management
WWF : World Wildlife Fund

YDM : Yaounde District Municipality

YCC : Yaounde City Council

GENERAL INTRODUCTION

1.1 Background to the study

Domestic waste management (DWM) has become an important component of the environmental sector in Cameroon. It includes activities and actions required to manage waste from its inception to its final disposal that is the collection, transport, treatment and final disposal of the waste. Throughout most of history, the amount of waste generated by humans has been insignificant due to low levels of population density and exploitation of natural resources. The major constituents of waste in yesteryear's traditional Africa were wood, food wastes, and vegetables etc. which were generally biodegradable. Today, the story is different. With the advent of technology where not only are many industries involved in the manufacturing of non-biodegradable products, but many households have abandoned the traditional methods of preservation to adopt the so-called modern industrial products such as plastics papers and plastic bottles. According to the experts of the United Nations Fund for Populations (UNFPA, 2004), population growth is one of the principal causes of the continuous increase in waste generation. Globally, millions of tons of waste are produced and generated every day and it can easily be observed by the huge piles of garbage lying uncollected on streets, causing visual inconveniences, environmental pollution and posing a threat to public health.

It is typical that developing countries lack the financial, human, technological, infrastructural and related resources to develop effective domestic waste management systems (Zhu et al., 2008). It is asserted in the 2005 United Nations Environmental Program (UNEP) annual report (as cited by Perou, 2012) that in many developing countries, the greatest impediments to the effective and environmentally effective handing of solid waste are managerial rather than technical. The Cameroonian government has strengthened the legal framework to regulate waste recovery and recycling activities.

Harday and Satterwait (2001) points out that Africa is known to be the least developed region in the world with 38% urbanization. They further state that although this is low compared to other countries in the world, African countries are experiencing rapid development with growth rates of 4% per annum. In the face of this development, African countries are bogged by huge amounts of waste which has direct bearings on human health in particular and on the environment in general. The 20th and the beginning of the 21st centuries have been marked with a substantial increase of domestic waste in relation to the rapid population growth

and diversification of activities. According to the United Nations Organization (UNO) (2014), the world's population attained 7 billion in the beginning of the 21st century and it continues to increase by 90 million every year. Rapid urban development facing developing countries has untold consequences on such countries as a whole and on the African continent in particular. To this effect, managing waste and the environment becomes even harder hence environmental degradation.

In Cameroon, the problem of domestic waste management is prevalent. Most towns produce waste that they are not capable of managing. This is the case of Yaounde II in the Mfoundi division where the sanitary conditions are precarious. This is easily identified by the persistent heaps of uncollected waste found on streets or ever-present illegal dumps. This practice produces unpleasant odours and liquids which has led to environmental degradation and health hazards. This explains why Dongquin et al. (2010) posits that "the characteristics and quantity of domestic waste is not only the result of the growing population or the rising living standards and technological development but also the result of the type of resources being used in the country". Hence, only a careful management can limit the damage done to the environment. The need to manage this increasing waste in an environmentally effective, technologically feasible, economically affordable and socially acceptable manner is a problem faced by all nations of the world today (Zurbrügg, 2002). Even though efforts have been employed in the domain of waste management, with the aim of improving the living quality of the population, the results are yet to be visible.

1.2 Justification of the study

Domestic waste management has become a major challenge in Yaounde II. Confronted with the rapid population growth and intensification of urbanization, waste management is a topic that deserves the technology and attention given to other works of the society more than they actually need it. Domestic waste management still faces a series of challenges which makes this topic relevant for research to be conducted in order to shed more light on the issue. This study therefore intends to explore the problems in the waste management sector. The results of this study will create awareness on the waste management practices. It would also show how poor collaboration between the general public and the stakeholders involved in the waste management has contributed to the worsening of the situation. This study consequently serves as a reminder to all stakeholders involved in waste management as well as the

population. It aims at proposing lasting solutions so as to limit environmental degradation, improve on human health and living conditions.

2. Delimitation of the study

2.1. Temporal delimitation

This study covered a period running from the late 80s to present. This is in order to give a clear picture of the evolution of the concept waste management and show how rapid demographic growth and the continuous increase in standards of living has affected the management practices in Yaounde II. Also, this time frame was chosen as there is more data available as from this time frame.

2.2 Thematic delimitation

This study concentrates on the sources of waste management and how they are managed in Yaounde II. The study also assesses polices and institutional frameworks of waste management in Cameroon as well as the effects of waste management on the environment. The coping strategies adopted by the inhabitants of Yaounde II to face these challenges are also explored in this study.

2.3 Spatial delimitation

Yaounde II area was created in 1987 by the presidential decree no 87/1365 of September 25, 1987. It lies between longitude 3.8916^0 N and $3^0$53'29.8 N and latitude 11.4981^0 and $11^0$29'.53.3" E. It is situated at the heart of the political capital of Cameroon at about 270km away from the Atlantic Ocean. It covers an area of 15km2. Its borders are delimited from the North and North West by the CAY 1 (Commune d'Arrondissement de Yaounde); from the south by CAY 6 and South West and East by the CAY 7 and at the East by the CAY 3. A majority of the population here are Ewondos with 54 out of 87 households that we visited (that is, 62.07%) we also find Bamendas, Bamiliekes and Hausas amongst others.

It has a population of about 336,381 inhabitants according to the general census of 2010 and is distributed in the 18 districts of its municipality. It increased by 40.79% as it was at 238,927 as presented by the 2005 population census). The population continues to increase since then.

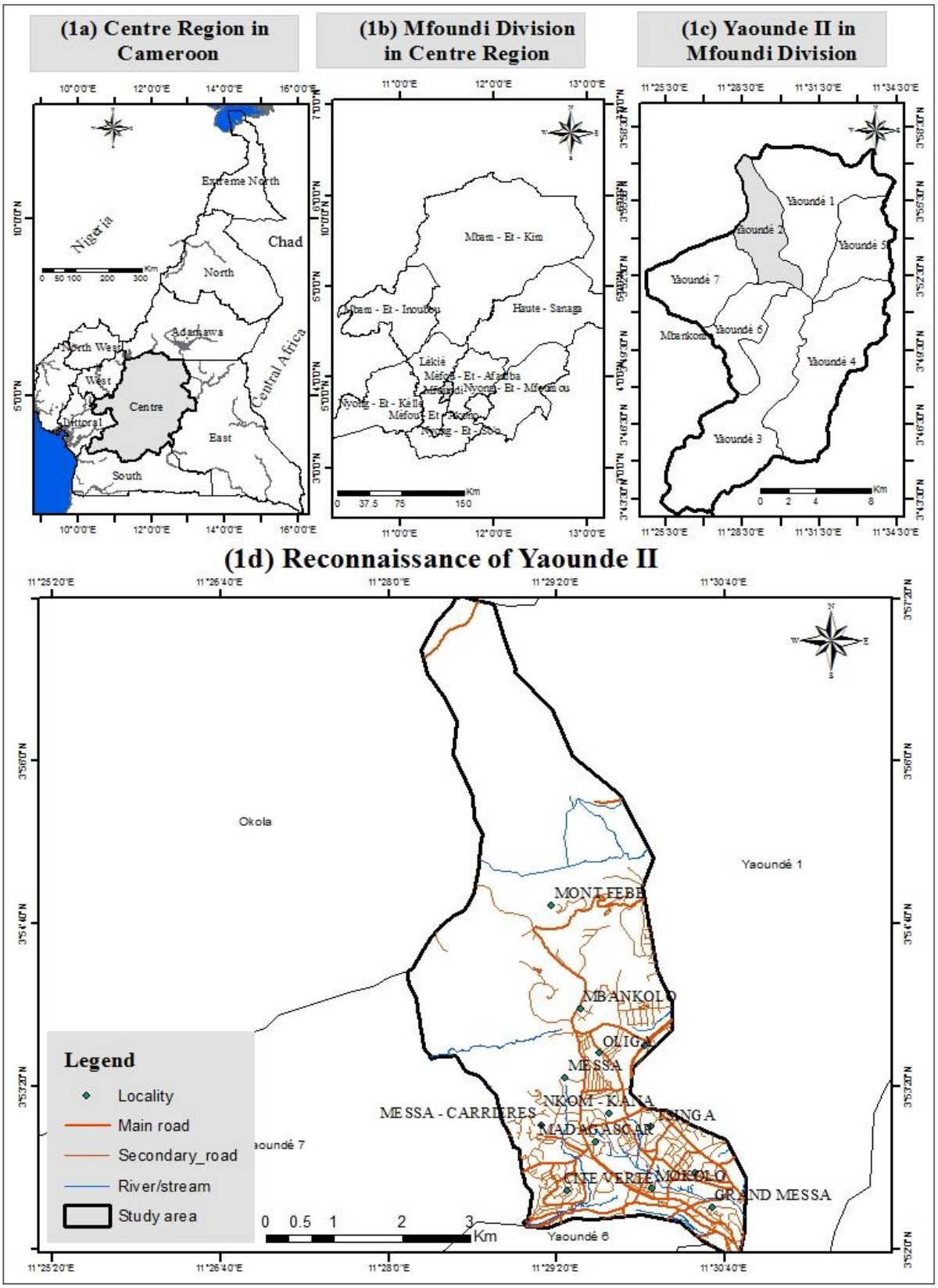


Figure 1: Location of the study area

Source: Adapted from the administrative map of Cameroon, NIC 2020, Yaounde.

2.2.1. Presentation of the physical milieu

2.2.1.1. Relief

The relief of Yaounde II is dominated by the most outstanding mountains and hills of the capital, notably Mt. Mbankolo (which displays the great John Paul II auditorium; a place of prayer and meditation) and Mt Febe (which houses the monastery and the sumptuous Mt. Febe hotel well known to the inhabitants of the town. The relief is well known and has golf course which is the only one in the city). Other mountains in this relief include Mt. Messa and Nkol Nyada mountains.

Despite the fact that the relief is dominated by mountains and hills, there are also lowlands which unfortunately accommodate slums, squatter settlements and quarries (for example, Mokolo, Messa, Carriere and Tsinga etc.). These areas are in non-compliance with the urban planning and sanitation criteria and therefore, constitute the main source of pollution of the locality. The hilly nature of the relief of Yaounde II is a major constraint to proper waste management in the town. This is because these hilly terrains do not allow the trucks to easily manoeuvre in such areas. Also, with the rapid urbanization, many people have built on slopes and difficult terrains which further compound the problem of waste management.

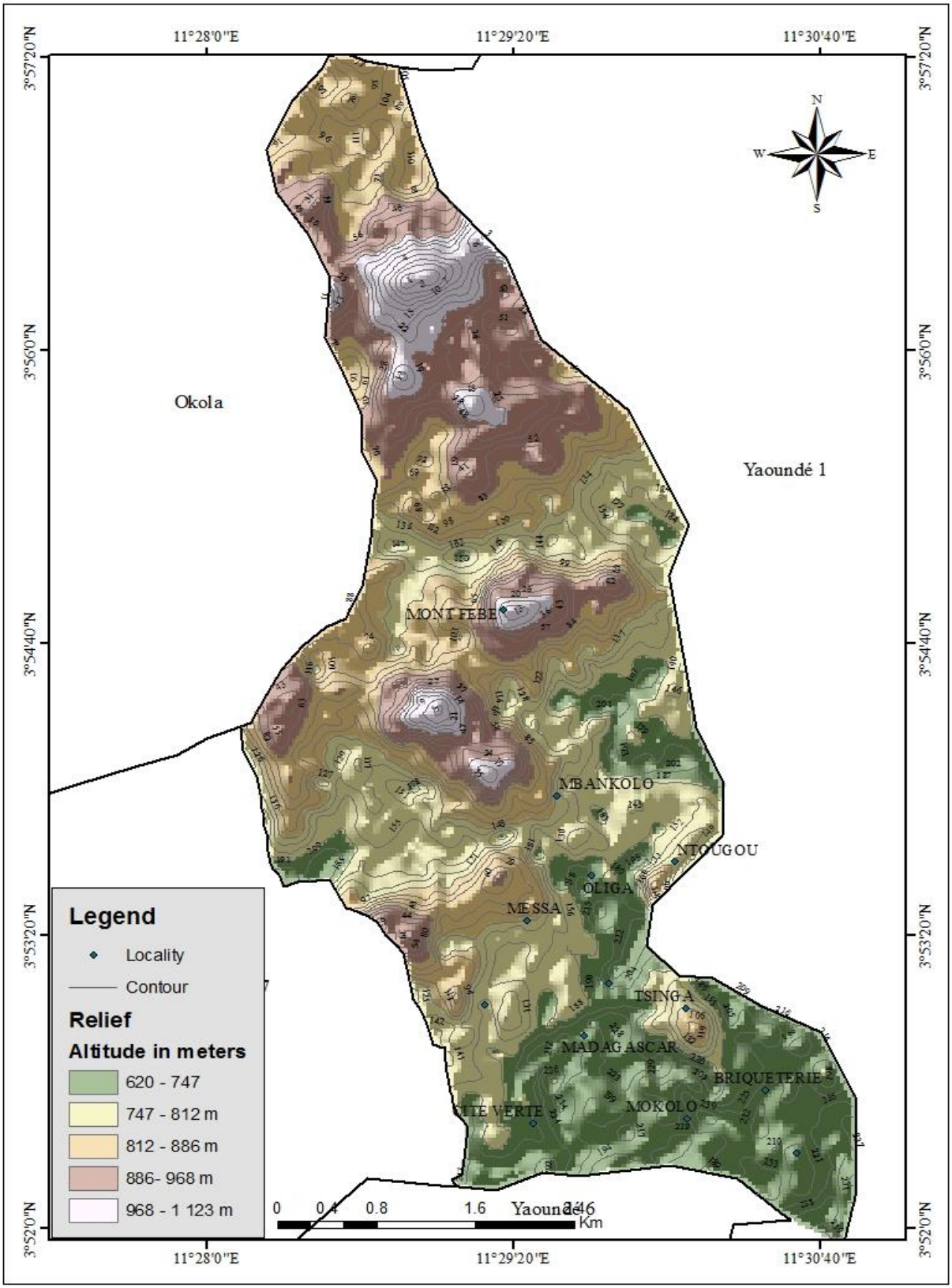


Figure 2: Relief of the study area

Source: SRTM,2020 Yaounde.

2.2.1.1.1. Climate

Yaounde II enjoys an equatorial climate with two rainy and two dry seasons: the rainy and dry seasons. These seasons have gradually been altered overtime due to some factors such as population increase, urbanization, pollution etc.

2.4 Socio-economic characteristics

Yaounde II is a multi-ethnic municipality characterised by peaceful cohabitation between its populations despite their diverse ancestries. Its population is estimated at over 336,381 and spread over the 14 neighbourhoods. It is easily noticed that the settling of the population here is motivated by tribal, ethnic or cultural affinities. For instance:

- Briqueterie and Ekoudou are mainly Northerners.
- Carriere and Nkomkana are mainly people from the Western part of the country.
- The entire rural area of Mbankolo and Febe are mostly occupied by the natives.
- The Mokolo is dominated by people from the centre region.

All these groups of people live in a spirit of togetherness and religious tolerance. For instance, there is the great mosque of Tsinga which is the largest and most frequently visited mosque of the town and the renowned Catholic missions of Tsinga and Mokolo all at the same place. There is also a number of protestant and other revival churches.

With regard to potable water, CAMWATER which is the enterprise that supplies water to the country is the main supplier in this zone. Others who cannot afford these services drill bore holes and wells for local consumption.

In the health sector, Yaounde II houses two of the most renowned hospitals of the capital: The Central hospital and the Chantal Biya Foundation. We also find a number of other health centres. The hasty increase in the number of these health centres is one of the reasons for the production of waste in the town.

Education wise, we differentiate primary, secondary and higher institutions of learning in both French and English.

Yaounde II promotes various activities. From primary to tertiary activities, such as; architecture, supermarkets, law firms, bailiffs, trade and service provisions, small trades and staff, production units of goods and services, small industries, agriculture and animal husbandry, just to list a few.

The town also houses the Mokolo market which is considered the biggest and most populated in the town and the 8th market very much in demand for fresh food from the outskirts and its large wildlife sector. It is also one of the sectors in the town which is considered to have highest waste generators.

3. Interest of the study

This study has 3 main interests, i.e. the academic, socio-economic and administrative or practical interest.

3.1. Academic interest

It would serve as an addition or contribution to knowledge. With regard to waste management, it would not only serve as a contribution to knowledge, but also, it would permit a better comprehension of waste management practices employed by both the local population and the authorities. Also, it would make people to be aware of the dangers of poor waste management on not just the environment but on health as well.

3.2. Socio-economic interest

It is well known that the geographers' interest has always been centred on human activities and their interaction with the environment. This study shows the validity of this statement. Decent and frequent waste collection guarantees a healthy environment and better living condition. The significance of this study is revealed by the fact that it discusses living conditions and socio-economic life of the inhabitants of Yaounde II and how it impacts the environment.

3.3. Administrative/practical interest

The results of this study would permit the stakeholders involved in waste management in Yaounde II to have a better understanding of how the local population should be more involved in the waste management process. They can therefore use this work as a reference to know where they are lagging so as to curb the situation and aim for a healthy environment.

4. Problem statement

Domestic waste management (DWM) is a major consequence of development and modernization and its environmental implications have become a contemporary issue in sub-Saharan Africa. The rapid urban development that most developing countries face has untold consequences on this part of the world. The generation of waste and final disposal poses a

serious problem in almost every country as they impact the environment, societal well-being and human health when not properly managed. Towns and cities in Cameroon exhibit the burdens of waste management (WM) which characterizes so many African cities. Several factors such as increase in population, urbanization, inadequate financial resources and technology to ease waste management practices, lack of cooperation between the stakeholders involved, lack of expertise and low levels of law enforcement often lead to poor DWM. Such challenges and their impacts have led to a search for sustainable solutions in domestic waste management in both developed and developing countries. According to the World Bank (2010), the risk of improper waste management is very high on human health and the environment. Despite this, management projects are very few in Cameroon. Major constraints to a safe environment are imposed by significant changes in the quality of waste. In 2006, the global amount of municipal waste generated reached 2.02 billion tons, representing a 7% annual increase since 2003 (Global Waste Management Market Report, 2007). The situation is similar in Yaounde II where DW increases daily at an alarming rate rendering the collection, transportation, disposal and treatment difficult.

Increasing domestic waste production has surpassed management capacity in Yaounde II is a reflection of the increasing population. DW is produced and generated at a rate that outpaces the capacity to properly manage it and this has largely influenced the collection, transportation, treatment and disposal of domestic waste in Yaounde II. Waste varies in type and quantity as well as between various neighbourhoods. Rapid increase in population, proliferation of socio-economic activities, poor mentalities, few suitable structures to adequately manage and eliminate waste, the distance of the public waste containers (PWCs) from houses, inaccessibility due to lack of roads in some areas of the town account for ineffective waste management. All these factors outpace the capacity to collect and dispose of it in a safe and environmentally sound manner vacant spaces. Managing such waste therefore represents one of the most important problems which the town of Yaounde II has to confront regarding the need for a healthy environment.

In addition, the policies and institutions that govern waste management in Yaounde II are ineffective. Despite the presence of several institutions involved with the management of waste in Yaounde II, their inefficiency is still strongly felt. This inefficiency can be justified by several failures which do not allow the implementation of some programs which could be of great help to the society. These failures among other things include: the apathetic attitude of the government and other stakeholders, too many actors without specifically defined roles,

limited financial resources and technical knowhow, a non-existent embryonic regulatory institutional framework, low levels of law enforcement, inconsistent decision making, lack of collaboration between the different stakeholders involved, but to name a few. Besides these, the efforts to enhance waste management from homes as it is the case with HYSACAM are usually so limited and irregular making the consequences to continue to persist: Yet those involved do not seem to understand the need to sensitize the population or waste generators of such waste on the management skills which could help to decompose domestic waste conveniently without necessarily littering or dumping waste in such a way as to pollute the environment. This has equally gone a long way to affect the behaviours, attitudes and perceptions of people towards waste.

In furtherance, inadequate domestic waste management has brought about environmental problems as well as health risks. The unbothered nature and poor mentality of the populations regarding the question of waste poses a serious challenge in the town. We noticed that people empty their trash by water bodies, by the roads, streets and even by their own homes. Huge piles of garbage lie by roads, streets and even dustbins which has proven to have high implications on not just the environment but also on human health. Some of the effects on the environment include: land, air, water and aesthetic pollution, blocked drains, greenhouse gases generated from the decomposition of organic waste landfills and untreated leachate which pollutes surrounding soils and water bodies. Some effects on health include diseases such as malaria, typhoid, and cholera but to list a few. All these lead to environmental deterioration since most of the waste is not degradable, hence a call for concern.

These problems, resulting from poor management of domestic are worth investigating with the hope to contribute to a proper environmental management plan. Hence, the following research questions:

4.1. Research questions

A. General Research Question

- What are the sources of waste production, the policies and institutions involved in the management of domestic waste and the effects on the environment of Yaounde II?

B. Specific Research Questions

1- What are the sources of waste production and how are they managed in Yaounde II?

2- How effective are the policies and institutions involved in the management of domestic waste in Yaounde II?
3- To what extent has domestic waste management impacted the Yaounde II environment?

4.2. Research objectives

A General Research Objective

- This study seeks to assess the sources of massive waste production, how they are managed, the policies and institutions involved in waste management and the effects on the environment of Yaounde II.

B Specific Research Objectives

1- To investigate the sources of waste production and how they are managed in Yaounde II.
2- To critically examine the policies and institutional framework that governs domestic waste management in Yaounde II.
3- To evaluate the extent to which DWM has impacted the Yaounde II environment.

4.3 Research Hypotheses

1- Increasing domestic waste production has surpassed management capacity in Yaounde II.
2- Ineffective policies and institutional framework have largely influenced the management of domestic waste in Yaounde II
3- Insufficient domestic waste management has largely affected the environment of Yaounde II.

5. LITERATURE REVIEW

It is unwise to proceed with a research work without reading to uncover knowledge that has been written and stored by various authors in the related domain of research. It is in this light that, a wide range of texts, journals, conference papers, published and unpublished documents, reports, dissertations and PhD theses were consulted to build a rich and appropriate literature to proceed with this study. This permitted the researcher to have some additional ideas on waste management and factors igniting the rapid increase in waste especially in urban areas. Equally, the rationale was also to avoid duplication of work that has already been carried out elsewhere. These documented works have divergent points of views concerning the topic

which focuses on waste management in Yaounde II, impacts of the solid domestic waste in the environment and regulatory policy framework in waste management.

Waste Management and policies

Several studies and research have been conducted on the sources and characteristics of wastes as well as the possible adverse effect of inappropriate handling and best international practices. One thing that is still not clear, however, is what exactly constitutes waste? How much do we know about what should be categorised as waste? What are the historical contexts of waste managements? (Ebikapade and Jim, 2016). This is especially as most human activities generate waste (Brunner and Rechberger, 2014). Despite this, the production of wastes remains a major source of concern as it has always been since pre-historic times (Chandler et al, 1997). In recent times, the rate and quantity of waste generated have been on the increase. As the volume of wastes increases, so also does the variety of waste (Vergara and Tchobanoglous, 2012). Unlike the pre-historic period where wastes were merely a source of nuisance that needed to be disposed of. Proper management was not a major issue as the population was low and vast amounts of land were available to the population at that time. Unlike the views of these authors, current populations are high and the volumes of waste produced are huge making it difficult to easily manage. Field work has thrown more light on this issue of increasing population and waste produced with time.

Ebikapade and Jim (2016) further underpinned that although it is generally agreed that wastes management services are essential services that must be provided in every society, nonetheless very little is known on what exactly constitute a waste. Knowing that the concept of waste is highly subjective as one man's wastes is a resource to another. Hence, it is important to have a clear guide as to what could be classified as waste. The present research therefore examines the concept of waste and waste management with a view to determining what waste is, how it can be classified and managed. It is also the interest of this study to exploit and operationalized the concept of waste management to also show the relevance of waste via recycling.

According to Maystre et al. (1994), good waste management requires information on the nature, characteristics and size of the waste produced. The scholars then offered a complete satisfaction of urban waste management strategies before focusing specifically on household solid waste of which pre-collection, collection, transport and treatment were analysed. The

authors found out that it is preferable to carry out some sort of separation of waste according to its nature (biodegradable or not). It is important to have assembling points arranged to avoid harming the environment and that pre-collection and collection must be dome regularly and be accessible to the entire population. To assess the accessibility of pre-collection and collection services, the collection rate has to be proposed. This indicator is the percentage of waste actually collected and compared to the actual production of waste. This study goes further to analyse waste management policies and strategies put in place by different organs to manage waste which are aspects that the above-mentioned authors were less interested in them.

According to Youssouph (1999), the problem of waste management is linked to the influence of geographic factors notably population growth, the proliferation of emission sites and the quality of equipment. In the same light, Gorgui Ciss, as cited by Mbiagjeu-Lawou (2015), through the examination of the increase in the volume of waste produced by the citizens of Dakar, Senegal (954 tons/day) shows that population growth and strong urban concentration poses problem of collection and treatment. According to this actor, all collection and treatment systems have shown the limits of their efficiency. The urban community of Dakar has opened up the garbage market to private companies after having entrusted the exclusivity of collection and unloading to the industrial and urban development of company of Senegal since 1985. While waiting for the establishment of the new collection system, the Dakar residents will be faced with the daily management of their waste. The study, however, does not only focus on the factors of waste management but also touches aspects of policies implemented in the management and also effects on the environment and human health which are aspects that most authors under look.

In a similar way, Onibokum et al. (2001), researching on the documentation and practical knowledge on the technical, administrative and institutional aspects of waste management in Africa noted that household waste is in a continuous increase and, thus, needs more proper and efficient policies in the management of the domestic waste. However, frameworks for action and implementation strategies must go hand in hand with new forms of governance in order to improve efficiency and promote the participation of the population in service delivery and waste collection. They noted a growing interest in partnerships between the public sector, the private sector and the community in containing waste management issues. They emphasized all the same that this interest mainly involved technical and financial question rather than the political, sociological and environmental aspects. The authors also found out that the technical and financial procedures did not lead to the organizational and institutional

methods necessary to allow citizens to understand the service and to participate fully in it because they lack a clear conceptual and strategic framework. These authors ultimately believe that, discussions on improving governance in the waste management sector lack the conceptual and strategic framework to empower populations at organizational and institutional levels. It is in this framework that this research goes further examine the organisational and institutional framework of waste management an aspect which literature has not yet emphasized on.

According to Vermande (1992), domestic waste causes multiple nuisances on the urban environment and seriously affects the health of city residents. According the author, the main impacts of poor management on the environment are many and include; the release of toxic gases: incineration or uncontrolled fires causes polyurethane, the fumes of a fairly toxic gas: phosgene. It should also be noted that, land filling causes the production of large quantities of methane which can give rise to explosions and fires. In addition, methane and carbon dioxide release contributes to accentuate the greenhouse effect, the cause of global warming. Clutter: when waste is not regularly removed, it clutters sidewalks and roadways, tarnishing them and destroying the beauty of the city. Due to all these effects both on the environment as well as on man, various domestic waste management policies have been put in place by the state in order to adopt them. As presented in these analyses, the author was more interested in purely environmental impacts of poor waste management neglecting human health repercussions though the two are intertwine.

This further explains why Nchouwat (2012), sees town planning as the rescue root for solid waste collection in the town of Foumban. To the researcher, each Cameroonian city should be properly organised in order to ease waste collection especially in poor neighbourhoods which seek to produce lots of waste but at times lacks access roads for waste collection organs to collect the waste which ends for several days or weeks on road sides. In the case of Yaounde II which this study dwells, this study goes further to place more emphasis on accessibility as a challenge to issues of waste management. Notwithstanding, the study transcends to also assess policies of waste management in Cameroon and in Yaounde II in particular. Furthermore, this work emphasizes on the preservation of the environment of cities through the combination of efforts and the multiplication of management techniques in this field. For a city to be able to solve the problem of waste within a given area, the human labour must automatically be strengthened and trained. Thus, the multiplication of partnerships between public and private actors turns out to be the driving force of this management. Waste management should not be entrusted to a single actor. There is the need for competition in the domain.

Tchobanoglous et al. (1993) describes solid waste as the waste produced by human activities that are in a solid or semisolid form and are thrown away as useless products. Beranek (1992) submitted that solid wastes are a broad group of wastes produced as a result of various activities such as agricultural activities, landscaping activities and other processes including domestic and commercial processes. He argued that solid wastes are distinctly different from waste water and gaseous waste emissions. His view is that, solid wastes are any wastes that people would normally consider fit for land disposal. Basu (2010) added that, solid waste includes municipal waste, some biomedical waste, electronic waste and some hazardous waste. Basu stated that solid waste could be putrescible and non-putrescible. Similarly, Kaseva& Gupta (1996) noted that solid wastes are waste materials from municipal, industrial and agricultural activities. Tchobanoglous et al. (1993) concluded that unlike other wastes, solid wastes do not disappear easily. They argued that, where they are thrown today is where they will still be found in future.

Sotamenou et al. (2005) assessed the impacts of a decentralized municipal solid waste (MSW) management system on the socio-economic and environmental development of an African city, south of the Sahara. In fact, not only the management of MSW in Yaounde is centralized that is provided by a single private company) the relief also makes it difficult for pick up/collection trucks to access some neighbourhoods which is detrimental to both the environment and to human health. Decentralization of the MSW management system through the multiplication of pre-collection actors and the construction of waste collection or transport centres in areas which are inaccessible to collection trucks appear to be the most effective solution to improve the MSW collection rate. This allows the creation of jobs foryoung people in the neighbourhoods and preserves the environment through recovery and recycling operations.They added that municipal solid waste is only a small fraction of the total solid waste arising. Vergara &Tchobanoglous (2012) observed that municipal solid waste reflects the lifestyles and customs of the people that produces it. They added that, MSW can have a negatively impact on the well-being of the public and the environment if not properly managed. Dixon & Jones (2005) reported that, the compositions of municipal solid include materials such as soil, garden and food waste, wood, paper, ashes, plastics, textiles and rubber. They concluded that, municipal solid wastes are a collection of wastes that are mainly from household and commercial sources. Similarly, Buah et al. (2007) added that, MSW mainly consist of food and garden waste, textiles, paper or cardboard, plastics, glass and metals. They argued that, due to the composition of MSW, the waste could easily be used for energy recovery

or the production of fuel. White et al. (1995) argued that, unlike other waste streams that are more homogeneous with a good percentage of each material, the composition of municipal solid waste is diverse and generally prone to changes from city to city and country to country.

According to Johansson (2006) and Kim et al., (2006) optimization of waste collection involves the novelty of spatial modelling techniques and GIS. These models can provide more effective and sustainable economic and environmental savings in waste management through the reduction of travel time, distance fuel consumption and pollutant emissions. These systems are particularly absent in the Yaounde II and HYSACAM partnership for waste management in the Yaounde city council area. According to the author, the use of GIS in tracking waste becomes very important in waste management techniques in most African cities like that of Yaounde, Cameroon.

Socio-environmental implications of domestic waste

A myriad of literature exists on the impacts of domestic waste environment and health related issues. Georg (1997), in his study carried out on the cities of Freetown (sierra Leone) and Conakry (Guinea) states that some diseases were linked to the phenomena of fermentation, putrefaction or contact with unhealthy environments. The research of Abdelli (2005) and Coulibaly (2006) confirm that "the proliferation of waste is a source of visual nuisance, animal morbidity and lung and carcinogenic diseases". These authors demonstrated that gas emissions during waste burning or incineration pollute the environment. This study goes in the same light to highlight the impact of waste on the environment and people's health paying greater attention on domestic solid waste.

There has been an increasing concern about the environment in which man lives. Solid wastes, mount of rubbish, garbage and sewage are being produced everyday by our urban society. In an attempt to dispose of these materials, man has carelessly polluted the environment. In a traditional underdeveloped world, a fact that partly reflects the sampling locations considered in the present work, household wastes are completely biodegradable and homogenous. Consequently, both biodegradable and non-biodegradable materials now constitute household wastes. In the past, men thought the environment had an infinite capacity to devour his waste without any ill effects (Olodae et al., 2009). More recently, however, man's health and welfare are being affected by environmental pollution. These pollutants are substances present naturally in the environment but when released in significant amount by humans, become toxic.

Ndukwe et al. 2019 underpinned that indiscriminate disposal of solid waste in dumpsites located within urban areas has proved to be a problem to nearby residents in most developing cities of the world, where Umuahia is no exception. Open dumps have environmental safeguards; they can pose major public health threats and environmental effects in urban cities. The authors went further to underlined on the results that most inhabitants suffered from related diseases such as malaria, chest pains, diarrhoea and cholera, due to the location of the dumpsite closer to their settlements. This study equally holds that the location of waste disposal sites is very important when adopting domestic waste, management strategies. However, accessibility seems to be one of the most important impediments to this development which was confirmed during field studies.

Open dumpsite approach as solid waste disposal method is a primitive stage of solid waste management in many parts of the world. It is one of the most poorly rendered services by municipal authorities in developing countries as the systems applied are unscientific, out-dated and in-efficient. Solid waste disposal sites are found both within and on the outskirts of developing urban cities. With increase in the global population and the rising demand for food and other essentials, there has been a rise in the amount of waste being generated daily by each household (Foday et al. 2013). These scholars focused their studies on hot spots of waste disposal but were less interested on the outcomes of such waste disposal methods which this study is critical about.

This waste due to poor management strategies is ultimately thrown into municipal disposal sites and due to poor and ineffective management, the dumpsites turn to sources of environmental and health hazards to people living in the vicinity of such dumps. One of the main aspects of concern is the pollution caused to the earth; be it land, air and water. According to Nguyen et al. (2011) many cities in developing countries face serious environmental degradation and health risks due to the weakly developed municipal solid waste management system. Several studies have been conducted in order to examine the health and environmental effects arising from waste dumps. Such studies showed that a link exists between the two (Aatamila et al., 2010; Giusti, 2009; Nwanta and Ezenduka, 2010; Xiao et al., 2007; Yongsi et al., 2008). The conclusion from this and other studies has led to an increasing interest of researchers in the study relating to environmental pollution as well as its effects on plants and animals. Few of these studies examined the environmental and health implications of solid waste disposal to people living in close proximity of wastes dumpsites (Boardi and Kuitunen, 2005; Forastiera et al., 2011; Gouveia and do Prado, 2009; Nabegu, 2010).

The ever-increasing consumption of resources results in huge amounts of solid wastes from industrial and domestic activities, which pose significant threats to human health (Foday et al., 2013; Frosch, 1996). However, the ills of inappropriately disposed municipal solid wastes are quite numerous to be mentioned. Health deterioration, accidents, flood occurrences, and environ-mental pressures are just a few of the negative effects. In many developing countries, solid waste disposal sites are found on the outskirts of urban areas. These areas become children's sources of contamination due to the incubation and proliferation of flies, mosquitoes, and rodents. They, in turn, are disease transmitters that affect population's health, which has its organic defences in a formative and creative state. The said situation produces gastrointestinal, dermatological, respiratory, genetic, and several other kinds of infectious diseases (Foday et al., 2013; Salam, 2010). Open dumpsites in developing urban cities involve indiscriminate disposal of waste. This study further points out the various environmental and health hazards resulting from indiscriminate waste disposal.

Normally, it is the wet waste that decomposes and releases a bad odour. The bad odour affects the people settled next to the dumpsite, which shows that the dumpsites have serious effects to people settled around or next to them. The group at risk from this un- scientific disposal of solid waste includes the population in areas where there is no proper waste disposal method, especially the pre-school children, waste workers and workers in facilities producing toxic and infectious materials. Other high-risk group includes population living close to the waste dump (Aatamila et al., 2010; Foday et al., 2013). It is also in the interest of this study to evaluate how domestic house waste affects health of inhabitants.

Rushton (2003) in his studies to establish a connection between health and hazardous waste showed that waste from agriculture and industries can also cause serious health risks. Other than this, co-disposal of industrial waste with municipal waste can expose people to chemical and radioactive hazards. Health care waste and other medical waste disposed in dumpsites, mixed with domestic waste, increase the risk of infection with Hepatitis B and HIV, and other related diseases (World Bank, 2005). Open dumpsites are a major problem to the environment especially to the air that we inhale. Dumpsites emit obnoxious odours and smoke that cause illness to people living in, around, or closer to them (Marshal, 1996). According to Medina (2002), pollution, a major environmental effect of dumpsites, is not directly transferred from land to people, except in the case of dusts and direct contact with toxic materials. Pollutants deposited on land usually enter the human body through the medium of

contaminated crops, animals, food products, or water. Also, the dumpsite has smelly and unsightly conditions.

We know that there is a serious solid waste problem, everywhere when we look garbage disposal is irregular and we are compelled to bear it around us. The garbage or household waste included the entire thing which is not related to human nutrition and utilization (Burnley, 2007). Bartelings, (1999) underpinned that in daily life, 250 grams to 1 kg waste material disposed every day. However, this study evaluates the origins of this waste and management strategies both by the municipal council and NGOs.

Gouveia and Ruscitto (2009) further underpinned that in a number of health surveys a wide range of health problems, including respiratory systems, irritation of the skin, eyes and nose, gastrointestinal problems, psychological disorders, and allergies have been discovered. In addition, dumpsites closer to residential areas are always feeding places for dogs and cats. These pets, together with rodents, carry diseases with them to nearby homesteads. The objective of this paper is to determine the environmental and health impact of solid waste disposal at Umuahia gate, Upstair line, Ahia Eke, New Timber gate, Government College first gate, etc. dumpsites on its surrounding human settlements.

Awareness and sensitisation

The lack of awareness and education of the population on waste and waste management is a serious hindrance to proper waste management. There is lack of data on the level of knowledge in relation to waste management and environmental pollution (Aina, 2006; Aloueimine, 2006). Also waste management is not a priority for African states. As Koehn said, taken up by Onibokun, “waste management is not a priority for most administrations. They focus on education, collection of taxes, agricultural services, water supply and health. From all the above, we notice that despite the prolific literature on waste management, few studies have addressed the issue from a strictly legal point of view services” (Onibokun, 2001). Few decision makers perceive waste as a real environmental problem and the lack of international legislation on waste management (apart from that on hazardous waste) are other factors that hamper good management of waste in these countries. This explains why after 60 years of independence, decision makers in African countries are still looking of lasting solutions.

6. THEORETICAL AND CONCEPTUAL FRAMEWORK

This part of the study would be meant for the definition of key terms, conceptualization and presentation of some theories that apply to the theme.

6.1. Conceptual Framework of the Study

Concepts and Conceptualisation

The conceptual framework is used to make abstract distinctions and organize ideas. It is used in research to sketch possible courses of actions or to present a preferred approach to an idea or thought (https://www.safeopedia.com/definition/1547/waste-management). It is therefore important to render the concepts we would use throughout this research operational. In accordance with this study, the main concepts we look at are waste, domestic waste management and the environment.

6.1.0 The concept of domestic Waste

Domestic waste is waste generated from households or living neighbourhoods. It is waste generated from day-to-day use of a domestic premise. It is also known as residential, household waste or municipal solid waste that is commonly called trash, garbage, refuse or rubbish waste which consists of everyday items that are discarded by the public.

The term 'Waste' has undergone changes in definition, concept and classification. According to Brown (1991, p._28), "waste is superfluous refuse, no longer serving a purpose, left over after use" or "useless by-product of manufacturing or physiological process". Some other authors define waste as "any moveable material that is perceived to be of no further use and is permanently discarded" (Eleanor et al., 1998, pp. 445). During the direct interviews we had while carrying out field work, different participants' also defined waste in various manners some of which included: *"it is nothing but dirt"* or *"anything that has no use to us anymore".*

Domestic waste is presented as any used object and deposited in any individual or collective dump for the purpose of removal or disposal by municipal services. A study on the management of waste carried out in Tunisia in partnership with the GTZ defines solid waste as "all waste transported by the municipality and thrown into municipal landfills" (George Habermann, 1993).

Sane (2002), has an economic and juridical point of view to waste. Economically, he defines waste as an object whose economic value is zero or undesirable to its holder. He either

pays someone to dispose of it, or he does it himself. Judicially, its definition permits one to distinguish it from a subjective and objective notion.

According to the subjective notion, a substance can only be regarded as waste when the owner labels it as such. This is particularly true because, one individual may regard a substance as waste while another may view the same substance as a resource. So long as it is in possession, it remains his. It becomes the property of the municipality when he has disposed of it because by so doing, he has clearly manifested his will to do away with the object. The objective notion on the other hand states that, waste is any object whose management must be controlled for the protection of the environment and public health.

Waste is any substance or objects that the holder discards or intends to discard.

The French environment and energy management agency (L'ADEME: Agence de L'Environnement et Maitrised'Energie) defines waste as "any residue from a production or transformation process or any movable property that its holder intends to abandon". (July 15, 1975 law)

Basu (2009) defined waste as any product(s) or material(s) which is useless to the producer.

In Cameroon, the definition of waste is set by the loi-cadre of 1996 on the environment voted by the national assembly. So, according this law No 096/12 of August 5th 1996 article 4, part C, waste is any residue from a production process, any substance or material produced or, more generally any movable and immovable goods abandoned or intended to be abandoned.

Domestic waste can also be classified into two types: biodegradable and non-biodegradable.

a) Biodegradable waste

This is waste that can be broken down, decomposed or disintegrated into carbon dioxide, water, methane or simple organic molecules by micro-organisms (like bacteria) and other living things by composting aerobic or anaerobic digestion or similar processes. For example, food remains dead plants and animals etc.

b) Non-biodegradable waste

This is waste that cannot be decomposed or dissolved by natural agents. They can cause pollution, block drains. For example, plastics, aluminium cans etc.

Several authors evoke the geographic dimension of covered by the concept of waste. The first geographer (Gouhier) who makes waste an object, defines it as “the elements of work materials which fall during the manufacturing process” (Gouhier 1972). His work demonstrates the spatial differentiation of waste and relates the location, type of habitat and characterisation of waste. His words “show me your trash, and I’ll tell you who you are” in 1984 clearly illustrates his ideas. He studied the connection between the social system (population, origin or social behaviour) and waste (nature, production) on the one hand and the implication of these connections on the other. He clearly demonstrated the marginality of waste. To him, the term expresses: “a real and observed depreciation i.e. the good no longer has a function and therefore no longer has a geographic anchorage. In addition, it adds harm to its uselessness. It is useless because it encumbers. It must therefore be thrown away. In order to better base its exclusion, it is attributed names like ugly, dirty, unhealthy, dangerous hence doing away with it seems necessary.

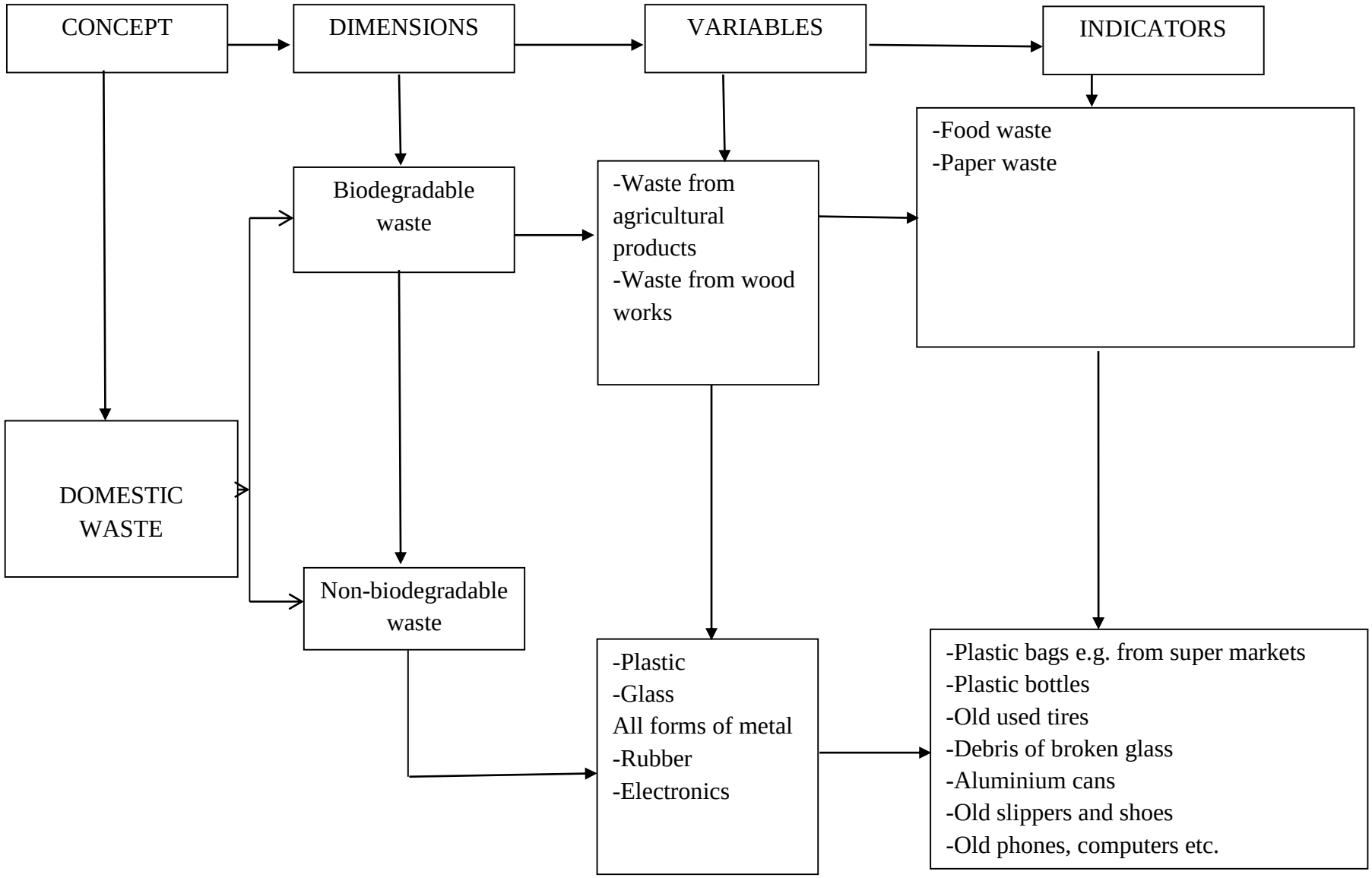


Figure 3: Conceptualization of Domestic Waste

Source: Author's conception, 2021

6.1.1 The concept of domestic waste management

Waste management refers collectively to the collection, transportation, handling and disposal process of dealing with removal of human waste. Waste management, generally, covers all aspects of human waste including waste reduction.

According to Ta Thu (1998), the concept of waste management refers to a global and coherent management of the entire sector (pre-collection, collection, transport and treatment) including the recovery of waste and their elimination. Following the same perspective, Gouhier (2000, 2005) indicated that "waste management consists of the collection, transportation, treatment, reuse and elimination of waste (usually those produced by human activities) in order to reduce their effects on human health, the environment, aesthetics or local enjoyment"

According to Aloueimine et al. (2006), waste management should obey four principles including:

- taking into account appropriate technologies for the optimization of the manufacturing process and the production of less pollutants during the development of a product;
- the implementation of waste reuse, recycling or composting channels which is the most important aspect of waste management;
- waste disposal taking the environment into account, when other strategies cannot be applied
- burying landfills of waste that cannot be reduced, recycled, composted or reused.

According to the national strategy of waste management in Cameroon, (2007-2015), law no96/12 of august 5th 1996 in relation to the environment: Domestic waste management refers to the total sum of activities and actions required to manage waste from its inception to its final disposal. It is therefore, the blend of the waste management practices that includes the collection, transportation, recycling, treatment and final disposal of waste as well as the inspection of disposal sites. A large proportion of waste management practices deals with municipal solid waste management which is waste created by households, industries and commercial activities. Waste management is projected to reduce the adverse effects of waste on the environment, health and aesthetics.

For us, we perceive waste management as "a process that integrates both the production of waste and its treatment. Production responds to the choice of the products at source their use

and their recovery and treatment corresponds to the process which starts from sorting waste to its treatment and or storage including collection and transportation".

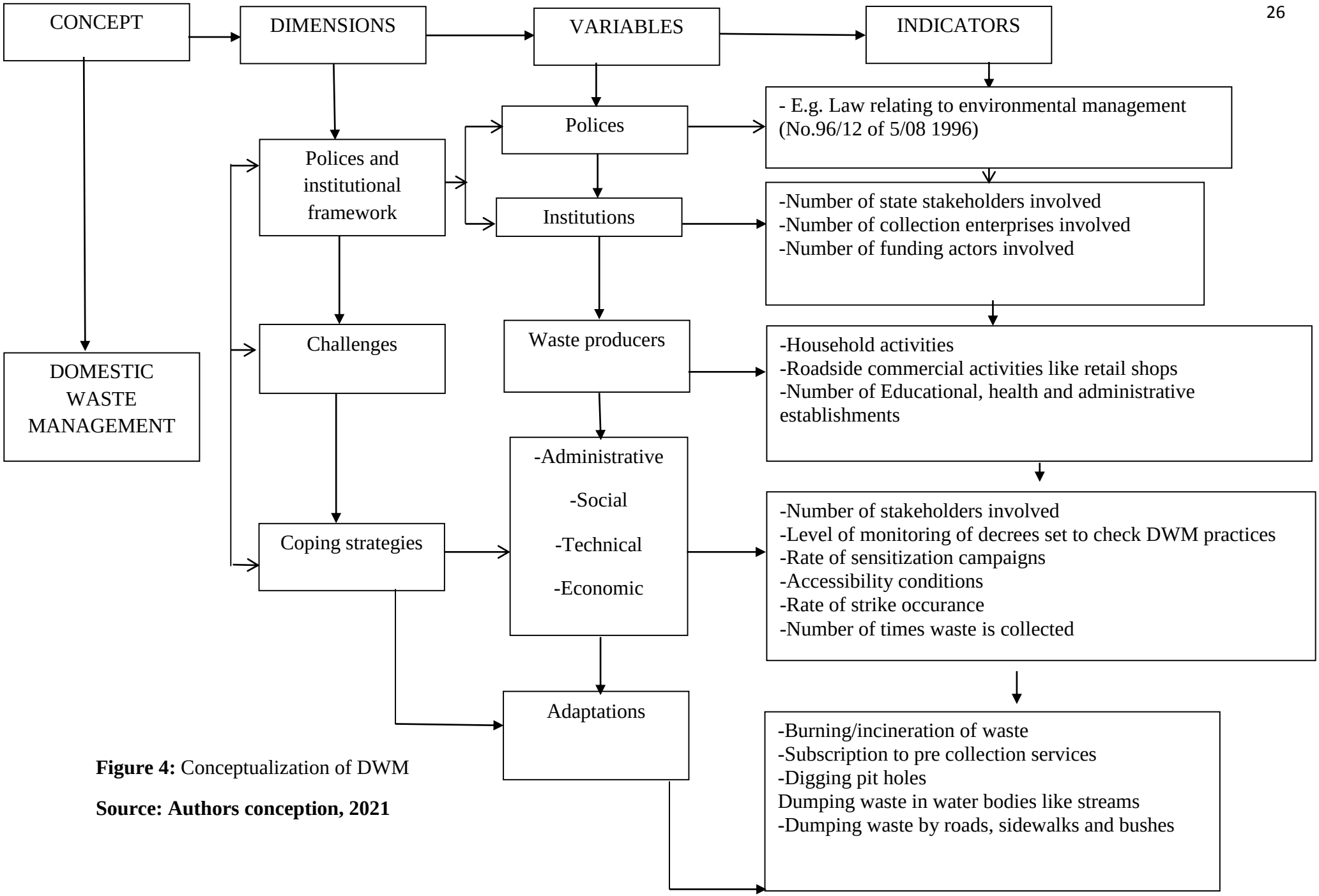


Figure 4: Conceptualization of DWM

Source: Authors conception, 2021

6.1.2 The concept of the environment

The Oxford dictionary defines the environment as the surroundings or conditions in which a person, animal or plant lives or operates. The environment is a concept that varies between different disciplines. In geography the environment is defined as, “the total sum of natural, artificial, economic and social elements in which human life lives. It entails, living environment, social and physical factors that constitutes the milieu whose blend exerts positive or negative effects on the development of individuals.

The environment is a system formed by natural and artificial elements which have the tendency of being modified by human actions. It is the milieu that conditions the way of life of a society and thus entails the social, cultural and natural values that exists in an area at a given time. So, environmental preservation is very important for the benefits of the present as well as future generations to come.

Kamto (1996) the environment refers to “all the elements of nature including cultural heritage and resources essential for socio-economic activities and for a better quality of life». Environmental problems are the difficulties faced by human beings in their living environment. The major problem here without any doubt is pollution.

The law no 96/12 of august 5th 1996 relating to the framework law on environmental management voted by the national assembly in Cameroon defines the environment as “all natural or artificial elements and bio-geochemical balances in which they participate as well as social, economic and cultural factors that promote the existence, transformation and development of the environment, living organisms and human activities”.

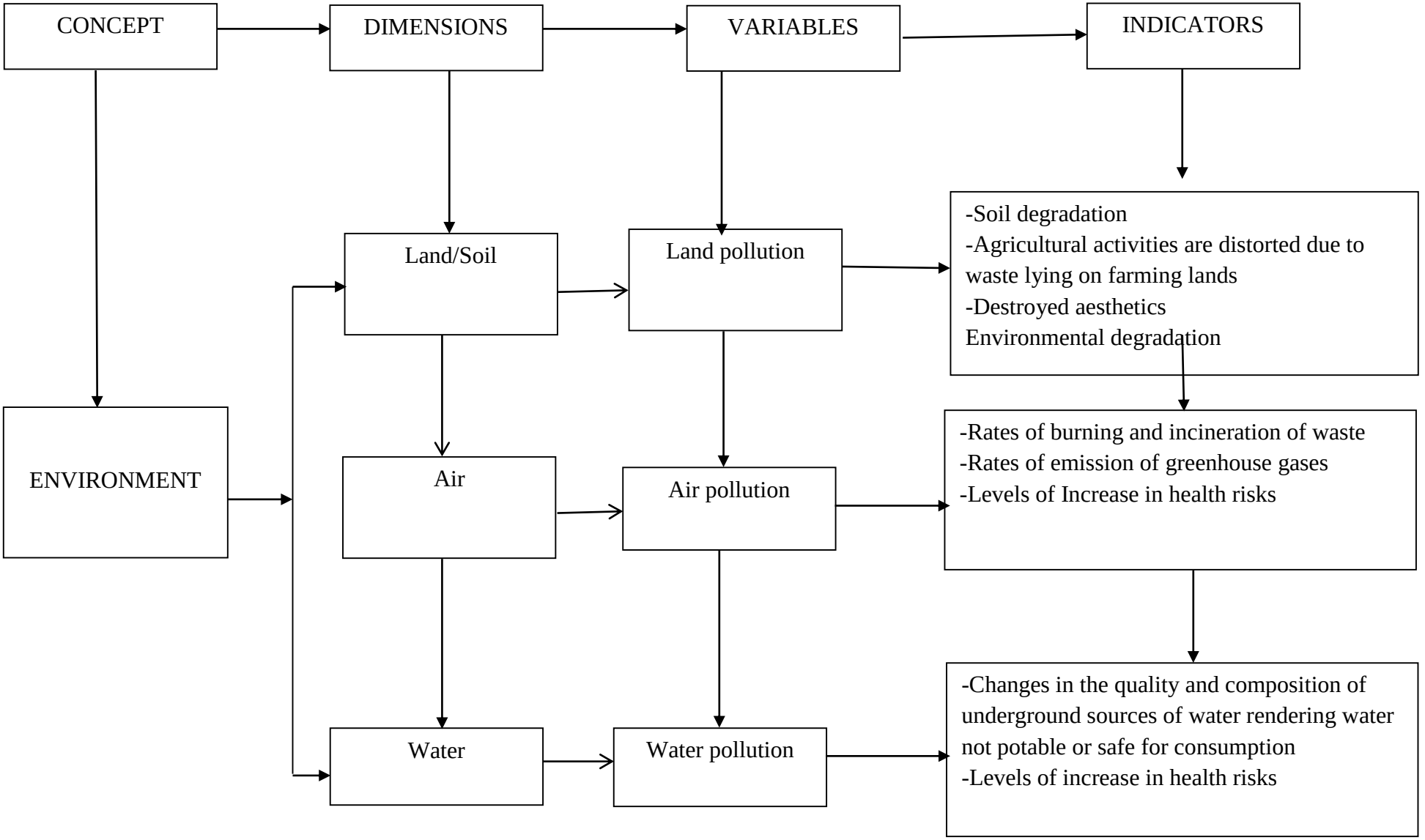


Figure 5: Conceptualization of the environment

Source: Authors conception, 2020

6.1.3 The concept of the 4 R's

This concept denotes reduction, reuse, recycling and recovery. **Reuse** involves repurposing materials instead of discarding them. **Recycle** is responsible for collection of material that can be processed to produce new materials. **Reduce** involves minimizing the use of items that cause pollution and finally **recovery** involves extracting materials from a waste product that can be used in future for different purposes.

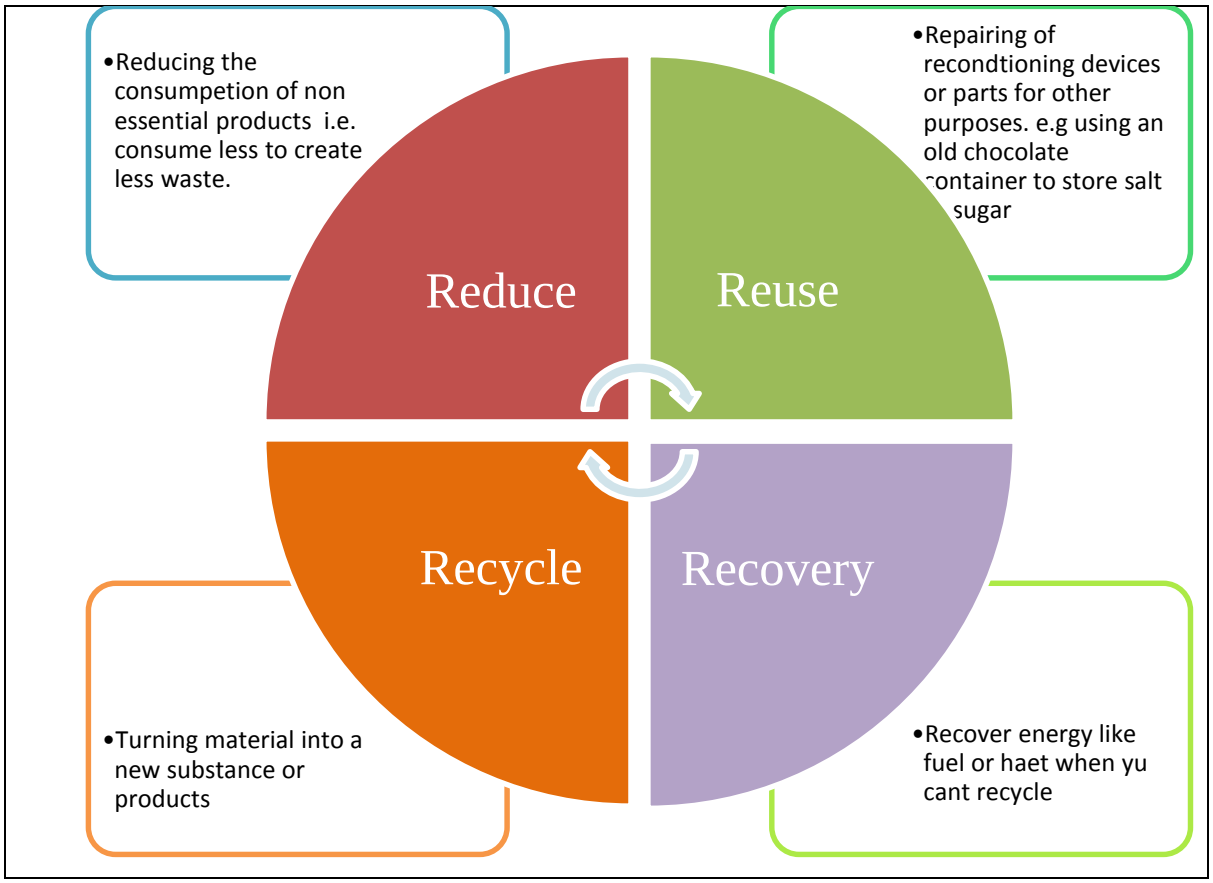


Figure 6: Conceptualization of the 4 Rs

Source: Yenni 2016

6.2. Theoretical Framework

Theories are a supposition or a system of ideas intended to explain something especially one that is based on general principles independent of the thing to be explained. The explanations are based on assumptions which are followed by possible hypotheses. It guides your research, determining what things you will measure and what statistical relationship you will look for which will act as a guide to the study and the methodology. To better explain this study, we made use of three theories;

6.2.1. The spatial diffusion of innovation Theory by Rogers

Before diving into that is meant by innovation diffusion, it is important to know the definition of innovation which is the introduction of something new (Damiono Jr. 2011).

This innovation diffusion theory was introduced by Rogers Everett in 1962. It provides a foundation for understanding innovation adoption and the factors that influence individuals' choices about innovation. Rogers's theory is broad in scope as it is usable across many fields and contexts. There are four main components in Rogers' diffusion theory; the innovation, communication channels used to broadcast information about the innovation, the social system existing around the adopters/non adopters of the innovation and the time it takes for an individual to move through the adoption process. According to Rogers, there are five elements that determine the adoption or diffusion of an innovation;

Relative advantage: It is how much the greater or lesser the benefits of the innovation are compared with the alternatives. That is, the degree to which an innovation is perceived as either better or worse than those that already exist. It does not mean that the innovation should possess more stamina than the already existing ones but that the individuals should perceive it as advantageous.

Compatibility: It is how well the innovation fits with potential adopters. It is the degree to which the innovation is perceived as consistent with the existing values, past experiences, social practice and the norms of the users. An idea that is not compatible with the aforementioned would take much more time to be adopted than a compatible one.

Complexity: the more difficult to learn and implement an innovation is perceived to be less likely to be adopted. This because the complexity is too high

Testability: This means that an innovation should be tested before being used. Potential adopters are most likely to accept innovations that they have an opportunity to experiment with and test before deciding to adopt or not.

Observable: this occurs once an innovation has been adopted and defused across enough people within the cultures' system that those who previously had not thought of adopting it change their minds at least start considering adopting the innovations. (Rogers, 2003)

Some innovations have been set up in the context of waste management in Yaounde II like the increase in collection bins around the municipality. This theory therefore would help us understand the efforts put in place by the different stakeholders involved in the management

waste in this area. It would also help us know if the innovations are adoptable in the town and how people perceive them.

The theory would also show how some areas or neighbourhoods of Yaounde II are well attended to while others are somehow neglected.

6.2.2. The theory of collective action

The theory of collective action by Mancer Olson (1965) seeks to understand how groups of individuals cooperate to overcome social dilemmas, assuming that being self-interested, short term maximiser is a default position. The behavioural approach to collective action begins with an evolutionary argument: human beings have evolved and developed the capacity to learn cooperative norms and social regulations which have enhanced the success of groups. In this view, individual rational action is just one of a suit of a continuous behaviour from different individuals to the very social activities which human beings exhibit and which can be adaptive in different circumstances.

This theory is therefore applicable in the theoretical framework of this research as it seeks to show how some areas of the town do not receive equal attention like others. Also, it shows how individual actions or groups of people which make up a community adapt to situations they are faced with and how they contribute to the betterment of different disturbing situations in their communities. It further explains how the effect of these actions can contribute to better living conditions. We will therefore be showing how collaboration between the different stakeholders involved in waste management can come about with a great wind of change in this sector.

6.2.3. The central place theory

The central place theory was conceived by Walter Christaller in 1933. It is a theory that explains the hierarchy of towns, their sizes, location and their functions. Derived from the centre-periphery theory, the central place theory stipulates that the areas called “centre” are those areas that offer the best services and the peripheries are areas of high demand.

We would therefore use W. Christaller’s central place theory to explain the demographic pressure that the town of Yaounde II has been experiencing for some years now. There is a rapid increase in population and socio-economic activities due to some factors such as increase in birth rates, rural exodus and the Northwest and Southwest (NOSO) crisis that is currently going on in the English regions of the country as well as in the Far North regions. This explosion of urban population comes along with numerous problems among which are the

creation squatter settlements, environmental and sanitary problems which lead to increase in waste production and generation, hence pollution and more difficulties in waste management.

This theory permits us to elaborate our methodology while taking into account the ideological, political, geographic and economic aspects liable to influence waste management in the town of Yaounde II. It equally enabled us to show if the distribution of PWCs in Yaoundé II was relatively reasonable. This process permitted us to amass all the necessary data to determine the limitations of the management system as well as reasons for the rapid increase of uncontrolled dumping around the town.

7. Research methodology

The methodology here therefore represents the hypothetico-deductive approach with the hypothesis at the point of departure, which is subject to verification. This section discusses the methods used in carrying out the experimental aspect of the study. The study is purely facts finding in nature. It is both quantitative and qualitative. For the collection of data, we would both primary (observations, questionnaires and interviews) and secondary methods (documentary data, internet, books, libraries, data banks).

7.1. Data Collection

This section presents the data collection methods and procedures. It looks at the instruments used in data collection and how they are administered. Data used in this work came from two main sources; secondary and primary sources through the use of some essential tools.

7.1.1 Sources of Secondary Data

This is data gotten from already existing sources i.e. libraries, memoires, articles, journals, the internet, data banks etc. Such data could be taken from the national or international level as far as it is in relation and of help to the evolution of the study. This largely constituted the qualitative data.

Many scholars advise starting a research work with the collection of secondary data (Syed, 2016). This is data gotten from already existing books, articles, journals, reports, magazines (data banks) etc. A wide variety of literature related to the key words: waste, domestic waste management, environment, problems and prospects was reviewed. This permits us to familiarize ourselves with what has already been written on the themes. This process made us visit places like National Institute for Cartography (NIC), BUCREP office to

obtain demographic data on the population of Yaounde II, the Yaounde II Council as well as the departmental library.

The use of the internet to aid research practice has become very popular over the years (Benfield and Szlemko, 2006). It is an inevitable data bank. The frequently used search engine for this research was Google because it was the most organized, comfortable and easy to use. This is the research engine that helped us realize part of the literature review and therefore constitutes part of our references. Material from here was downloaded into a flash disk and later on exploited.

7.1.2 Sources of Primary Data

This is data collected by the researcher through field work and direct contact with resourceful persons which largely constituted of quantitative data. This data was elicited with the use of questionnaires, interviews and participant observation.

7.1.2.1 Population of the study area

The population of the study area was composed all the 14 neighbourhoods in Yaounde II. These neighbourhoods include Ekoudou, Azegue, Briqueterie, Cite Verte, Messa, Madagascar, Carriere, Mokolo, Nkomkana, Ntougou, Oliga, Tsinga, Mbankolo and Febe. They regroup approximately 336,381 inhabitants and 45512 households (BUCREP, 2010 population and housing census). These 14 neighbourhoods make up the study area (table 1).

Table 1: The population of the study area

No	Quarter	Population	No of Households
1	Ekoudou	23328	4708
2	Azegue	10362	1988
3	Briqueterie	31718	6410
4	Cite verte	16681	3237
5	Messa	11228	4648
6	Madagascar	69989	2025
7	Carriere	23395	4283
8	Mokolo	13911	2596
9	Nkomkana	30960	6011
10	Ntougou	17927	3258
11	Oliga	20024	3737
12	Tsinga	13022	2383
13	Mbankolo	34112	2342
14	Febe	1511	228
Total:		**336,381**	**45512**

Source: BUCREP, 2010 Population and Housing census. HH= Household

7.1.2.2 Sample size

This refers to the number of people to whom questionnaires was administered to. The sample size was drawn from the 45512 households in the study area following the 2010 population and household census. Yaounde II has a total of 14 neighbourhoods and all 14 of them were visited. Random sampling was employed here. The distance from homes to dumping bins, absence or insufficient public waste containers in relation to the population were other parameters that influenced the choice of the sample population. Putting these arguments together, 150households were investigated. It was a door-to-door process where after, a 10-meter distance from the previous home that has already been investigated, another random house was chosen.

The reason for this rational was that, it is much easier to administer questionnaire in households than individuals on the streets and this would equally reduce cost and facilitate the work. To this effect, 3% of the households made up the sample population of this study.

The reason for choosing 3% sample size is in accordance with the postulation of Nwana (1982: p92) which stipulates that:

- If the population of the study is in hundreds, a 40% or more sample should be used,
- If the population is in many hundreds, a 20% will do,
- If the population is in a few hundreds, a 10% will do and,
- If the population is in several thousands, at least a 5% or fewer samples will do. (Nwana, 1982, cited by Enchaw, 2009).

The 3% chosen was to ease the work due to the fact that the town and the country as whole has been facing sanitary crisis (the Corona virus crisis commonly called Covid-19). It was therefore not easy to administer questionnaires to a very large population as most of them were not receptive as to receiving people in their homes especially not knowing their covid-19 status.

The 0.3% sample size for this study was selected from the total number of households in each quarter using the formula: x* 3/100 where:

X= total number of households
*= multiplication sign
3= sample size choses

From the total number of households, a 0.1% sample size household was selected. This 0.3% gave 150 households to which questionnaire was to be administered. This sample helped the researcher to know the total number of questionnaires to be taken to the field for effective administration (table 2).

Table 2: The population of the study area and effective respondents

No	Quarter	HH	0.3% sample size	Eff Resp.	% of eff Resp.
1	Ekoudou	4708	15	13	82%
2	Azegue	1988	6	6	100%
3	Briqueterie	6410	20	18	88%
4	Cite verte	3237	10	9	92%
5	Messa	4648	14	14	100%
6	Madagascar	2025	7	5	85%
7	Carriere	4283	13	13	100%
8	Mokolo	2596	8	8	100%
9	Nkomkana	6011	19	17	91%
10	Ntougou	3258	10	10	100%
11	Oliga	3737	12	11	83%
12	Tsinga	2383	8	6	83%
13	Mbankolo	2342	8	6	83%
14	Febe	228	1	1	100%
Totals		**45512**	**150**	**137**	**84%**

HH: household, Eff. Resp: effective respondents.

Source: BUCREP, 2010 population housing census and Fieldwork, 2021.

Table 2 illustrates the different neighbourhoods, household totals, sample size and effective respondents in each quarter of the study area. The total of effective respondents as well as the percentages is equally illustrated by the table. It shows that a total of 150 questionnaires were to be administered in the field but only 137 of them were administered representing **84%.**

7.1.2.3 Research design

This study was both descriptive and quantitative in nature and made use of the mixed method approach. According to Creswell (2014), mixed method research is conceptualized as "an approach to inquiry involving that involves collecting both quantitative and qualitative data, integrating the two forms of data, and using distinct designs that may involve philosophical assumptions and the theoretical frameworks" (p. 4). In this way, one method can be used to supplement the weaknesses of the other. Another reason for using the mixed method is that it one approach helps to better explain and understand the results of the other approach.

7.1.2.4 Operationalization of variables

A serious standpoint at the research questions, objectives and hypotheses indicates that we have dependent and independent variables which need to be operationalized to help in the structuring of a questionnaire and equally the type of data to be collected.

Hypothesis 1: Increasing waste production have surpassed management capacity in Yaounde II.			
Independent variable	**Indicators**	**Dependent variable**	**Indicators**
Increasing waste production	-Population size -Number of markets and commercial activities -Number of Health, education and administrative establishments	Surpassed management capacity	-Number uncontrolled and constant illegal dumps -number of times waste is collected from public waste containers and homes -Number of public waste containers -Number of vehicles deployed for waste collection per quarter -Amount of funds disbursed to invest in proper techniques of waste management

Table 3: The operationalization of variables for hypothesis 1

Hypothesis 2: Ineffective policies and institutional framework has largely influenced the management of domestic waste in Yaounde II			
Independent variable	**Indicators**	**Dependent variable**	**Indicators**
Ineffective policies and institutional framework	-Rate of collaboration between stakeholders involved -Number of policies -Number of institutions with involved	Has largely influenced the management of domestic waste in Yaounde II	-Low levels of monitoring of laws put in place in relation to waste management -Number of Uncontrolled dumps -Rate at which burning or incineration of waste is done in public spaces. -Rate of public awareness -Percentage of the population served by waste collectors

Table 4: The operationalization of variables for hypothesis 2

Hypothesis 3: Inadequate domestic waste management has largely impacted the environment of Yaounde II			
Independent variable	**Indicators**	**Dependent variable**	**Indicators**
Inadequate domestic waste management	-Number of public waste containers -Littering -Number of Uncontrolled dumps -Amount of adequate equipment for waste collection and disposal	Negatively influence the environment of Yaounde II	-Destruction of aesthetics -Increase in health vulnerabilities -Bad odours -Presence of insects and rodents -Flooding and contamination

Table 5: The operationalization of variables for hypothesis 3

7.1.2.5 Direct field observation

Field observation played a very important role throughout the study. It is a technique that consists of collecting data without necessarily consulting the concerned population. This permitted us to see things for ourselves and directly judge the state of waste management practices and their effect on the environment. It also permitted us to verify and criticize what we had read in previous documents.

7.1.2.6 Interviews

Interviews were chosen as one of the methods of data collection because the information provided by respondents is a source of qualitative data. Mace (1988—) as cited in Guigoume (2003) states that "it is a means by which the researcher attempts to obtain information which does not appear to be void by most people often been witnesses or actors of events on which the research relates». In order to better explore the people's awareness and perceptions on waste management practices, the interview guide was much needed. Information collected from these interviews was very important to the research because such cannot be sourced through questionnaire and it was also an opportunity to crosscheck information that was not yet documented. That is, in the course of the interviews, respondents' answers were not restricted in any way even though at some point, some of them talked about things that were insignificant to the study. The interview sessions were done both individually and in groups in cases where I got to meet many people at some place at the same time.

- **Inhabitants**

In line with hypothesis one and three, the inhabitants were interviewed to have better insight on the different sources of waste production and how people management and/or waste at their level. Also, it was aimed at getting information on their perception and knowledge on the effects of waste management on their environment and health.

- **The mayor Yaounde II**

The mayor was interviewed to have profound information on the situation of waste in Yaounde II. The interview was very enriching as it shed more light on the policies put in place by the institutions involved in waste management and the measures they have taken so as to ensure that these policies are applied. This was in light with the second hypothesis which focused on the policies and institutional framework of waste management in Cameroon.

- **The communication manager of HYSACAM**

The communication manager was equally interviewed to have more insight on the measures that the HYSACAM has put in place to curb the waste situation in Yaounde II. This was in line with hypothesis 1 and two on the functions and regularity of HYSACAM. This enabled us to evaluate the management capacity of HYSACAM and equally assess whether or not the organization is enough for the whole town being that they are the only registered organ for waste collection in the town.

- **Focus group discussions**

This process of data collection was used during the second field work and was made up of a sampled population. The focus group discussions had a maximum number of 10 people and a minimum of 6 people. This helped us to have additional facts on the perception they have on waste especially the challenges they face and the strategies they adopted to cope with the situation.

- **Life experiences and telephone surveys**

This involved the contact with some respondents who helped gather facts on the evolution of waste management practices in the Yaounde II area over the years as well as their personal experiences, perceptions and how to they have had to adapt due to the situation. Telephone surveys could not have been left out during this period where the country is surviving the sanitary crisis (COVID-19). Phone calls were therefore of great importance as it limited physical appearances and promoted barrier measures. We therefore contacted some resourceful persons that were difficult to be contacted physically notably because of the COVID-19 and busy schedules.

7.1.2.7 Questionnaire administration

The research used a cross-sectional design that combined purposive and random sampling techniques. Purposive sampling is directed towards the waste management companies given that they are usually few in number and so one is obliged to make use of the few available ones as well as the divisive rates of waste collection around the municipality. The aim of the questionnaire was to get a large amount of data regarding their perceptions on waste management and its effect on the environment of Yaounde II. Random sampling was employed in selecting the limited sample to respond to the questionnaire. Once in a quarter, the researcher goes indiscriminately into homes and any responsible person met in such homes

is liable to responding to the questionnaire irrespective of whether he or she is known to the researcher or not. The questionnaire was divided into four main sections; section A contains household and demographic information, section B corresponds to the sources of domestic waste production and how they are managed, section C involves knowledge about the laws on waste management and section D, the effects on the environment and health.

8. Ethical issues

With regard to ethical considerations, a research permit was sought from the Head of Department of Geography which enables the researcher to undertake the present study. Both verbal and written permits were granted. After having received these permits, the researcher then met with the necessary bodies that in turn consented to be part of the study in one way or the other. The participants were reminded of the anonymity of the data they provided. Also, before conducting any interviews, the participants were asked if they could be recorded and it was only after their approval that the recording was done.

9. Data analysis

Having manually done the questionnaire, the qualitative data were codified, processed and analysed with the Statistical Package for Social Science (SPSS) and Excel. Results were presented using charts, graphs and tables. Data collected were analysed using software such as; the SPSS and Golden surfer for the processing of images so as to increase the quality of the photos.

Data treatment, presentation and analysis

In this research, several types of data were collected and were accorded different types of treatment before presentation, analysis and interpretation. The main types of data collected were qualitative and quantitative data. The data collected embodied interview data, focus group discussion data, questionnaire data, cartographic data and observation data. All of the data collected were treated differently and presented in the form of graphics, figures and tables.

Interviews, focus group discussions and observation data; treatment, analysis and presentation.

The treatment of qualitative data began with coding where the Strauss method of open data coding was used. In this case, categories of responses from respondents and the major themes were identified, assigned and classified. These categories were manually recorded on a

prepared block note as per objective of the study and enabled the formation of constructive codes from in vivo codes obtained during interviews and focus group discussions. This coding method championed because of its usefulness in highlighting the voices of the participants themselves during interviews and focus group discussions. The in vivo coding method was also used because it was thought to be very reliant to pass across the message using the direct words of the participants. The codes obtained as per objective of the study included;

1- To investigate the sources of waste production and how they are managed in Yaounde II.
2- To critically examine the policies and institutional framework that governs domestic waste management in Yaounde II
3- To evaluate the extent to which inadequate DWM has impacted the environment of Yaounde II.

Observed phenomenon was captured with the use of a digital camera. These data were input in a Photoshop software where photos were enhanced through enlightening and clearing of impurities found in the photos to make them clear and visible.

Cartographic data treatment, analyses and presentation.

This data was acquired with the use of a Global Positioning System (GPS) whereby way points were collected on PWCS and illegal dumping sites in Yaounde II. These data were downloaded from the GPS and superimposed on cartographic shape file of Yaounde II where they were spatialized in space and the information represented on maps. With regard to the road network and relief maps realised, the data were obtained from the National Institute of Cartography (NIC) and uploaded into the cartographic shape file of Yaounde II from which maps were realised for spatial analyses.

Questionnaire data treatment, analysis and presentation

The data collected with this instrument was largely quantitative data and required a succinct method of treatment and presentation. Questions in the survey instrument that required the respondents to choose from a range of options were weighted one point for easy quantification. Statistics were collected for each question in the questionnaire after which they were input in the Microsoft excel and SPSS where the totals of each were summed. Tables showing statistics, totals and percentages were therefore generated. From the totals and percentages obtained, various graphs such as pie charts, bar charts and areas were generated

for analysis. Many tools and instruments were used in this study that assisted in the collection of data. (Table 6)

Table 6: Data collection instruments and functions

Instrument	Function	Obtained results
Books, internet	Literature	Secondary data
Questionnaire, interviews, observation	Ground truthing and field investigation	Primary data
SW maps	Geographical referencing and spatialization	Maps
SPSS Software	Data analyses	Tables and graphs
GPS	Collection of coordinates	Maps
Golden surfer	Image processing	Maps
ArcMap and ArcGIS	Data processing	Maps
Excel	Data analyses	Tables and graphs
Camera	Pictures	Images
Eyes	Observation	Data
Book and pen	Taking down important information	Archiving the useful information
Maps	Localization	Allocation
Legs	Transportation	Data
Car	Transportation	Data

10. Difficulties encountered on the field and they were solved

The completion of this study was not a very easy task because we encountered so many problems along the line:

Firstly, the lack of sufficient data and maps on the study area was a main hindrance.

Secondly, the fact that one has an attestation or an authorization to conduct research does not mean that people would automatically collaborate. Many people were not willing to cooperate with us because they were afraid. They took us for infiltrators sent by the government to come and gather information from them. After explanation and proof of research (our authorisation of research) some were receptive and answered our questions.

Others gave us appointments and when we came back, they were either not available or had changed their minds on their previous willingness to attend to us. To solve this problem, we went towards other people who could fill in their positions and carried out the said exercise with them.

Others were not receptive because of the Corona virus pandemic which is highly contagious. Many people did not want to receive strangers at their homes especially not knowing their Covid status hence the fear of contamination. Also, there was a slow turn in of the questionnaire by the respondents. This equally hindered the researcher from respecting the

deadline set for data collection. To solve this problem, we took contacts and discussed through phone

Again, it was not easy to conduct interview sessions with some of the concerned personnel from the council and ministries because of their busy schedules and the sanitary crisis. This made the researcher conduct just a few interviews. Others basically did not know what to say regarding the situation.

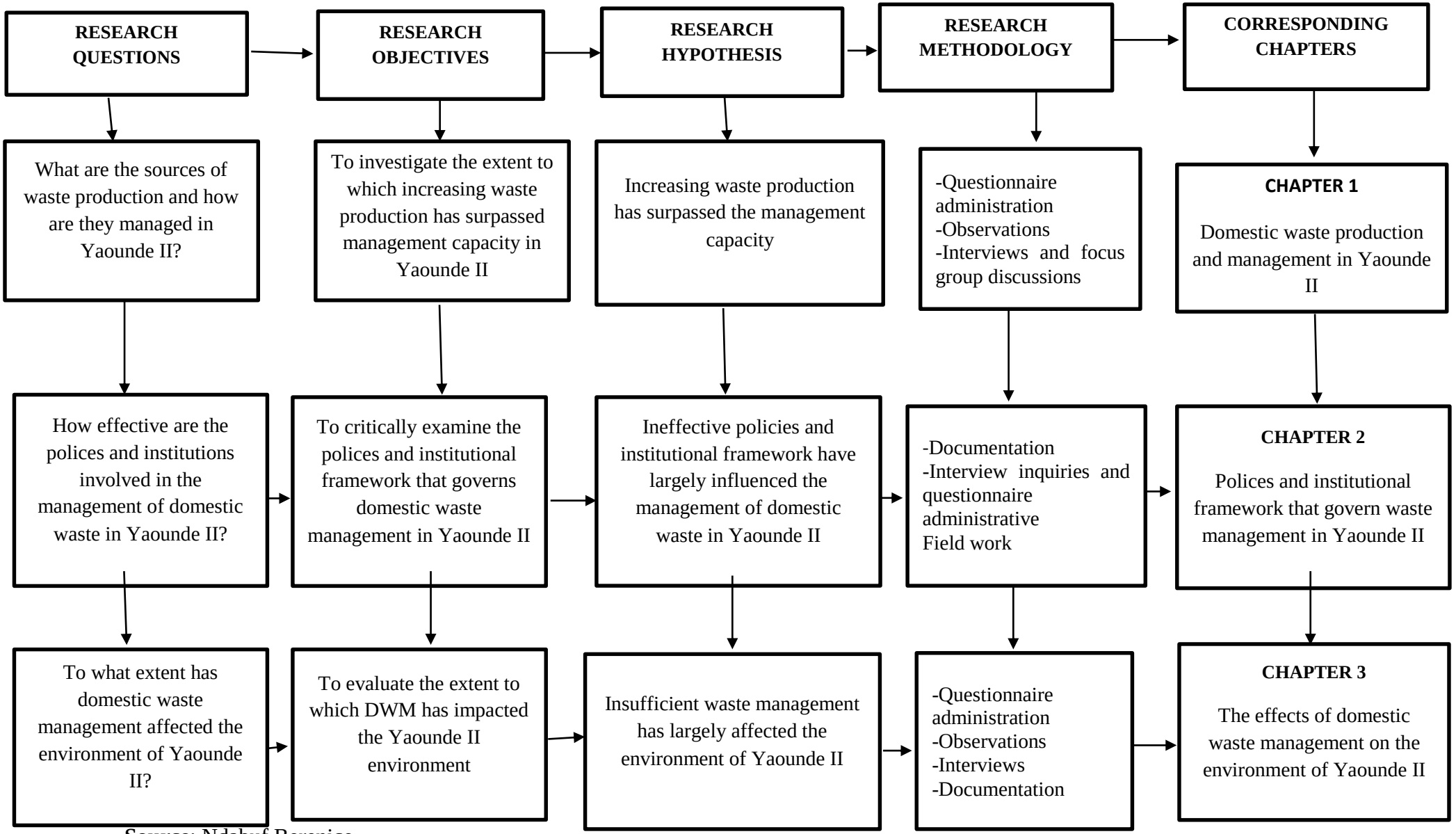
Dissertation chapter layout

In line with the academic requirements, this study embodies a general introduction which covers the background to the study, delimitations of the study, the problem statement, research questions, objectives and hypothesis, the literature review, the conceptual and theoretical framework as well as the methodology.

It is then preceded by three (3) chapters. The first chapter presents the sources of domestic waste production and how they are managed. The second chapter constitutes the polices and institutional framework that governs waste management in Cameroon and finally, the last chapter represents the effects of domestic waste management on the environment of Yaounde II.

The general conclusion focuses on the summaries of findings and recommendations for further research.

To better apprehend this study, we created a synoptic chart as seen on the table below



Source: Ndabuf Berenice

SYNOPTIC CHART OF THE RESEARCH

CHAPTER 1

DOMESTIC WASTE PRODUCTION AND MANAGEMENT IN YAOUNDE II

Introduction

Domestic waste production in African towns and cities is on the rise and has far reaching implications on the performance of urban functions. Yaounde, as one of the highest urbanising cities in Cameroon, faces numerous domestic waste production and management challenges in most of its neighbourhoods such as Yaounde II. This chapter focuses on DW production and management together with the associated challenges in Yaounde II. Studies carried out in seven towns in Cameroon showed that waste production is evaluated at about 4,148 tons per day with specific production of 0.6kg per inhabitant per day (Mbiadjeu, 2015). According to Ngnikam et al, (1998), towns located in humid areas such as Yaounde and Douala produce more waste than towns located in arid zones such as Maroua in the far north of the country though the rates vary from town to town and climate. This chapter is divided in two main sections. The first part lays emphasis on the demographic factors and sources of waste management and the second part discusses the management capacities and challenges faced by HYSACAM.

1.1 Sources of Waste Production in Yaounde II

Generally, the sources of domestic are diversified though household waste always seems to dominate. According to our field surveys, the different sources of waste were identified and classified. (Table 7).

Table 7: Respondents' views on sources of waste production in Yaounde II

Neighbourhoods	**Number of respondents**	**In your opinion, what activity do you carry out that constitutes a source of waste production?**					
		Households	**Markets**	**administrative establishments**	**Others**		
Ekoudou	13	6	3	3	1		
Azegue	6	3	1	1	1		
Briqueterie	18	13	4	0	1		
Cite verte	9	5	2	2	0		
Messa	14	12	2	0	0		
Madagascar	5	2	2	1	0		
Carriere	13	7	2	2	2		
Mokolo	8	3	2	1	2		
Nkomkana	17	10	3	2	2		
Ntougou	10	6	2	1	1		
Oliga	11	6	3	2	0		
Tsinga	6	4	1	1	0		
Mbankolo	6	4	1	1	0		
Febe village	1	1	0	0	0		
Total	**137**	**82**	**28**	**17**	**10**		
%	**100%**	**60%**	**20%**	**12%**	**7%**		

Source: Field work, 20210

Table 7 shows the responses of the respondents on the sources of waste production in Yaoundé II. We notice that according to them, most of the waste produced in Yaounde II comes from households with 60%. This is due to the rapid increase in population caused by a series of factors such as the crisis in the Northwest, Southwest and Far north regions of the country as reported by our respondents. Waste generated from roadside commercial activities and emerged markets come second with 20%. Waste from educational, health and administrative establishments score 7% and lastly, we have 12% for transport systems and services. All these factors, in one way or the other, contribute to massive waste production which is obviously above the management capacity of the town. (Table 8)

Table 8: Respondents' views on sources of waste production in Yaounde II

Do you believe that the waste management organs have the capacity to manage all the waste produced in Yaounde II?	
Yes	**No**
0	13
0	6
0	18
0	9
0	14
0	5
0	13
0	8
0	17
0	10
0	11
0	6
0	6
0	1
0	**137**
0%	**100%**

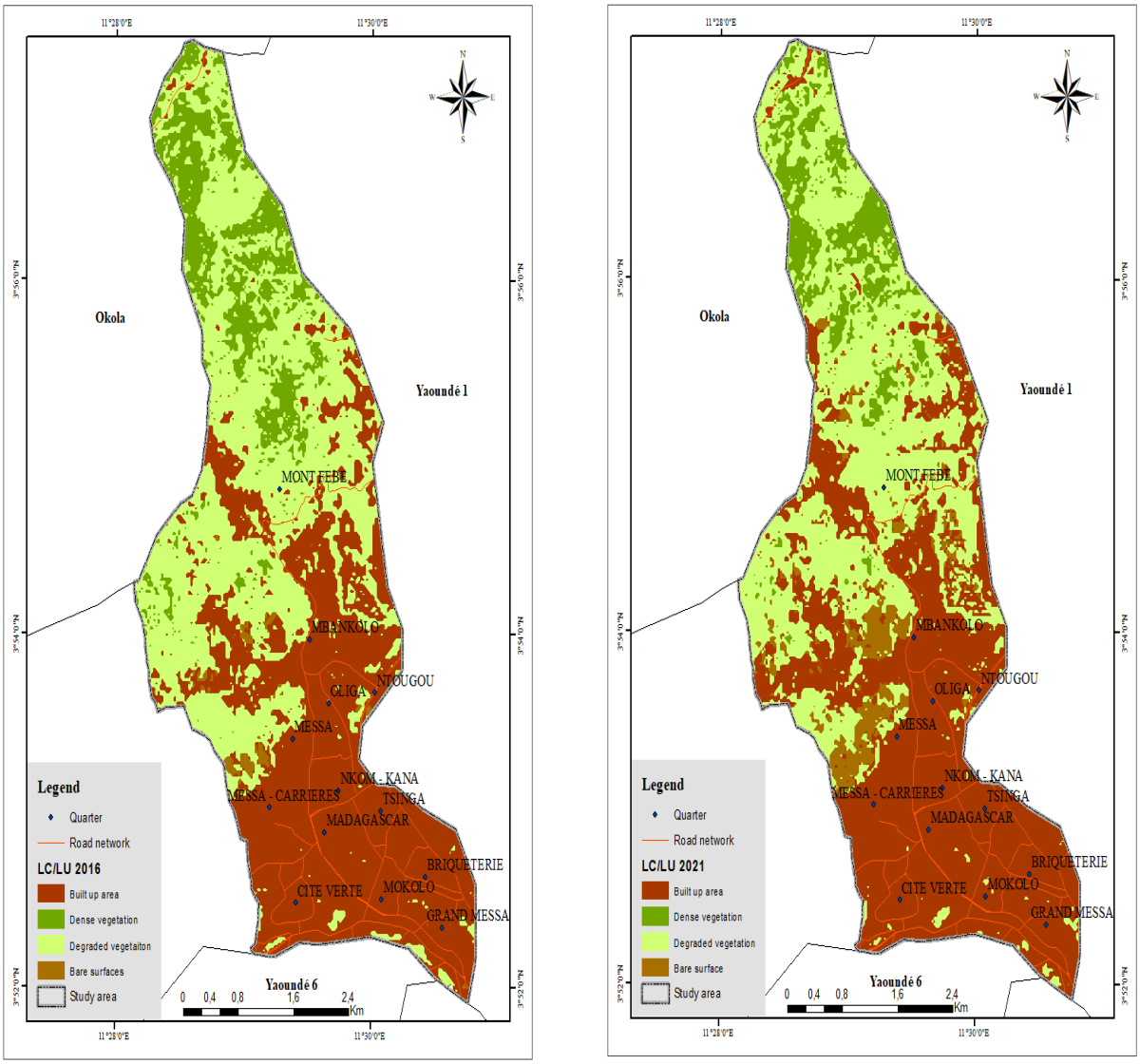
We also notice that all respondents seem to believe that the waste management organs do not have the capacity to manage all the domestic waste produced in Yaounde II. When questions on the reason they do not think the waste management organs notably HYSACAM do not have the capacity to manage the waste produced in the town, most of them underscored that there is constant uncollected waste along streets and irregular collection of waste from their home.

1.1.2 Demographic component

Increase in urban population is one of the principal causes of domestic waste management. Rural exodus, high fertility rates, the crisis in the far north of the country and the recent Northwest and Southwest crisis have engendered a population boom in the cities of Cameroon, east of the Mungo such as Yaounde II. These crises have caused a large number of

people to be internally displaced as they seek refuge in safer towns, Yaoundé II inclusive. According to the Yaounde II Council, the population of the town in 2010 was 336,381 inhabitants with a growth rate of 2.59 compared to the national average of 2.78 per year. Figure 7 shows the evolution of land use from 2016 to 2021.

Figure 7: Evolution of land cover in Yaounde II between 2016 and 2021



Source: Extracted from Landsat ETM 2016, NIC and Landsat 2020, Yaounde.

Table 9: Land cover and Porosity index

Land use type	Land use 2016 (ha)	Land use 2021 (ha)	Land use evolution	Positive and negative
Bare surfaces	22.1	125.1	0	
Built up area	1050.5	1125.0	-74.5	-ve
Degraded vegetation	991.5	897.7	93.4	+ve
Dense vegetation	278.2	194.6	83.6	+ve
Total area	2342.3	2342.4		
Open spaces	1449.9	1217.4	-232.5	
Porosity index	0.62	0.51	-0.11	

Source: Calculated from figure 7

Surface areas of land use attributes were generated using ArcGIS and the ratio of open spaces with urban area to the total area was computed for porosity index. We notice that the porosity index is low. When the index value is low, the denser the area is and when it is high, the less dense it is.

The volume of waste produced is a function of population size. From table 8, we notice that between 2016 and 2021, Yaounde II has experienced a rapid increase in population. Figure 7 further depicts the differences in land use between 2016 and 2021. As the population is increasing, the increase in land use has also been increasing. Besides the recent NOSO and Boko Haram crises in the Far north regions, this rapid growth rate can be attributed to the status of Yaounde as the seat of strong centralized system of government with many administrative and political opportunities from the local/national to international levels as well as increase in birth rates. Also, the availability of education, health facilities, and commercial activities among others are factors that attract people leading to an increase in population in Yaounde II with a direct impact on waste generation.

An increase in population is always followed by the proliferation of social and economic activities. This sector covers various commercial activities from markets to the sale of food/drinks, retail and wholesale shops, restaurants, to garages, petrol stations etc. Commercial activities are accountable for considerable amounts of waste produced every year. These activities generate paper, carton, bottles, plastic, food remains, etc. Most at times, these wastes end up in gutters footpaths, sidewalks and drainage systems due to uncontrolled dumping and littering. Most of these activities, when not checked, are shadowed by precarious environmental conditions such as pollution, unhygienic environments and eventually illnesses. This is the case with the Yaounde II municipality where waste production is directly related to the increase in population as well as the socio-economic activities they carry out. The growing number of people in a city puts a strain on waste management efforts.

1.1.3 Household waste production

Households, domestic or residential areas constitute the primary producers of waste in almost all parts of the world be it urban or rural areas. 69% of our participants attest to the fact that household activities produce large quantities of waste (Table 7). According to them, population has been increasing at an alarming rate and an increase in household size means increase in amounts of waste produced and generated (table 8). Most of them reported that the major reason for the increase in household size in Yaounde II is the NOSO crisis. This crisis has forced many people to leave their homes in Northwest and Southwest to seek refuge in safer towns such as Yaounde II.

Before 2016, most households were composed of about 0-4 persons. During our field investigations, we noticed that, today the case is different. We now find more homes with more than 10 or more persons. The average household size in the Yaounde II municipality was 8 people (table 9).

Table 10: Respondents' perception on the increase in their household sizes over the last five years

Neighbourhoods	Number of respondents	Has there been an increase in the number of people living in this house after 2016?		If yes, Household size?					
		Yes	No	Household size before 2016			Household size after 2016		
				0-4	5-10	10+	0-4	5-10	10+
Ekoudou	13	13	0	4	6	3	0	4	9
Azegue	6	6	0	2	3	1	0	2	4
Briqueterie	18	18	0	0	8	10	0	6	12
Cite verte	9	9	0	2	6	1	0	4	5
Messa	14	14	0	0	7	7	0	13	1
Madagascar	5	5	0	1	3	1	0	4	1
Carriere	13	13	0	2	9	2	0	4	9
Mokolo	8	8	0	2	4	2	0	2	6
Nkomkana	17	17	0	0	10	7	0	7	6
Ntougou	10	10	0	3	7	0	0	8	2
Oliga	11	11	0	2	9	0	0	11	0
Tsinga	6	6	0	1	5	0	0	2	4
Mbankolo	6	6	0	3	2	1	0	4	2
Febe village	1	1	0	0	1	0	0	0	1
Total	137	137	0	24	78	35	0	70	67
%	100%	100%	0%	18%	57%	26%	0%	51%	49%

Source: Field work, 2020

Table 9 above shows that all the respondents acknowledge that there has been an increase in their household size after 2016. We noticed that 18% of the population had a household size of 0-4 persons, 57% have 5-10 persons, and 26% have more than 10 persons. After 2016, we notice that the dynamics have drastically changed. 0% of the respondents affirm

to live with just 0-4 persons as compared to 18% before 2016. 51% of the population confirmed to have a population ranging from 5-10 persons as compared to 57% and another 49% confirmed to have more than 10 persons in their homes as compared to 26% before 2016. The minimum household size was 4 and the maximum household size was 17. During our investigations, we noted that this sudden increase is not primarily natural (increase in birth rate). According to respondents, the rapid increase in their household sizes is dominantly as a result of the on-going crises in the NOSO and far north regions of the country. When interviewed, some people said that, normally they were not many at home but with the on-going crisis in the northwest, southwest and far north regions, they had no choice but to harbour some internally displaced persons (IDPs) who may be their family members or just family friends. Other persons, most of those who were already living in Yaounde II, said it was their choice to have big families.

The respondents also attested to the fact that the quantities of food they cook has greatly increased as compared to what they used to cook before. They said that before 2016, they could cook a meal and eat it for two days but with the increase in household size, they cook more than once in a day. This means that not only has the quantities of meals cooked increased by the frequency of cooking has also increased. This has further led to increase in quantities of waste produced and rapid filling of PWCs which leads to littering of streets or road sides and gutters with domestic waste.

This information was backed by HYSACAM waste collectors during a focus group discussion. They said that PWCs get full faster than before and has surpassed their management capacity (plate 1).

Plate 1: Frequency with which PWCs are filled

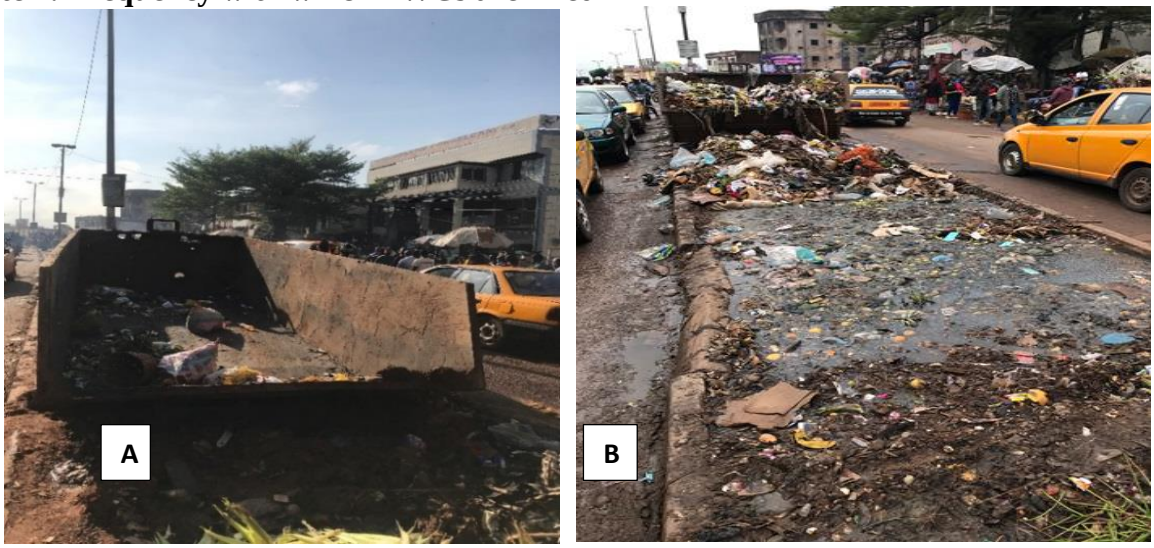


Photo A above shows the state of an empty PWC at Mokolo which was placed by HYACAM at 9 a.m. immediately after waste collection. Photo B shows the same PWC at 1 pm of the same day and at the same location. We notice that in the space of five hours, the place does not look the same. The PWC has not only been filled, but some people have littered the area as is depicted on Photo B This implies that just 1 PWC here is visibly not sufficient for the area. Photos by Ndabuf, September 2021 at 09 am and 1pm respectively.

We also noticed that waste production varies from quarter to quarter. We observed that neighbourhood's like Carriere, Briqueterie and Tsinga produce greater amounts of waste due to their large population sizes. According to Abu-qdais et al. (2007), there is a relationship between waste production and household size. In Cameroon, households produce an average of 0.66kg of waste per day and per inhabitant. Daily production per household is almost the same and varies per quarter. For example, in one neighbourhood, we notice a home with just 3 persons and the next door can have up to 10 persons

1.1.4 Educational, health and administrative establishments

From our surveys, 8% of the respondents attest to be involved in this sector of activities (Table 7). From our field investigations, these are areas where abundant amounts of waste are produced. They are mostly composed of paper, office materials, used medical equipment and food remnants. Yaounde II has a good number of schools and administrative centres and they generate considerable amounts of waste. Schools are areas where the practice of hygiene has to be felt but it is not usually the case. Education has to play a major role in educating pupils and students on hygiene and waste management. This must be done not only in schools but also at home. Most waste collected from these areas is burnt in open and improvised spaces due to the lack of an organised structure to cater for such waste.

The health sector is another sector that produces huge quantities of dangerous waste. Medical waste unlike other ordinary waste poses serious health risks to its handlers, health staff and patients but also to the environment (Tsamo et al, 2017). HYSACAM, the household waste collection company does not collect medical waste but these little health centres often dispose of their waste in PWCs. With the rapid increase in population and search for jobs, many clinics and health centres have emerged. According to our respondents, there has been a rapid increase in clinics and health centres in their neighbourhoods. Most of these structures especially the private ones produce waste that they have no idea of how they are treated despite how dangerous this particular type of waste can be Many respondents complained about the presence of used syringes, drug flasks, plasters, etc. which are disposed like normal waste.

1.1.5 Emergence of markets and Road side commercial activities

From our field investigations, 17% of the respondents affirm to be part of this sector of activities (Table 7). We found out that there are daily and weekly markets in the town. An example of a daily one is the Carriere market commonly called the Jean Vespa market. It holds on Mondays and Thursdays. Mokolo market is a daily market except for Wednesdays which is set aside for cleaning. It is the most prominent market in the town and is considered to be the biggest and most populated. Traders in this market sell both biodegradable and non-biodegradable good. When asked why they do away with waste from their market activities, they said that HYSACAM is here for that. Also, they pay the ticket for the market sweepers so they don't have to go and throw their garbage in the bin anymore. They said that they can't leave their merchandise to go and throw away garbage.

Aside from these already existing markets, we observed that, some small daily markets have emerged in areas like Mbankolo and Briqueterie. When interviewed, they said they are forced to create these markets for survival. Some people sell by the road side, pavement or sidewalk where they spread out their goods for sale (usually because they do not want or have the means to obtain shops. At the end of the day, waste from these activities is usually abandoned by the road, shops and in gutters. Most of this waste consists of food remnants, plastic papers, cartons and bags. As they are left in these gutters, they block drainage and which causes flooding, environmental degradation, destruction of aesthetics and pollution of all sorts. Likewise, we also noticed that most of these traders sell very close to big heaps of dirt. They spread out their food products on the floor and by these heaps of dirt and people still buy. When

asked why, they said they did not have any choice as they don't have any other place to go to. This is another threat to public health that people have chosen to ignore.

In accordance to what the respondents said, we noticed a proliferation of many roadside commerce and businesses. The presence of many containers on almost all corners of all streets cannot be ignored. Most of the respondents affirm to have engaged in diverse activities so as to survive. Some of these activities include frying fritters (beignets), selling drugs, fruits, callbox, hair salons, wholesale and retail shops, bars, snacks, restaurants. This sector of activities leads to the increase in waste production and generation. These consummation residues do not undergo any special treatment and most at times end up in gutters/drains, road sides and other uncontrolled dumping sites.

1.1.6 Others

From the responses got from our questionnaires, 7% of the respondents partake in other waste production sectors such as transportation related activities. They said that there has been an increase in transport services in Yaounde II as compared to before. They attest to the fact that bus stations, motor parks and garages have progressively been installed in Yaounde II. We spotted bus station in Carriere and a motor park in Mokolo. In consonance with hat we noticed, our respondents affirmed that these areas are naturally congested and polluted areas. Just like other urban structures, most bus stations were not created in accordance with the forecast of the urban planning. However, the point that attracted our attention during our field investigations was the development of resourceful activities. Once again, we observed that the increase in population was also the reason for the increase in transport services as well as commercial activities. These activities, such as the sale of foodstuff and artisanal products generate considerable amounts of waste in these areas. The unorganised vendors and their lack of interest in waste management practices provoke chronic insalubrity which exposes the consumers and the beauty of the town.

We also observed the presence of many garages. They constitute very important source of waste production and generation. According to respondents, the steep drop in the prices of motorcycles during this decade has favoured the omnipresence of scrap in the urban landscape. This situation has led to the creation of many small automobile garages in Yaounde II. Most of these garages are close to homes, shops and roads. Used oils from vehicles in these automobile garages represent a danger to the environment as well as public health.

1.2 DOMESTIC WASTE MANAGEMENT IN YAOUNDE II

Thousands of tons of waste are produced and generated daily in Yaounde most of which are non-biodegradable. However, the management of this waste remains a problem as not all parts of the town receive attention. Most of these wastes are not recovered and are not managed in an environmentally safe manner. Above are some of the factors of domestic waste production in Yaounde II, Cameroon. Among these mentioned factors is the increase in population. This demographic boom comes along with the proliferation of socio-economic activities which in turn boosts the production and generation of waste. If this waste is not properly managed, it can be extremely dangerous to man and his environment. This problem is well known to all the stakeholders involved; be it public or private. In Yaounde II, the waste management capacity does not to equate quantities of waste produced. There are several problems such as technical, human, material and financial problems that do not allow the management company to copiously succeed in its task. We would discuss and analyse the problems associated with low management capacity in the town.

1.2.1 Waste Collection and Storage Methods in Yaounde II

In Yaounde II, waste collection and storage are problematic. Collected waste represents only a fraction of waste generated although there are no statistics on collection efficiency. There is generally no distinction between service providers and municipal waste streams though this is clearly stipulated in the legislation. Though the entire system of waste collection is the responsibility of the council, this can often be contracted to third party private companies.

Generally, three approaches are adopted for the collection of waste in Yaounde II, namely, pre-collection, door-to-door collection and fixed-point collection.

1.2.1.1 Pre-collection method

Pre-collection refers to the movement of waste from the generation points to the municipal collection bins or public waste containers. This is the first step in the waste management process. The CUY-HYSACAM hygiene and sanitation contract does not take into account the pre-collection phase. This task is performed by the inhabitants. Despite the fact that they do not take part in this phase, we noted two forms of pre-collection in Yaounde II. The first is the one where family members carry their waste themselves to the secondary collection points Children move 80% of the household waste to public bins (Achankeng, 2003). The second form is carried out by the pre-collection agencies. This is a rapidly emerging

collection service. The emergence of this service is in Yaounde is as a result of the adoption of the law nº90/053 of 19/12/1992 on the liberty of associations in Cameroon. This could be an individual or a group of individuals who offer waste collection services in homes; commercial centres shops etc. either voluntarily or in search for profit. During our investigations, we discovered that there is an existent pre-collection service in Yaounde II. It is known as "Options". When interviewed, they told us that they are registered under the Yaounde II Council that allows them to carryout pre-collection services throughout the town. They have a subscription fee of 3000frs per month and they come either once or week or twice depending on the agreement they have with the individual from whose residence they would be carrying the waste from. They equally provide plastic bags to their subscribers for waste collection. Even though this service contributes to the sanitation conditions in some homes and areas, much still has to be done to see that these individuals are fully integrated into the official organisation scheme of DMW. This service is not yet very visible as just few people have turned to such services as compared other parts of the town. When asked, most of the respondents affirmed to have heard of such services but their main reason for not subscribing to it was that they did not have the money to pay for the service. The mayor of Yaounde II expressed that pre-collection services would not guarantee sanitation in the town but it would help to ease work for HYSACAM which would go a long way in contributing to the betterment of hygiene conditions in most localities (plate 2)

Plate 2: Pre-collection of waste

Photo A above shows a child who has carried dirt from his home to the public waste container. The picture shows that the PWC was already full upon his arrival and he threw the dirt on the floor. Photo B depicts the collection truck of Option, a pre-collection service in Yaounde II as they are collecting waste. These are both pre-collection methods. Photos by Ndabuf, September 2021 at 09,45 am and 10am respectively.

1.2.1.2 Door-to-door collection

This method consists of mobile waste collection trucks specialised for this type of operation. These trucks produce a peculiar hooting signal inviting the inhabitants to bring out their waste without wasting time. The waste is then loaded directly into the truck for transportation. We observed that this service is typically carried out in the afternoon and at this time, most people are not at home therefore they might remain with the dirt at home despite the fact that the collection company has passed. This method of collection is very common especially in neighbourhoods that do not dispose of public bins. It was difficult for us to determine exactly the schedules of this service. Nevertheless, based on the specifications, the passage of trucks and skips would be between 6:30 am and 11 am and from 3 pm to 5:30 pm. In an interview with an inhabitant from Nkomkana, he revealed that, almost if not all, do not know the hours of passage of collection vehicles. He said that,

"for two weeks they can come by every Thursdays or Saturdays and by the time we want to save the schedules they have used for the past two weeks; they suddenly change and don't come at the same time or they don't come at all. Usually we just wait for them. When they come, we are informed by the repetitive and distinctive horns of their trucks."

This type of service remains suitable in neighbourhoods with good or medium roads. It is advantageous for households located no more than 100 meters from the collection corridor. In areas with poor housing, only the main road through the neighbourhoods is sometimes travelled by trucks.

A quarter like Febe village where HYSACAM does not pass by very frequently and there no available PWCs, do not receive adequate attention. Whereas neighbourhoods like Cite Verte which has PWCs in almost all corners of the streets cannot go for more than five days without HYSACAM passing to collect waste there. Not only do they have these PWCs, door to door collection is equally practiced there. A respondent from Febe village said that waste accumulates in homes so much so that when they (HYSACAM) finally come, their truck gets full in just one little sector of the quarter and the others still have to remain with their dirt or they would pile it by the roadside. When it is piled by the road, if HYSACAM leaves the quarter and does not come back to continue from where they ended, the dirt would equally remain on the road till they ever come back since people cannot carry dirt back to their homes (plate 3).

Plate 3: Door-to-door collection by HYSACAM truck going into neighbourhoods to collect waste directly from homes

Photo A shows an HYSACAM truck in Mbankolo collecting dirt. Photo B shows the dirt left behind due to the fact that the truck got full at one section of the quarter and had to leave without collecting all the waste that was brought out by the inhabitants. Photos taken by Ndabuf, September 2021 at 11am and 2pm respectively

1.2.1.3 Fixed-point collection

This consists of placing large communal bins in designated locations of a quarter or neighbourhood for subsequent pickup. These PWCs are mostly placed in streets with good and or accessible roads. They are of different shapes and sizes (360litres, 770 litres and 1001 litres). Not all neighbourhoods have these PCWs. Some neighbourhoods have them but the sizes are the appropriate to the population of the area. The choice of the public container, its size, location and even frequency of pick up is designated by the rate of waste produced and generated as well as the type of activities that are carried out in a particular neighbourhood. This is the most widely used method of collection in Yaounde II. In contrast to door-to-door collection, waste is being stored for longer periods along the roads, streets and sidewalks which in turn destroy aesthetics, become homes to vermin, as well as exposes the community to this waste hence health issues. Scavengers usually search these areas to recover materials and sell (plate 4). From our observations, we noticed that fixed point collection is more practical for the inhabitants than door to door collection that demands their presence when they are passing to collect waste. In Yaounde II, waste collection schedule usually varies (table 19). When interviewed, an inhabitant of Carriere said that,

"HYSACAM gives more attention to the high and medium standing neighbourhoods like Tsinga, and Cite verte where influential people live. We on the other hand have to device our own methods which are usually not the best to survive. Can you imagine that a quarter like Carriere which is very populated has just three public waste containers which are not only very far from homes, but also most at times very full and overfull".

Plate 4: Overfull public waste containers in Yaounde II

Photo A shows a 360 litre PWC in Carriere. We notice that the container is obviously small as waste is already lying on the floor. Photo B equally depicts a 1001litre container with a similar situation by a road at Nkomkana. We notice that the PWC has been overfilled and has started invading the road. Photos taken by Ndabuf, September 2021 at 10am and 2pm respectively

When we interviewed, an HYSACAM personnel on how they cope with the constant overflowing PWCs, he lamented over the unethical behaviour and lack of good hygiene and sanitation techniques among the inhabitants of Yaounde which he says has leads to environmental pollution and health hazards. He said not only do people throw dirt just anywhere along the streets of Yaounde, some of them even make the effort of going near the PWC and instead of throwing their dirt in the containers, they throw it outside.

1.2.2 Household methods of domestic waste storage

According to Decree No. 195/CUY/06, (see appendix) each household must have a garbage bucket in good condition of at least 15 litres for the home collection of the waste produced. Field experience and survey results show that most of the populations do not own these 15 litre bins. Most of them have classical bins to store their waste. The prominent ones are plastic bags and old buckets and to a lesser extent pit holes and old baskets. Table 10 below shows the preferred storage methods used by the respondents.

Table 11: Preferred domestic waste storage methods used by the respondents in Yaounde II

Quarter	Number of respondents	How do you store waste in your house/vicinity?					
		Recipient with lid	Recipient without lid	Pile in the yard	Fibre or Plastic bag	Pit hole in or around the compound	Basket
Ekoudou	13	4	5	0	4	0	0
Azegue	6	0	2	2	1	1	0
Briqueterie	18	3	11	4	0	0	0
Cite verte	9	4	0	3	2	0	0
Messa	14	0	0	7	7	0	0
Madagascar	5	0	0	1	1	1	2
Carriere	13	3	7	2	0	1	0
Mokolo	8	0	4	2	2	0	0
Nkomkana	17	6	0	0	11	0	0
Ntougou	10	3	4	3	0	0	0
Oliga	11	0	3	0	8	0	0
Tsinga	6	1	0	1	0	1	3
Mbankolo	6	1	4	0	1	0	0
Febe village	1	1	0	0	0	0	0
Total	**137**	**26**	**40**	**25**	**37**	**4**	**5**
%	**100%**	**19%**	**29%**	**18%**	**27%**	**3%**	**4%**

Source: Household survey analysis by author, 2021

Table 10 above shows that, 29% of the respondents use recipients without lids as opposed to just 19% use recipients with lids. Most of these recipients without lids are old buckets that have gotten broken and have been transformed to dustbins. Further polls show that 27% of the respondents use plastic bags to store their waste. Some of these bags could be old market bags commonly called “sacks and motor “or “Ghana must go”. Others either buy disposal polythene bags of different sizes or they are given by the pre-collection service they are subscribed to. Another 18% of the respondents alleged that they pile their waste in the yard. The reason for piling is simply due to the retarded collection rates of HYSACAM. When HYSACAM delays to pass and collect the accumulated waste, bad odours, black water, maggots and other unpleasant features develop in people’s vicinities making them uncomfortable. This pushes them to create illegal dumping sites. Again, 3% declared to throw their waste in pit holes in or around the compound and the remaining 4% use baskets.

1.3 Availability of Public Waste Containers in Yaounde II (PWCs)

Public waste containers are also known as public bins, garbage can, trash can etc. They are usually made out of metal or plastic. These bins are barrels of different shapes and sizes placed in different crossroads of the town. Their spatial distribution shows disparities (Figure 7). Our field investigations revealed that not all neighbourhoods in Yaounde II possess PWCs.

We noticed that they are unevenly distributed and are usually far away homes. From our investigations, we totalled about 120 public waste containers in Yaounde II and most of them are concentrated by roads which are usually very far from residents. In Febe village, they are totally absent. A town with a population of about 350.000 inhabitants, the ratio would be 2 PWC's for 3250 people which are very insignificant. We notice that, one PWC covers about 4 hectares which is justified by the insufficient means employed by the stakeholders involved in managing waste as well as the communities to get more PWC's and change the dilapidated ones (table 11).

Table 12: Respondents' views on the availability of PWCs in Yaounde II

Neighbourhoods	**Number of respondents**	**Do you have a public waste container in your locality?**		**If no, where do you throw your waste?**				
		Yes	**No**	**HYSACAM truck**	**Streams/water bodies**	**Open spaces or bushes**	**Pit hole in or around the compound**	**By roads or streets**
Ekoudou	13	13	0	9	0	4	0	0
Azegue	6	4	2	1	2	1	1	1
Briqueterie	18	9	9	4	0	9	3	2
Cite verte	9	9	0	5	0	1	0	3
Messa	14	7	7	0	0	10	0	4
Madagascar	5	3	2	3	0	1	0	1
Carriere	13	7	6	6	1	3	0	3
Mokolo	8	8	0	5	0	3	0	0
Nkomkana	17	17	0	8	0	7	0	2
Ntougou	10	10	0	3	0	0	0	7
Oliga	11	6	5	2	0	6	0	3
Tsinga	6	5	1	2	1	1	1	1
Mbankolo	6	6	0	3	1	0	0	2
Febe village	1	0	1	1	0	0	0	0
Total	**137**	**104**	**33**	**52**	**5**	**46**	**5**	**29**
%	**100%**	**76%**	**24%**	**38%**	**4%**	**34%**	**4%**	**21%**

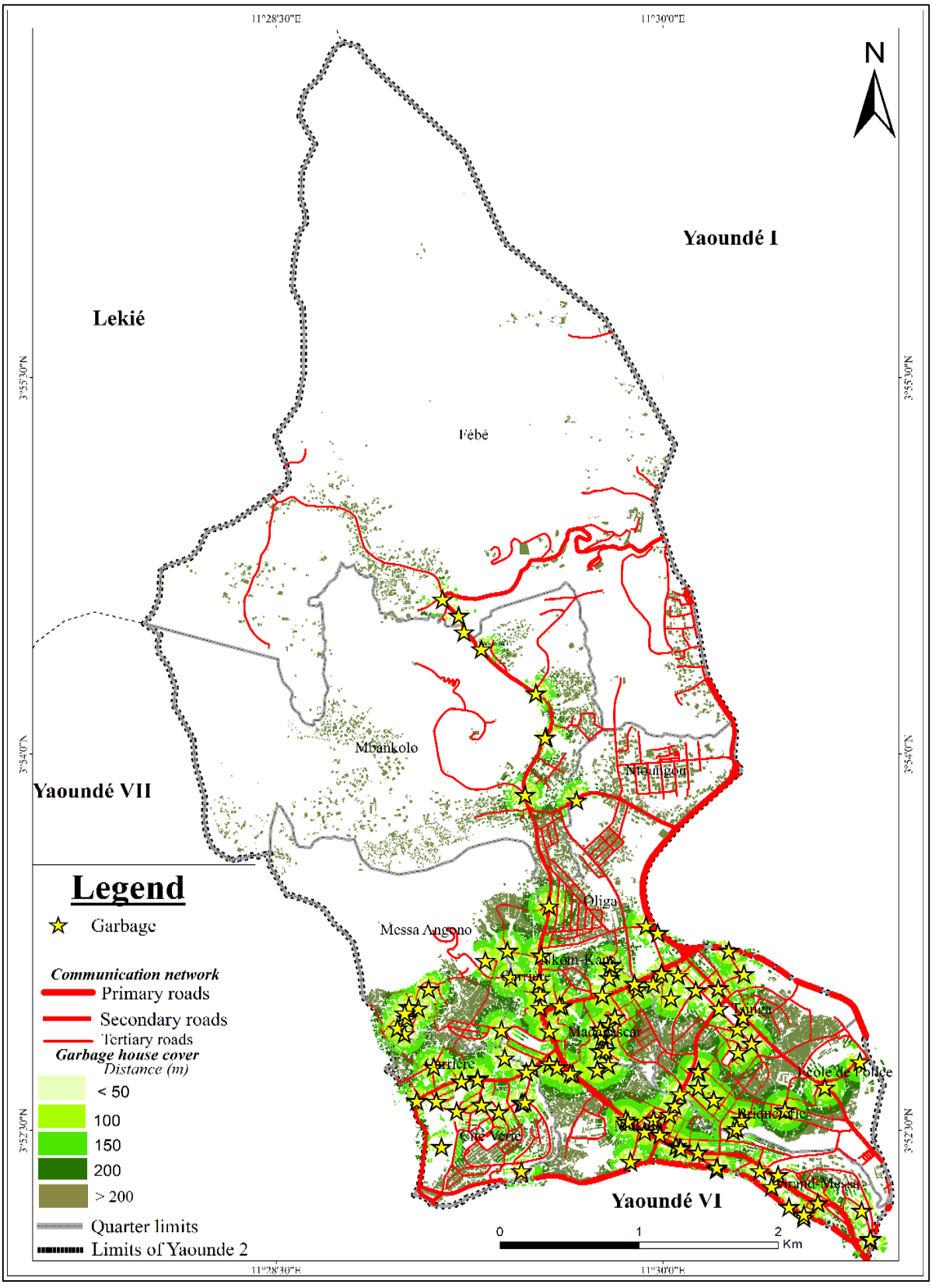
Source: Field data, 2021

76% of respondents as depicted by table 11 above admit to have a PWC in their localities. The remaining 24% said they don't have any PWC in their neighbourhood. Despite the fact that a majority of the respondents affirmed to have PWCs in their localities, not all of them throw their waste in them (figure 9). The norm should have it that since there are PWCs people should throw their waste in them but that is not the reality on the field. We observed that most of these PWCs were always full and overflowing. When questioned on why they do not make use of the available PWCs, they explained that the distance from homes to these PWC's, the irregularity of the collection company, the poor state of the PWCs and permanently

overflowing nature of these containers usually discouraged them from going to dispose of their waste there.

Table 11 further depicts the disposal methods adopted by the inhabitants of Yaounde II in the absence of PWCs. From the table, we notice that 38% of the population dispose their waste directly when the HYSACAM truck is passing. Conforming to what our respondents said and what we noticed during field investigations, HYSACAM have a peculiar hooting sound they make. When people hear this sound, they know that they are around and so go they out to throw their waste. From the table we notice that neighbourhoods like Cite Verte, Nkomkana and Mbankolo benefit from both fixed-point collection as well as door to door collection whereas another quarter like Febe village benefits only from door-to-door collection as there is no available PWC. Another 21% of the respondents held that they throw their waste by streets or by the road. 34% of the inhabitants prefer throwing theirs in open spaces and bushes by their homes. Another 4% of the respondents said they throw their waste in streams and water bodies which are usually around their homes and the remaining 4% throw in pit holes in or around their compounds. (figure 8).

Figure 8: Distribution of public waste containers in Yaounde II



Source: NIC and field work

Fig 8 shows the distribution of PWCs in Yaounde II (the yellow stars on the map). Even though we have not demonstrated in exhaustive manner the all the PWCs in the town, we can already notice that most of them are located only by the primary and secondary roads and not inside the neighbourhoods. Most homes and are far away from roads and these roads are usually not very accessible (Table 12). The hilly terrains of Yaounde II make it difficult for HYSACAM vehicles to freely manoeuvre through the narrow streets of the town. This limits access to some areas in the city. Without the door-to-door collection, a quarter like Febe villages would be totally abandoned as it is not just the only rural quarter in Yaounde II, it does not have any tarred road nor any available PWC. It barely receives attention as compared to other areas of the town. Again, a quarter like Tsinga that have PWCs still benefits from the door-to-door collection. Some respondents attributed this to discrimination. They said that when they go to other neighbourhoods, they see how waste is collected frequently but it is not the case in their own neighbourhoods.

According to an HYSACAM personnel, the installation of garbage bins throughout the city is a function of the rate of garbage production in a place and demographic change. But these criteria are highly questionable. It is true that certain indicators such as the installation of 16 m3 bins in markets, stations and certain crossroads allow the provider to remain logical in its approach. However, it is not enough to rely on this exemplarity in crowded public places. The fundamental problem lies in the equitable distribution of bins in the neighbourhoods.

1.3.1 Accessibility

The challenges of the terrain of Yaounde II make it difficult to limit and limits access to some areas in the city. Due to rapid population increase and urbanization, many people have built on slopes and difficult terrains which further makes accessorily problematic. To verify the validity of this assertation, the responses of the respondents were exploited (table 12).

Table 13: Respondents views on the accessibility conditions in Yaounde II

Neighbourhoods	Number of respondents	How best would you describe the accessibility conditions in your locality?					
		Footpath	Motorable all seasons	Motorable only during the dry season	Path passable with wheel barrow	Tarred in bad state	Tarred in good state
Ekoudou	13	2	0	2	0	9	0
Azegue	6	0	0	2	0	4	0
Briqueterie	18	0	0	0	0	14	4
Cite verte	9	0	0	0	1	0	8
Messa	14	0	7	7	0	0	0
Madagascar	5	2	1	0	0	1	1
Carriere	13	10	0	0	3	0	0
Mokolo	8	3	2	0	0	1	2
Nkomkana	17	0	4	0	4	0	9
Ntougou	10	0	0	0	4	0	6
Oliga	11	0	0	0	0	0	11
Tsinga	6	0	0	3	1	1	1
Mbankolo	6	3	2	1	0	0	0
Febe village	1	0	1	0	0	0	0
Total	**137**	**20**	**17**	**15**	**13**	**30**	**42**
%	**100%**	**15%**	**12%**	**11%**	**9%**	**22%**	**31%**

Source: Field data, 2021

In accordance with Table 12, 31% of the respondents confirm that, the roads in their neighbourhoods are tarred and in good state**.** From the table of all sampled neighbourhoods, only the respondents in cite verte all affirmed to have tarred roads in good state whereas other neighbourhoods like Ekoudou, Azegue, Febe village have none. Almost all neighbourhoods in Yaounde II have tarred roads but Cite verte is the only quarter with tarred roads by homes and very few paths compared to the others that have plenty. This area benefits from better waste evacuation services than most of the other neighbourhoods as it easily accessible. 15% said they frequently used foot paths. These footpaths are short cuts used by inhabitants due to the lack of motorable roads. For example, in Carriere, all respondents said they had access only to foot paths. Some of the respondents who have cars said that they park their cars on the main road and trek down to their homes due to the lack of roads. Another 19% confirmed that they live in areas with tarred roads but which are in bad state. That is, the roads have expired to a level where the tar is no longer visible and all that is left of it are potholes. Almost all sampled neighbourhoods had such roads made up of numerous potholes which usually cause traffic. Again, 12% affirmed to have access to motorable roads only during the dry season, 11% are passable with wheel barrows and 10% are motorable in all seasons. All major roads in Yaounde II have tarred roads but the problem is that most of them are far from homes. Roads around the homes are usually not tarred. Most of them are footpaths or tarred in bad state. The lack of

accessibility by vehicles is a problem that hinders effective DWM. The rate of DW removal would be much more efficient if roads are available.

We interviewed the manager of HYSACAM on why they attend to some neighbourhoods more than they attend to others. He said,

"All neighbourhoods are entitled to the same level of cleanliness and collection services. There is nothing like a privileged quarter or neighbourhood. However, the collection of waste depends fundamentally on the road service and accessibility of an area. Neighbourhoods that are easily accessible would obviously be easily attended to than non-motorable neighbourhoods. The sad thing is that the population of most of the neighbourhoods that receive more attention are the wealthiest. They have more PWCs and trucks can easily go around. However, the areas to which we deploy more of our human and material resources are the non-motorable areas with a result that is not the same because work is more difficult. Such neighbourhoods are not only denser in population, but also they throw dirt ubiquitously and anyhow."

Furthermore, as reported by our respondents, the distance from homes to PWCs is too much. This situation is very common and embarrassing when we know that a distance of 300m is much and the inhabitants would have difficulties in travelling long distances to go and throw dirt. Without door-to- door collection, we assist to exuberant proliferation of uncontrolled dumps. 39% of the population of Yaounde II confirms that the PWCs are situated at less than 100m from their homes against 61% that declares that the PWCs are situated at more than 100m from their homes. (Table 13).

Table 14: Respondents views on the distance from their homes to the public waste containers in Yaounde II

Quarter	Number of respondents	How far is the public waste container from your home/vicinity	
		10 to 100 meters	More than 100 meters
Ekoudou	13	6	7
Azegue	6	2	4
Briqueterie	18	7	11
Cite verte	9	5	4
Messa	14	4	10
Madagascar	5	2	3
Carriere	13	3	10
Mokolo	8	2	6
Nkomkana	17	7	10
Ntougou	10	8	2
Oliga	11	0	11
Tsinga	6	4	2
Mbankolo	6	4	2
Febe village	1	0	1
Total	**137**	**54**	**83**
%	**100%**	**39%**	**61%**

Source: Field work, 2021

Table 13 reveals the distance from homes to the PWCs in Yaounde II as perceived by the inhabitants. The distance travelled by most inhabitants to dispose to of their waste is not very encouraging. We notice that 61% of the respondents indicate that the PWCs are located at more than 100m from their homes as opposed to just 39% who said that they are located at less than 100m from the PWCs. According to them, this is the primary reason why they prefer to throw their dirt in bushes, streams, and pits around them hence the increase in wild, uncontrolled and illegal dumps. Residents, for those who can, have to walk hundreds of meters and cross the street to empty their garbage cans. Despite the multiple demands made by the populations to HYSACAM and the municipality to denounce this manoeuvre, a fair solution has still not been found to facilitate access to garbage bins for all inhabitants. The case of this area is not isolated because there are several in Yaounde II. One of the criteria for the distribution of bins by HYSACAM is also the installation of high-capacity containers in working-class districts. Once again, this criterion is being ignored. Figure 9 below, shows some of the illegal dumps where the inhabitants dispose their waste.

1.4 Types of waste dumps in Yaounde II

This refers to an allocated site for the disposal of waste material. In Yaounde II, there are legal or authorized dumping sites created by the authorities in charge of waste management. There also exist illegal and uncontrolled dumps which are created by the local populations. As earlier mentioned, the respondents affirm that most of their waste ends up in illegal dumping site which is very visible in the town.

1.4.2 Controlled dumps

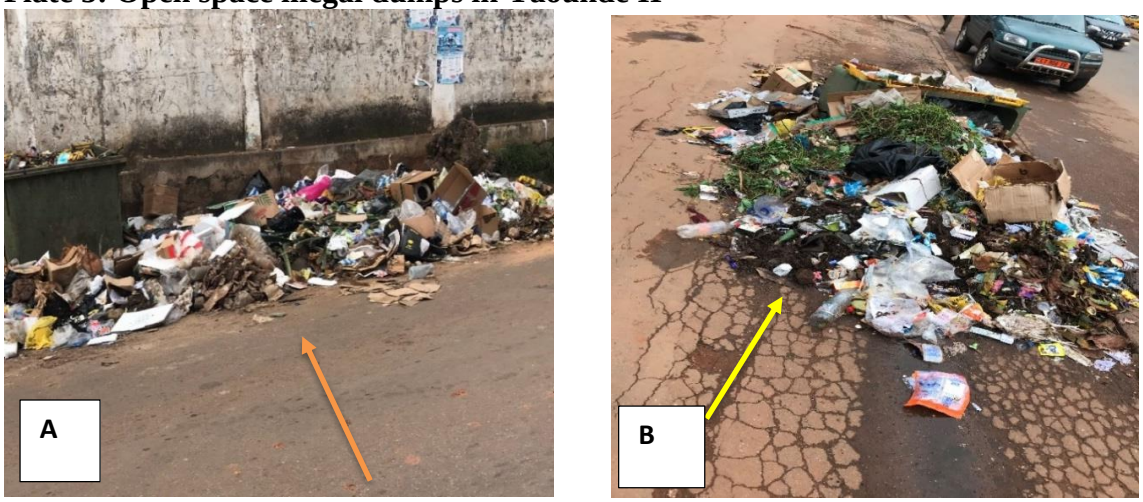
They are the ultimate link in any urban waste treatment train. They are accepted and tolerated areas for waste disposal and usually paced in specific and appropriate locations across the town after administrative authorisation. This authorisation is usually accorded after a study has been carried to make sure that the location is not harmful for the population and the environment. This therefore refers to public waste containers placed by road sides by the organisations specialized in waste management like HYSACAM.

1.4.1 Uncontrolled dumps and illegal disposal

These are random locations created without any administrative authorisation. A more general but neglected form of uncontrolled or illegal disposal is littering. It involves careless throwing of waste round houses, markets, public places and offices etc. illegal dumps are very common in Yaounde II. They are very prominent and visible in all 14 neighbourhoods of the

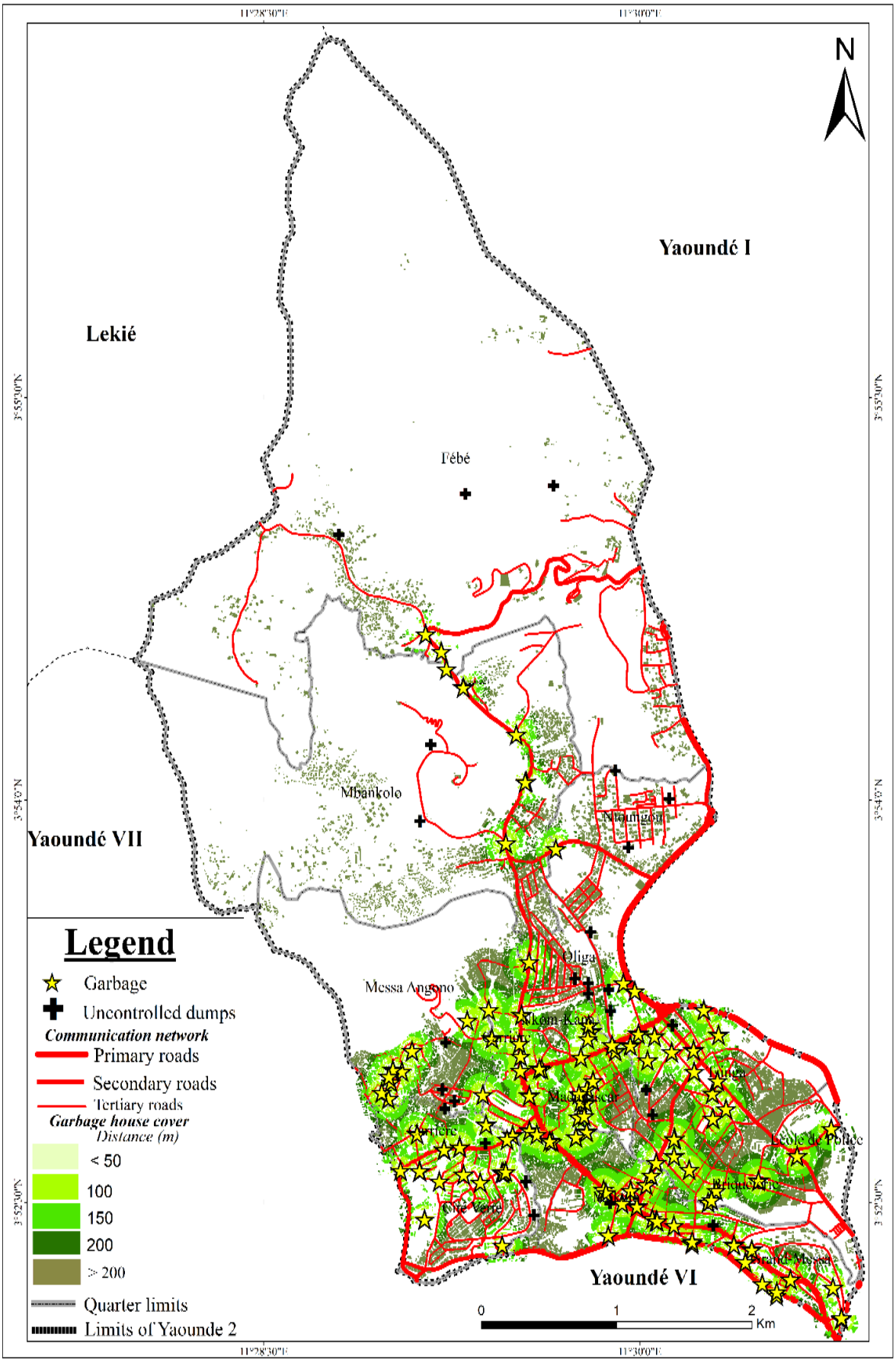
town. This is partly due to the lack of finances to provide more technical material. Irregular collection and distance of homes from the PWCs are also factors that influence the proliferation of uncontrolled dumping sites in the town (Figure 10). People dump waste anywhere and these actions usually have significant effects on man and the environment **(**Plate 5).

Plate 5: Open space illegal dumps in Yaounde II



Plates A show an open dump in Tsinga. Photo B also depicts a case of uncontrolled dumping in Ntougou. These areas usually tend to host rats and other vermin that destroy properties and are vectors to many illnesses. They also destroy the aesthetics of the town. Photos taken by Ndabuf, October 2021 at 1pm and 2pm respectively

Figure 9: Distribution of public waste containers and some illegal dumping sites in Yaounde II



Source: NIC and field work, 2021

The figure above depicts the distribution of public waste containers in the town of Yaounde II (yellow stars on the map) and the dark blue dots are some points of illegal dumping. We notice that, illegal dumping is very widespread. We also observed that even the areas that have PWC's equally have a number of illegal dumping sites. Also, many people travel long distances to go and dispose of their waste. As earlier mentioned, the primary reason for the creation of these illicit sites is because of the distance of the PWCs from homes. The irregularity in the collection pattern of waste by HYSACAM has also contributed to this problem.

1.4.3 Regularity of HYSACAM

Most of the respondents complained of irregular collection pattern in waste collection (table 14). Many people expressed that they are not satisfied with the collection pattern of HYSACAM. The data collected during field investigations equally prove that HYSACAM is irregular (table 14)

Table 15: Respondents perception towards the regularity of HYSACAM in waste collection in Yaounde II

Neighbourhoods	Number of respondents	How often does the collection company come around to collect waste in your vicinity?		
		5 to 10 days	Weekly	Irregular
Ekoudou	13	6	0	7
Azegue	6	2	0	4
Briqueterie	18	8	0	10
Cite verte	9	4	0	5
Messa	14	0	13	1
Madagascar	5	0	2	3
Carriere	13	0	0	13
Mokolo	8	0	0	8
Nkomkana	17	14	0	3
Ntougou	10	10	0	0
Oliga	11	8	0	3
Tsinga	6	0	0	6
Mbankolo	6	2	0	4
Febe village	1	0	0	1
Total	**137**	**54**	**15**	**68**
%	**100%**	**39%**	**11%**	**50%**

Source: Field work, 2021

The table above shows the consistency level as perceived by the populations of Yaounde II. The table shows that 50% of the respondents ruminate that HYSACAM, who is the company in charge of waste collection are not regular. When interviewed on the regularity of HYSACAM in the waste removal process, one of our respondents from Febe village emphasised that,

"Madam we call it waste because we no longer need it right? It is not good that these people stay for this long to come and carry waste. When they stay for more than two weeks how do they think we are coping. It is better to know that there is no one to do the work than that they are there and they and not do their job. To be honest it's not fair. Today we hear that they don't have equipment, tomorrow you hear that they are striking. It is always one story to another. Personally, I believe that if these HYSACAM workers were treated better we would have better results when it comes to waste collection."

We notice from the table that all the respondents from Febe village, Tsinga and Carriere said that HYSACAM workers are irregular. Febe village that does not have a PWC is usually submerged with waste. The only collection method is here is directly into the PWC and even so, very irregular. There is no particular day or time that they collect waste there. One of our respondents from Azegue said that normally they should pass and collect dirt at least once every week but sometimes they come after two weeks to collect the dirt".

Another 39% said that they collect waste after every 5 to 10 days. The remaining 11% said they collect waste weekly. Almost all respondents believe that HYSACAM would do better if they had better machinery and constant rewards or pay for the work they do. The extent of frustration by the respondents can be summarised in the following assertation by a key informant.

To corroborate with what the respondents insinuated, we looked into the HYSACAM collection schedule (table 15).

Table 16: HYSACAM work schedule in Yaounde II

Neighbourhoods	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Messa-Madagascar	6am-1pm	6am-1pm	6am-1pm	6am-1pm	6am-1pm	6am-1pm	6am-1pm
Cite verte-Carriere	6am-1pm	6am-1pm	6am-1pm	6am-1pm	6am-1pm	6am-1pm	6am-1pm
Nkomkana-Azegue	6am-1pm	6am-1pm	6am-1pm	6am-1pm	6am-1pm	6am-1pm	6am-1pm
Mbankolo-Febe Monastery	6am-1pm	6am-1pm	6am-1pm	6am-1pm	6am-1pm	6am-1pm	6am-1pm
Tsinga-Mokolo	6am-1pm	6am-1pm	6am-1pm	6am-1pm	6am-1pm	6am-1pm	6am-1pm
TsingaFecafoot-	2pm-9pm	2pm-9pm	2pm-9pm	2pm-9pm	2pm-9pm	2pm-9pm	2pm-9pm
Mbankolo-radio reine	2pm-9pm	2pm-9pm	2pm-9pm	2pm-9pm	2pm-9pm	2pm-9pm	2pm-9pm
Mokolo Market and surroundings	10pm-5am	10pm-5am	10pm-5am	10pm-5am	10pm-5am	10pm-5am	10pm-5am

Source: HYSACAM

The table above shows the HYSACAM work schedule in Yaounde II. From this schedule, we noticed that they are programmed to collect waste in Yaounde II every day. They have to collect waste at Messa, Madagascar, cite verte, Nkomkana, Azegue, Mbankolo, Tsinga as from 6am to 1pm. As from 2pm to 9pm, they collect in Mbankolo, Febe village to the Monastery, Mokolo and other parts of Tsinga. In Mokolo market and its surroundings they

collect at 10pm to 5am. This schedule is not in line with what we experienced on the field. We observed that the HYSACAM waste collectors do not respect this schedule. If they did, many people would be aware of this program and take necessary measures to dispose of their waste in time. This is justified by the respondent's perception on the collection rate and schedule of HYSACAM (table 14). They indicated that they are not aware of HYSACAMs work schedule as sometimes they come, and other times they don't. They further underscored that most at times they come when they are not at home.

When questioned on why they do not respect the collection schedules, an HYSACAM personnel told us that they have so many internal problems that do not permit them to constantly follow the schedule. Some of these problems include the lack of materials like tucks and the constant late payments of their salaries. The HYSACAM agency has recently observed a change in mood. On 30th July and 10th August 2021, HYSACAM employees announced that they would be going on a strike. At the time they were asking for salaries for July but till September they still were not paid. So, the employees have been demanding three months of salaries that have not been paid. This strike plunged the town into a state of insalubrity. We have noticed that this is a very recurrent problem that occurs at least twice every year where employees are demanding salaries. To date, the unpaid debts of the state and local authorities are estimated at least 10 billion FCFA, as we learned from good sources.

According to the HYSACAM communication manager, this is due to the delay of payment of their services by the public administrations. He stated that HYSACAM has not attained the limits of their capacities because it is a company that is endowed with enormous potential. Despite this, what he said does not tie with what we noticed during our investigations. PWCs are constantly full, some are dilapidated, all neighbourhood's do not receive equal attention and collection schedules are not respected but to name a few.

Also, the government instead ahead to hire about 1000 people to keep the town clean in view of the upcoming African Cup of Nations. These new recruits obviously do not have the expertise and experience that HYSACAM employees possess. They equally do not have adequate apparatus for the processes involved in waste management. When we questioned an HYSACAM personnel about how he felt about the current situation and how the government has handled it, he said,

"*The government is plain out wicked. Three months without salary and instead of trying to see into our grievances by simply giving to us what belongs to us, they have set out employ up to 1000 people. Is it not our right to claim what belongs to us? Can they themselves spend*

a whole month without salaries? We all have families. The money they are using to pay these large numbers of new recruits is money that they could use and pay us and everything would continue going the way it was. But no, they have decided otherwise. Let us see where this would take us."

1.5 Public perception on the waste collection services in Yaounde II

The waste collection company, HYSACAM, is both appreciated and unappreciated by many people. A majority of the inhabitants of Yaounde II are not satisfied with their services. This is justified by the irregular collection of waste in the town, constant overflowing PWC's and the proliferation of illegal and uncontrolled dumping sites. According to the data collected during field investigations, the proliferation of these illegitimate dumps is fully due to the inability of HYSACAM to adequately undertake their assignments. This has caused the populations to rate them very low (table 16).

Table 17: Public perception on the waste collection services in Yaounde II

Neighbourhood	Number of respondents	How best would you evaluate the collection of waste in your locality/vicinity?		
		Good	Fair/mediocre	Bad
Ekoudou	13	0	13	0
Azegue	6	1	3	2
Briqueterie	18	0	14	4
Cite verte	9	5	3	1
Messa	14	0	4	10
Madagascar	5	0	2	3
Carriere	13	0	7	6
Mokolo	8	0	3	5
Nkomkana	17	0	9	8
Ntougou	10	0	10	0
Oliga	11	0	11	0
Tsinga	6	0	5	1
Mbankolo	6	0	2	4
Febe village	1	0	0	1
Total	**137**	**6**	**86**	**45**
%	**100%**	**4%**	**63%**	**33%**

Source: Field work, 2

Table 16 is a representation of the evaluation of the respondents on the collection company, HYSACAM. We notice that, 63% of them recognize that they are not doing terrible. According to an interview conducted with an inhabitant of Ekoudou on the collection services provided by HYSACAM, the respondent underlined that,

"*We know that HYSACAM is not doing excellent but they are really trying. They are always striking. Recently they were striking because they have not been paid and we are now well treated despite the situation. Any person in our shoes would be angry and do same. Those salaries they are demanding is what puts food on their tables. We all saw the situation of waste management in the town when the HYSACM workers were on strike. The whole town is mess*

so imagine what would happen if they strike for a month. We would be in deep shit. They are not doing well and they are not doing bad either".

Another 33% of the respondents had a different perception contrary to those who said the services of the collection company was fair. Most of those who said they were doing bad were coming from neighbourhoods such as Carrere, Mokolo and Febe village. This is contrary to the responses of the respondents from Cite Verte where just one person said they their services were bad as opposed to the rest of the respondents in that neighbourhood who said they were good (4 respondents) or fair (6 respondents). This 33% of the respondents underscored that HYSACAM is not doing well because they constantly have waste lying around their homes, roads and other public places. According to our respondents, HYSACAM is lagging is the collection frequency. Most people have been discouraged due to irregular collection and emptying of the PWCs. In a quarter like Carriere, we noticed that it is very rare to see the PWC's empty. There are only three PWCs there for a population of 336,381 (BUCREP, 2010 population and household census) these PWC's are always overflowing and waste is always lying on the sidewalks and even on the road. Further interviews with the respondents revealed that more on the same topic. Another inhabitant from Mokolo underscored that,

"I rarely see that dustbin. It is always so full. Dirt has covered it to the point where we don't see it. We just see a big heap without seeing the recipient. It is just to tell you how full it is always. When we go there, we just pour the dirt on the floor and move away. Even when you are privileged to find it empty, you still find people especially children throwing the dirt on the floor".

We observed that, in Yaounde II, the collection service does not respect time nor days for collection. They come when they feel like so. If they had a schedule on when and how they pass and collect waste, and people knew about this schedule, the situation would have been far better and some would totally be avoidable.

Our field inquiries also revealed that the stakeholders involved do not collaborate with the local authorities like quarter heads. These are people who can greatly help the good functioning and operation of waste management process in many localities. Quarter heads and community members could be active partners in the waste management process but unfortunately it is not the case. This pushes people to continue throwing their waste where they deem fit and in turn, reduces the efforts of those who actually participate in the betterment of sanitary situations of their communities.

Also, the lack of institutional support at the local and municipal level constitutes another drawback. The role of municipalities in Cameroon is well defined in the waste management domain. The problem arises from the fact that these actors do not show enthusiasm and proper implication in the support of this operation. Whereas it is their role to control the hygiene and sanitation so that inhabitants in their turn would be concerned. One shop owner in Carriere said,

"*These people are very inefficient; you see them only once in a blue moon. They go only to rich neighbourhood's then we in neighbourhood's like this Carriere we are left to ourselves. You cannot more than 5 meters without seeing heaps of dirt by the street. They go and stay for long and come when they feel like it and when they even decide to come, they come and cause traffic and litter the whole place. My daughter those people are hopeless".*

Just 3% affirmed that they doing well. We notice that its respondents from Cite Verte and Azegue that benefits from both fixed point and door to door collection that affirm that HYSACAM is doing a good job. This is because HYSACAM frequently collects waste in their areas.

1.3 Conclusion

DW in Yaounde II is increasing in quantity and variety mainly because of population growth and increase in socio-economic activities. This has clearly surpassed the management capacity of the HYSACAM who is the main waste collector in the town. The first problem of DWM is linked to the shortage of adequate technical equipment such as trucks, inadequate PWCs, inaccessibly to some areas in the town, long distances to PWCs, and constant strikes because of no salaries. All these lead to the creation of uncontrolled and illegal disposal of waste on vacant spaces, water bodies, roads and drains. In Cameroon, waste management is governed by laws and decrees. These legal texts would be examined in Chapter 2 as well as the principal actors involved in the WM process: their roles and functions.

Testing of hypothesis 1, analysis and discussions of results.

To verify the stated hypothesis, the Chi square statistical tool was used to analyse the data obtained in the field through direct observation, interviews, and questionnaire. After testing each hypothesis, some analyses and discussions of the results were made.

Research hypothesis 1 guided the study to collect relevant data to establish a link the increasing waste production and management capacity in Yaounde II. to verify the validity of this assertion, the responses of the respondents were exploited (table 7).

In a bit to establish the degree of relationship between variables, a contingency table was developed and a null and alternative hypothesis were equally stated.

The contingency table will thus be **(SEE APPENDICE 4)**

Source: Table based on Chi square statistics

$$X^2 = \frac{(O-E)2}{E}$$

Degree of freedom (df) = (c-1) (r-1) = (6-1) (14-1) = 5x13 = 13

Null Hypothesis (Ho): Increasing waste production has not surpassed management capacity in Yaounde II.

Alternative Hypothesis (Ha): Increasing waste production has surpassed management capacity in Yaounde II.

We now have our chi square statistic ($X^2 = 22.362$), which is the calculated value, our predetermined alpha level of significance (0.05) and our degree of freedom (df = 65). Situating the Chi square distribution table at 13 degrees of freedom and reading along the row we find that the value ($X^2 = 22.362$) is above critical value 137.1. Since our calculated value of ($X^2 = 22.362$) is far above the critical value of 137.1 we can then rejected the null hypothesis which states that: Increasing waste production has not surpassed management capacity in Yaounde II and retain the alternative hypothesis which states that: Waste production has surpassed management capacity in Yaounde II.

The first specific objective was aimed at investigating the sources of waste production and how they are managed in Yaounde II. The continuous increase in population results to the continuous increase in waste production which in turn has surpassed management capacity. During field investigations, it was revealed that HYSACAM has a hard time keeping up the quantities of waste being produced in the town. This is visible form the constant uncollected waste lying by roads and homes irregular waste collection and insufficient PWCs. All these are clearly demonstrated from the responses of the respondents on tables 11, 12, 13, 14 and 16.

CHAPTER 2

POLICIES AND INSTITUTIONAL FRAMEWORK THAT GOVERNS DOMESTIC WASTE MANAGEMENT IN YAOUNDE II

Introduction

Institutional responsibilities are delimited in texts creating institutions and defining its mission in decrees, laws, orders, circulars or decisions. These legal texts define and orient the overall hygiene and safety. They also allocate the missions of the various stakeholders involved in waste management and urban cleanliness. At the institutional level, two type of actors are identified. These are the legal actors (ministries, municipalities and donors) and informal actors (actors of the civil society). The roles and missions of legal stakeholders however, remain difficult to allocate especially on ground as most of them are given the same responsibilities. Coordination is usually needed to avoid conflicts, negligence and duplication. According to Schudler (1996), the key components for an institutional framework includes; the distribution of functions and responsibilities, the organizational structure, incentives, interests and accountability. Many obstacles however, stand as stumbling blocks for stakeholders to adequately contribute to the improvement of the waste management process in Yaounde II. These challenges range from administrative, technical and financial.

In this chapter, the study aims at examining the activities of stakeholders involved in waste management process in Yaounde II. This would be an attempt to answer the second hypothesis which states that “ineffective policies and institutional framework has largely influenced the management of domestic waste in Yaounde II”. This chapter is divided into three sections. The first section of this chapter lay emphases on the structure and institutional framework of waste management in Cameroon. The second section discusses the civil and criminal sanctions levied on defaulters of waste management as well as the limitations of waste management policies and institutional framework in Yaounde II. The last section examines the problems related to waste management in Yaounde II.

2.1 THE STRUCTURE OF WASTE MANAGEMENT IN CAMEROON

In Cameroon, several ministerial departments have mandates to implement solid waste management regulations. There are many ministerial departments that have the mandate to implement waste management regulations and the highest body responsible for municipal solid waste management is the Inter-Ministerial Commission for municipal solid waste in Cameroon

(ICMWM). It was created under the direction of the prime minster (Decree No. 95/230PM of 31/04/95) and charged with the formulation and policy development of appropriate municipal solid waste management strategies.

Sanitation is of paramount importance in a society. In view of this importance in the protection of public health, the environment and its specific role in the efficiency of water projects and programs, Cameroon has embarked on a campaign to protect its populations through the erection of an arsenal of texts, laws, and decrees. According data collected during field investigations, the polices and institutional framework that governs waste management practices in Yaoundé II were not very much appreciated by the respondents (table 17).

Table 18: Efficiency of polices and institutional framework of waste management in Cameroon

Neighbourhoods	Number of respondents	Do you think that the polices and institutional framework put in place to manage domestic waste are efficient?		Have these polices and institutions affected proper domestic waste management?	
		Yes	No	Yes	No
Ekoudou	13	5	8	8	5
Azegue	6	2	4	4	2
Briqueterie	18	0	18	18	0
Cite verte	9	6	3	3	6
Messa	14	7	7	7	7
Madagascar	5	0	5	5	0
Carriere	13	0	13	13	0
Mokolo	8	0	8	8	0
Nkomkana	17	4	13	13	4
Ntougou	10	1	9	9	1
Oliga	11	0	11	11	0
Tsinga	6	2	4	4	2
Mbankolo	6	2	4	4	2
Febe village	1	0	1	1	0
Total	**137**	**29**	**108**	**108**	**29**
%	**100%**	**21%**	**79%**	**79%**	**21%**

Source: Field work, 2020

The 79% of the respondents as depicted by table 17 have a negative view on the polices and institutional framework as opposed to the just 21% who believe that the polices and institutions are efficient and have a negative effect on waste collection in Yaounde II. From the table, the high level of yes-respondents in all neighbourhoods in Yaoundé II is justified by the fact there are constant strikes by HYSACAM workers, many institutions involved with waste management with no specified roles, constant anaesthetic state of the town and insufficient waste collection organs involved in waste collection. Most of the respondents attested that HYSACAM alone could not properly collect waste in not just Yaoundé II but the many towns

where they work. They said that more waste collection organs should be approved by the stakeholders involved so as to help improve the sanitation and visual pleasure of the town.

2.2 Polices, legal and regulatory framework on waste management in Cameroon.

The polices, legal and regulatory frameworks for waste management in Cameroon are quite dense. But the respective areas of competence and roles of several actors create a confusion that is not likely to promote interaction and the effective application of defined government strategies. The data used to build this debate were collected during household surveys, interviews with municipal and ministerial services and the analysis of waste legislation in Cameroon. The interviews were mostly conducted anonymously according to the request of the interlocutor. A series of decrees have been signed to govern the management of waste in Cameroon. (table 18).

Table 19: Legal frameworks for waste management

Legislation	Key elements related to waste management in Cameroon	Statutory order
Law relating to environmental management (No.96/12 of 5/08 1996)	Modalities for the conduct of Environmental Impact Assessment (EIA); specifies air emission and waste water discharge standards; Set conditions for issuing authorizations for allotment and management of land uses, i.e. industrial urban; Prescriptions relating to waste elimination by persons producing or treating waste; Stipulates the terms of reference for the supervision of municipal dumps by competent authorities	Decree No. 2005/0577PM of 23/02/05, Order No. 006 MINEP of 08/03/05
National Environmental Management Plan	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	9/11/99, Order No 13/MINMEE/DMG/SL of 19/04/77, 02MINMEE/DMG/SDAMIC of 04/01/99
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 operations and management must follow prescribed guidance. It sets out the regulations governing the installation and exploitation of facilities classified dangerous, obnoxious and polluting.	
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 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 management.	

Source: Manga et al, 2007

Many people are aware of the fact that there are polices and decrees set out to check waste management practices. The sad part is that, despite the fact that they are aware of the existence of these decrees, people do not respect these laws. This is justified by constant malpractices like haphazard dumping and poor mentalities developed on the issue of waste management (table 19).

Table 20: Respondents awareness on the existence of laws on waste management in Yaounde II

Neighbourhoods	Number of respondents	Are you aware that the Cameroonian law strictly prohibits the dumping of waste in unassigned public spaces?		If yes, do you implement this law in your daily activities?	
		Yes	No	Yes	No
Ekoudou	13	12	1	3	10
Azegue	6	4	2	2	4
Briqueterie	18	18	0	1	17
Cite verte	9	9	0	5	4
Messa	14	14	0	1	13
Madagascar	5	5	0	2	3
Carriere	13	13	0	3	10
Mokolo	8	8	0	0	8
Nkomkana	17	14	3	6	11
Ntougou	10	9	1	4	6
Oliga	11	11	0	4	7
Tsinga	6	4	2	2	4
Mbankolo	6	4	2	2	4
Febe village	1	1	0	1	0
Total	**137**	**126**	**11**	**36**	**101**
%	**100%**	**92%**	**8%**	**26%**	**74%**

Source: Field work, 2021

In line with table 19, we notice that many people know about the existence of laws on waste management practices in Yaounde II representing up to 92%. Just 8% of the respondents are ignorant of the existent of these polices. This implies that most of the respondents know that illegal dumping is prohibited by the law. When interviewed, most of them confessed not to know the name of the particular decree that states that waste should not be disposed of in unassigned locations but they know that they are aware of the existence of a law in that nature.

The same tables demonstrate that, despite the fact that people are aware that the law prohibits haphazard dumping, they do not respect this law. 26% of the respondents affirm to respect the law as opposed to 74% who say they do not implement this law in their daily activities. When questioned on the reason why they do not respect this law one inhabitant in Mokolo said that it was of no use. He said that places are always ornamented with waste even if they wanted to just the surrounding in which they live in does not encourage them to do

anything differently. Again, if the actors involved in the waste management sector were reassuring, or doing their job, that question would have not even come up.

This implies that despite the presence of these decrees, their implementation on the field are yet to be felt or are not visible. The lukewarm attitude of the state officials in Yaounde II to implement the prime ministerial decrees on the conditions and modalities on the operation of waste managers has led to the neglect of this sector in the Yaounde II. These decrees are not really respected. This is the reason why the proliferation of waste and uncontrolled dumping, poor habits and perception, continue to gain grounds with little or no respect to these decrees Yaounde II and nationwide.

A simple example is the ban of the use of plastic non-biodegradable plastic papers in 2012 (Joint Order No 004/Minepded/Mincommerce of October 24, 2012). Many people were and are still aware of this ban but from the day that decree was signed till date nothing has changed as people still use plastic papers in 2021. The situation is even worse than what is was before the ban. There is no progress or change as people keep using them in markets, homes etc. In an interview conducted with one lady selling these non-biodegradable plastics, she underscored that they cannot ban something and not bring a substitute or better solution. The lack of constant inspection contributes to the persistence of the circulation of these plastic papers in the Yaounde II.

2.3 Institutional framework of waste management in Cameroon

Waste management in Cameroon is provided by a host of public and private actors. In order to get a more precise view of the subject, legal and unlicensed actors who intervene directly or indirectly in the field of household waste in urban areas in Cameroon and Yaounde in particular will be discussed in this section. Unlicensed actors are individuals or corporations whose activities in waste management are not legalized. The legal actors are all legally recognized institutions with rights and obligations in waste management. To these must be added the international financing institutions (World Bank, European Union, African Development Bank, etc.) which, together with the State, are present in most urban sanitation projects.

2.4 Activities of ministerial departments related to waste management in Cameroon

Through the decentralized responsibilities of the different ministerial departments a number of statutory orders related to solid waste management have been enacted. Generally, these aim to address issues to all types of waste streams specifically environmental and public health protection. Table 20 provides a summary of the roles and responsibilities of the different ministries involved in the implementation of municipal waste management in Cameroon.

The different state institutions intervene through their technical services which develop standards and legislation around household waste. Their actions range from planning, defining national strategies, funding, monitoring the legal framework and standards in the area of health and safety, monitoring and evaluating projects, and enforcing existing sanitation regulations. The intervention of each actor is governed by a legal text defining its responsibilities (table 20).

Table 21: Roles and responsibilities of key ministerial departments related to waste management in Cameroon

Ministerial department	Key responsibility related to waste management in Cameroon	Statutory order
Ministry of Territorial administration	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	Decree No. 99/818/PM of 9/11/99, Order No. 13/MINMEE/DMG/SL of 19/04/77, 02/MINMEE/DMG/SDAMIof 4/01/

	public; Develops regulations governing installation and exploitation of facilities classified as dangerous, obnoxious and polluting	
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 21/05/0
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 assessments	Decree No. 2005/0577/PM of 23/02/05 7], Order No. 006/MINEP of 08/03/05
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 No. D69/N6/DMHK/SHPA of August 198
Ministry of agriculture and rural development (MINARD)	Promote and transform agro-industrial and urban waste into organic manure. The main mission of this service is the promotion of composting and the extension of compost among farmers.	Order No. 2005/118 of 15/05/05

Source: Manga et al. 2007

Although these ministerial departments are of different responsibilities, their general aim is to address the issue of waste.

2.5 Other Actors Involved in Waste Management in Cameroon

In Cameroon, waste management mobilizes a host of stakeholders and actors in the waste management sector: private and public actors. Waste management in all the towns in Cameroon are done through competition from actors who act in accordance with the law. Each of them takes care of the different sectors involved in management. These are decentralized collections organized by local authorities and the hygiene and sanitation of Cameroon (HYSACAM).

2.5.2 EXECTION AND MANAGEMENT ACTORS

2.5.2.1 Urban Councils (UC)

Urban Councils (UC) implements waste management policies set out by ministries. The main role of the UC is technical and financial management, and the execution of health and sanitation projects (Decentralization Policy Act No.2004/017 of 22 July 2004 Law 74/23 of December 5, 1974, bearing communal organization, Articles 1 and 2). The YCC has delegated technical waste management to HYSACAM. The delegation consists of assigning a private company to provide the public service for the management of household waste under the control of a public institution which has a say in the administration of the service.

Our observations show that UCs are responsible for the removal of household waste at the local level. This work is the responsibility of the hygiene and environmental department coordinated by the technical services. UCs have focused their activities on raising awareness to limit the proliferation of wild deposits and promote hygiene and safety rules.

2.5.2.2 HYGIENE ET SALUBRITE DU CAMEROON (HYSACAM)

The Société d'Hygiène et Salubrité du Cameroun (Hygiene and sanitation of Cameroon, HYSACAM) is a private company specialized in the collection, transportation, treatment and disposal of solid waste. It was founded in 1969 by the French Granjouan and then taken over in 1995 by a handful of its executives has reigned supreme in this sector of activity for five decades. Its last success dates back to 2018, when they company once more won the markets of Yaounde and Douala and, a few months later, that of Ngaoundere, the large city north of the country. In Yaounde, HYSACAM offered a financial offer of 40.8 billion FCFA (over 62 million euros) despite being the main waste most breadwinners in relation to waste

management in Cameroon; competition continues to be prevailing due to the interest of the interest of many foreign groups in the sector.

HYSACAM is the main domestic/household waste treatment company in Cameroon. It operates on the basis of management contracts signed with 14 Cameroonian cities. It accounts for a little over 1100 employees, 112 vehicles and engines, (4 street cleaning machines, 2 garbage compactors etc.). HYSACAM collects, transports, and disposes of solid household waste collected in the city. The YCC's technical services regularly assess the delegate; carries out technical checks of projects, construction sites and equipment. They also receive and transfer useful equipment for good waste management if necessary.

Yaounde Urban Council/HYSACAM contract

The service contract signed between HYSACAM and the YCC aims to collect, transport and treat waste produced throughout the city of Yaounde. HYSACAMs mixed performance compared to the city's coverage (less than 50%) raises questions about the company's ability to fulfil its missions well. This service delegation denotes so many blurred contours. The surveys carried out in the field during this study show that the entire city of Yaounde is not covered by the public waste service. This weakness of the waste management system is due to the inconsistency between the formulation of the specific objectives of the Yaounde Urban Council contract and the Cameroon Hygiene and Sanitation Society. The contract specifically states that HYSACAM is responsible for sweeping streets, markets and public squares; collection, transport, waste treatment throughout the city of Yaounde. For example, the daily collection of waste is set at a maximum of 1000 tons per day by the YCC. However, the average production of the city is estimated at nearly 2000 tons, knowing that the weight of garbage varies according to the seasons. HYSACAM is required not to exceed this figure and therefore is immediately led by the YCC not to fulfil its mission, namely to collect all or at least 80% of the garbage produced in Yaounde. The costs of excess waste collected, transported and treated are the responsibility of HYSACAM.

The above example put in place by the YCC seems tacitly programmed in advance, excluding access to the public waste service for a large part of the city. The operation of the management system shows that the principle of equitable access to the public waste service and the performance objectives of this service are defied by the state institution responsible for guaranteeing better hygiene and sanitation in the city of Yaounde. HYSACAM, who is the executor of the contract, pays the price through criticism, denunciations and denigration by the

public who are usually under-informed about the operation of the system. Sotamenou (2010), who made an analysis on the performance indicators of the public waste service in Yaounde, also notes that HYSACAM has no obligation to collect waste in the shallows and its contract authorizes it to collect only waste deposited in garbage bins and those collected by trucks.

2.5.2.4 Awareness participation rates and awareness/sensitization actors

Effective communication between waste management organizations and citizens is essential to the efficient operation of waste management services. Citizens need to know what services are available to them. In a bid to achieve sustainable waste management, public campaigns are usually key drivers. According to the United Nations Conference on Environment and Development (UNCED) (2012), education and awareness are major tools when it comes to sustainable domestic waste management. This approach is meant to reach all urban populations by going from door to door, television, radios, school activities, sharing posters and even organising community meetings. According to data collected on the field, 91% affirm to have received sensitization on waste management and just 9% said they have never received any form of sensitization. (Table 21).

Table 22: Respondents views on the medium of waste management sensitization in Yaounde II

Quarter	Number of respondents	Have you ever had any form of sensitization or education on waste management practices?		If yes, through what medium were u sensitized?				
		Yes	No	Radio	Television	Community meetings	School environmental clubs	Posters or sign boards
Ekoudou	13	12	1	0	0	0	0	13
Azegue	6	4	2	0	0	2	0	4
Briqueterie	18	18	0	0	0	4	4	10
Cite verte	9	9	0	0	0	3	3	3
Messa	14	14	0	0	0	8	0	6
Madagascar	5	5	0	1	1	0	1	2
Carriere	13	13	0	0	0	5	0	8
Mokolo	8	8	0	0	0	1	3	4
Nkomkana	17	15	2	0	0	3	3	11
Ntougou	10	9	1	0	0	0	3	7
Oliga	11	11	0	1	1	3	0	5
Tsinga	6	4	2	0	1	2	2	2
Mbankolo	6	4	2	0	0	1	2	3
Febe village	1	1	0	0	0	0	0	1
Total	**137**	**127**	**10**	**2**	**3**	**32**	**21**	**79**
%	**100%**	**93%**	**7%**	**1%**	**2%**	**23%**	**15%**	**58%**

Source: Household survey analysis by author, 2021

Most of our respondents attest to have received some form of sensitization. We notice that 93% of the respondents acknowledge to have received some form of sensitization as opposed to just 7% who said they have never received any form of sensitization. When we interviewed the mayor of Yaounde II, he said that they usually send out outreach teams that range from 3 to 5 people. They do so to sensitize as many people as possible. He highlighted that

"We are aware of the lack of information, awareness and education campaigns for our people, but we cannot do better. We have already made complaints to the YCC and even to the interdepartmental committee. On the other hand, HYSACAM also organizes awareness campaigns. Messages are conveyed through advertising signs placed at intersections and major avenues, posters on motorized equipment and the media. The outreach methods used by HYSACAM are not accessible to everyone."

In contrast to what he said, most of our informants said they've never seen or received such form of sensitization. Table 21 gives an insight on the forms of sensitization received by the respondents in Yaounde II.

According to the yes-responses on the table, it shows that 58% of them were sensitized on waste management through posters or signboards. Most of these posters are pasted on public dustbins found along roads, schools and other places. The messages that are usually carried on these posters were *"do not throw dirt here", "cleanliness is next to godliness", "put your dirt in the trashcan", "keep your surroundings clean"*, We noticed that some of the no-throwing plates placed in places to dissuade people have become a simple backdrop, because it is in these same places, we notice the greatest amounts of littering. Most of the respondents said that they did not know who put up these posters. This is because those who put them up do not work in collaboration with the local population. Awareness-raising campaigns without going into repression no longer have any effect on inhabitants of Yaounde II. The application of the law through the payment of fines and community service for any offender remain avenues to be explored to reduce the insalubrity in Yaounde and increase the performance of the public waste service.

In furtherance, the table portrays that 15% have received sensitization in schools. The respondents said that when they were still in school, they had environmental education in the curriculum and that's how they got to know about waste management and its effects on the environment. Respondents in neighbourhoods like Messa, Azegue, Ekoudou, Madagascar, Carriere and Oliga, they said they never received any form of sensitization on waste

management in school. This might mean that the schools they went to did not include environmental education in their curriculum.

Another 23% admitted have received it through community meetings which are usually organised by the community members themselves. The members of all neighbourhoods in Yaounde II except Febe village and Ekoudou affirm to organize community meetings. This is in a bid to work together to ensure that their localities are clean rather than wait for HYSACAM. Some people in these neighbourhoods said they do not take part in these meetings because they are not usually informed about them.

Just 2% stated to have received sensitization through TV. They said that what they usually see are general messages from other channels which are usually not necessarily designated to the Cameroonian public but are relatable. The remaining just 1% affirms to have received sensitization through radio. Many people confessed that they do not remember the last time they listened the radio or even saw one. Most of them now see any useful information on social media.

It is worthy to note that no matter how low the percentage of a response is, it is very necessary as even if one person sees or listens, it goes a long in way in bringing change. According to field surveys, it was found out that these sensitization campaigns are usually organized by different bodies (table 22).

Table 23: Respondents perception on who organized the sensitization they have received in Yaounde II

Neighbourhoods	Number of respondents	Who organized the sensitization?						
		Ministries	NGO	Council	HYSACAM	Community	School clubs	I don't know
Ekoudou	13	0	0	0	0	0	0	13
Azegue	6	0	0	0	0	2	0	4
Briqueterie	18	0	0	0	2	6	8	2
Cite verte	9	0	0	2	0	4	2	1
Messa	14	0	1	5	0	8	0	0
Madagascar	5	2	0	0	0	0	1	2
Carriere	13	0	0	2	0	2	0	9
Mokolo	8	0	0	1	0	1	1	5
Nkomkana	17	1	0	1	0	1	3	11
Ntougou	10	1	1	0	0	0	4	4
Oliga	11	5	0	3	0	3	0	0
Tsinga	6	1	0	1	0	1	1	2
Mbankolo	6	0	0	0	2	2	2	0
Febe village	1	0	0	0	0	1	0	0
Total	**137**	**10**	**2**	**15**	**4**	**31**	**22**	**53**
%	**100%**	**7%**	**1%**	**11%**	**3%**	**23%**	**16%**	**39%**

Source: Household survey analysis by author, 2021

Table 22 shows the various institutions that set out to sensitize populations on waste management practices. This table shows that, a majority of the respondents do not know who organises the sensitization campaigns as they scored 39%. Most of them emphasised that they just see sign boards or posters on the streets but do not know who puts them up. This means that they have not received any form of direct sensitization. Others said they usually see some people walk around and talk about waste but they do not know who sends them.

Another 23% of them revealed that most of their campaigns are carried by they themselves the population. When interviewed, the quarter head of Febe village alleged that they cannot sit every time waiting for HYSACAM. So, if they leave the place the way it is, they are the ones who would still suffer the odours and insalubrity not HYSACAM. So, they rather do it once in a while.

The table equally depicts that 11% of the respondents affirm to have been sensitized by the council. School clubs scored 16%. The respondents said they started knowing more about waste management practices and its dangers while they were in school. They used to belong to environmental clubs where they taught about waste management practices. They also said health and environmental sciences was part of their curriculum. NGOs scored just 1%. Most of our respondents did not know that NGOs were involved in any form of waste management. The impact of NGOs is yet to be felt in Yaounde II as it is in other parts of the town.

From the table we see that only 3% of the respondents have received any form of sensitization from HYSACAM. Most of them just know that they collect waste but have never received any form of waste management education from them. When interviewed another man said,

"I have never heard anything like sensitizations on waste management practices from anybody talk less of HYSACAM. I did not even know that HYSACAM carries out sensitization campaigns. I just see them come and collect dirt and go. I never seen them tell people how to store or manage their waste. It is just that we are bound to keep our environments clean but I have never received any form of sensitization."

This data is contrary to what an HYSACAM personnel told us. He said that HYSACAM usually sensitizes people through door-to-door campaigns in all neighbourhoods in Yaounde not just Yaounde II. But from our table, we notice that it is only in Briqueterie that people affirmed to have received sensitization on waste management from them.

The Municipalities, unable to meet the demands for urban cleanliness of the growing populations, are should be in constant collaboration with civil society actors or non-state actors (NSAs) carrying out sanitation projects in neighbourhoods.

2.6 Private Actors

The management of solid household waste in Yaounde and in Cameroonian cities in general is not yet very open to private investors. Decree No. 2012/2809 /PM of 26/09/2012 reaffirms that any operation to collect and store household waste is carried out by the decentralized local authorities in conjunction with the competent state services. This makes private initiatives in waste management difficult if not impossible. Nevertheless, the intervention of private actors in the collection, transport and storage of household waste was possible through the establishment of the public-private partnership.

However, the involvement of private companies in waste management remains highly dependent on the administrative and financial tutelage of the public authorities. In addition, the conditions for financing and the awarding of delivery contracts also quickly limited the number of private actors. In all Cameroonian cities where public-private partnership is applied, the only service provider approved to ensure hygiene and safety is HYSACAM.

2.7 The population: An indispensable but neglected and ignored actor

This refers to all natural or legal persons who produce domestic waste. They come from all walks of life. They may be inhabitants of rich or poor neighbourhoods, traders, civil servants, craftsmen, etc. They are not integrated as an actor by the government in the waste management process, nor are they consulted for the definition and implementation of a waste management project. Users are considered only as users of cleanliness services and occasionally benefit from some awareness and information campaigns conducted by municipalities. Yet it is the link that makes the public waste service work thanks to the taxes paid. The populations work in collaboration with the civil society actors in pre-collection contracts for monthly pay. Where there is no pre-collection service, users are the patent, the liberating tax, etc. That is, they themselves provide the storage and collection of garbage and then empty it directly into trucks or in the HYSACAM garbage bins.

There are different sectors where the different stakeholders involved in waste management intervene (table 23).

Table 24: Some examples of simultaneous interventions by public actors in the management of household waste

Sectors of intervention	**Public actors that intervene in the domestic waste management sector**								
Collection, transportation and treatment of waste.	**MINHDU**	**MINEPDED**	**MINSANTE**	**MINATD**	**MINFI**	**MINADER**	**FEICOM**	**CUA**	**CU**
Planning and coordination of projects	X							X	X
Elaboration of regulations and control of hygiene and sanitation	X	X	X	X		X			
Financing of projects					X		X		
Technical control of projects	X		X	X			X	X	X
Control and respect of environmental norms				X					
Valorisation and promotion			X			X			
Sensitization and education of the populations	X	X	X					X	X

Source: Ngambi Jules, 2014.

X= non executed missions X: partially executed Mission; X= executed Mission

The analysis of this table and other legal texts show that the institutional framework of domestic waste management in Yaounde II is very fragmented in decision-making and policy enforcement. This could be an advantage if the different institutions were complementary in carrying out certain missions. The misunderstanding begins at the level of the responsibilities of each actor since they are not collaborative. The majority of decision-makers have almost the same responsibilities. To date, there is no legal or concerted provision that allows different stakeholders to harmonize their activities and explicitly divide roles. According to Ngambi Jules (2014), the inaccuracies noted are a source of conflict, overlapping powers, struggles for influence and underperformance throughout the household waste management system. Most institutions blame others and take the opportunity not to do anything to the detriment of the inhabitants who are languishing on the effects of unsanitary conditions. Conflicts are more exacerbated between the Urban Communities and the municipalities. In the case of Yaounde, the scope of the YCC has no limit and its decisions take superiority over those of the YD's. The YCC is ubiquitous in all major works (Sanitation, Hygiene and Sanitation, Highways, Waste Collection, etc.) without close collaboration with the local municipality. For example,

as part of the DW collection and removal project in Yaounde, the municipalities are only members of the monitoring committee of the waste management contract. This status is only an observer posture for mayors and their councillors. These representatives of the people are sometimes limited to submitting grievances to the monitoring committee in the hope of a possible improvement of the hygiene and environment service in their municipality. The power of the Government Delegates, appointed by presidential decree, is above the local elected representatives (Mayors). The impression that emerges is that the YCC would exercise a kind of hegemony over the municipalities because there are rarely joint YCC/UC activities. However, this collaboration would be an undeniable element for the success of the projects in Yaounde.

CIVIL AND CRIMINAL SANCTIONS

In the Cameroonian law, there are sanctions in the area of waste management. While the 1996 Framework Act addresses the general framework on the environment and, incidentally, on sanitation, the 1998 law deals specifically with the water regime and Decree No. 2001/216 of 2 August 2001 which establishes a special trust account for the financing of sustainable water and sanitation projects. Decree No. 2008/0737/PM of 23 April 2008 sets out the rules of safety, hygiene and sanitation.

In a trial on sanitation and environmental issues, the judge relies on a liability on the basis of the person, carelessness or negligence. Civil environmental litigation is based on Articles 1382, 1383 and 1384 of the Civil Code of 1804. Indeed, mutatis mutandis, " any subject that causes damage to the environment obliges the one by which this damage happened to repair it." Thus, four fundamental elements must be present to constitute a civil action in court:

- The polluter will be considered responsible if he commits a fault (the pollution);
- No-fault liability is possible;
- Compensation for victims for neighbourhood disturbances or air pollution by a foul smell due to the rotting of household waste present in a garbage bin that has not been drained by the concessionaire and/or a leak or overflow of the excreta of the treatment plant can be implemented as soon as the nuisances or disturbances exceed a permissible threshold, given the circumstances of time and place;

- And the victims of visual pollution caused by piles of rubbish resulting from the resignation of HYSACAM in its missions.

From the interviews and questionnaire data, it was generally realised that most of them were not aware of the gravity of the sanctions that could be levied on them if caught poorly disposing waste (table 24).

Table 25: Respondents views on the awareness of sanctions levied on poor waste disposal in Yaounde II

Quarter	Number of respondents	Do you know that the Cameroonian law on waste management states that you can get a fine of 25 to 1million and a risk of 2 to 6-month imprisonment if you are caught dumping your waste around certain areas of the town/streets?		If yes, what do you do to avoid being charged of this crime?	
		Yes	No	I throw in the assigned places	I throw it when no one can see me
Ekoudou	13	7	6	4	9
Azegue	6	2	4	0	6
Briqueterie	18	1	17	0	18
Cite verte	9	6	3	4	5
Messa	14	0	14	0	14
Madagascar	5	2	3	0	5
Carriere	13	0	13	0	13
Mokolo	8	7	1	0	8
Nkomkana	17	6	11	6	11
Ntougou	10	6	4	4	6
Oliga	11	11	0	6	5
Tsinga	6	4	2	2	4
Mbankolo	6	4	2	3	3
Febe village	1	0	1	0	1
Total	**137**	**56**	**81**	**29**	**108**
%	**100%**	**41%**	**59%**	**21%**	**79%**

Source: Field work, 2021

From table 24 we notice that majority of the respondents affirm to know about the existence of laws on waste management but they are not aware of the sanctions which accompany these laws. This is justified by the fact that 59% of the respondents said they were not aware of the sanctions and how grievous they are. When interviewed, a lady said

"*so, I would sleep in prison for throwing dirt? Hmm, this government is very funny. Those collecting stay for weeks and sometimes even months without collecting dirt. What should I do with the dirt accumulating in my house meanwhile? Do you want me to put the waste in my market bag or swallow it? Besides, I am not an HYSACAM agent. Everyone must do their job"; "HYSACAM garbage collectors must justify their salaries"; "I don't have time to go to the bin because it is too and I don't have anybody to help me.* Sote *e say we fit pay up to 1 million. We no first get chop for chop na 1 million we go pay for sika dorti."*

This shows how ignorant people are in this domain. Just 41% affirms to know about the sanctions related to waste management practices. In further interviews conducted with an autochthone of the town of Yaounde II, he said that he knows about the laws on waste management as well as the sanctions that follow but the truth is many people do not know them. They enact laws and they don't follow them up. How do they want people to adhere? They just sit in their offices sign papers and eat money. He further stated that they have to constantly follow people up because if they start today and stop tomorrow, there is no need. People pick up bad habits faster than good habits.

Table 24 further depicts that out of the 41% yes-respondents, 79% of them throw their waste when no one can see them so as to avoid being caught and being sanctioned. Some of them said they mostly do this at night when people are sleeping or during. Other said they usually throw the dirt during the day when people are not at home to see them. The remaining 21% of the yes-respondents said they simply throw their dirt in the designated areas to avoid any problems. We noticed that all of those who said they throw their dirt in places where no one can see them are those that live far from the PWCs and those that said they throw their dirt at the designated areas live closer to the PWCs. This implies that distance is one of the reasons why some people hide to throw their dirt.

Much remains to be done in this direction. It is a question of combining the right to a judge with the economic law. The issue of poverty needs to be addressed at the same time as environmental and sanitation issues. This is useful because legal action also contributes to the efficiency of service rendered by waste management actors. This is useful because legal action also contributes to the efficiency of service rendered by waste management actors. Indeed, in addition to the Penal Code which contains specific provisions relating to environmental damage resulting from mismanagement of waste, fines and sanitation taxes are as many penalties as the criminal judge can take. Susceptible to application in the area of sanitation, Article 79 of the framework law on environmental management in Cameroon states that: Is punished with a fine of two million (2,000,000) has five million (5,000,000,000) of FCFA and a prison sentence of six (6) months to two (2) years or one of these two sentences only, anyone who:

- carries out a project requiring an impact study, without an impact study;
- performs a project that did not meet the criteria or standards and measures set out for the impact assessment;

- Prevents the support of the control and analyses provided for by this law and/or its implementing decrees.

It should be noted that the Cameroonian legislation has strengthened the penalty in the field of the environment because the harshness of this special provision appears in the setting of a more rigorous amount of imprisonment and fine and the setting of cumulative prison sentences and fines.

Despite all these measures, waste management in Cameroon still knows limits hence the need to review certain things so that the right to a healthy environment of each is guaranteed.

2.8 THE LIMITATIONS OF WASTE MANAGEMENT POLICIES AND INSTITUTIONAL FRAMEWORK IN CAMEROON

The management of urban waste in Cameroonian cities is not easy. It faces some obstacles that rub off on all efforts to achieve effective remediation in Cameroon. Sanitation and waste management whether solid or liquid, is experiencing real problems in Cameroon. During our field investigations, we noted a series of limitations in the polices and institutional framework that handles waste management in Cameroon.

2.8.1 Neglected decrees and legal texts

In Cameroon, the legal texts creating the institutions and assigning to them the missions in terms of household waste management are diversified. But their content is sometimes confusing. It should be noted that a law gives the same powers to several state institutions. This ambiguous situation has facilitated the overlapping of powers and the inertia of some state actors. For example, the Ministry of Agriculture and Rural Development, one of whose main missions in waste management is the promotion of urban waste processing, does not support any composting initiatives in Yaounde. However, urban agriculture is booming in the capital and the demand for compost is very high.

Also, Decree No. 2004/320 of 8 December 2004 clearly mandates the Ministry of Housing and Urban Development to deal with the collection and treatment of waste with other competent administrations. Once again, MINHDU seems to resign before its sovereign mission because no activity of this institution in the field of household waste is recorded in the city of Yaounde. The above observations show that there is a lack of solidarity between institutions for the implementation of joint or complementary projects and adapted strategies to effectively manage urban household waste.

In addition, there is no legal text defining the mechanisms for the management of domestic waste (collection, transport, treatment and/or landfill). In order to make domestic waste management strategies more effective and efficient, both in terms of recovery and performance of the public waste service, it is essential that the framework law on the environment that laid the foundations for waste management in general be followed by decrees. This aims at explicitly defining the role of each stakeholder and the means of action to be granted to it as well as facilitate the integration of civil society actors into the public waste management process.

Also, there exists no decree or law that clearly defines the mechanisms of domestic waste management i.e. collection, transportation, treatment and disposal. There is no official policy made by the state on recycling and recovery.

2.8.2 The number of stakeholders involved in waste management in Cameroon.

In practice, the implementation of remediation activities faces enormous operational challenges due to the excess stakeholders. This reduces the effectiveness of the actions taken, thereby reducing the impact of all the efforts of each of them. In reality, institutional overcrowding or overpopulation in sanitation in Cameroon is a problem, as it is the high number of organizations, which sometimes leads to fragmentation of responsibilities, duplication of human and capital resources, and poor coordination.

2.8.3 Low population participation.

The population is the most important actor when it comes to waste management but is neglected. They are not consulted at any level of decision making. There is a top-bottom approach that exists in Cameroon that is, decisions are taken by the authorities and implemented on the populations without consulting them instead of the other way around. This results in decisions that reflect political inclinations rather than scientific reality. The populations live the situation and they know their way around their various neighbourhoods more than these authorities who make the laws. For example, the placements of the public skips do not take in to account the distances people travel to dispose of their waste. So, when they are not consulted, the implementation of some of these laws cannot be effective.

2.8.4 Accessibility, urban planning and geomorphological aspects

Long called "city of seven hills", Yaounde now has more than twenty. The hill is certainly the most prominent element by its imposing posture that can be observed in the distance, but other topographical units such as plateaus and valleys make Yaounde a very

contrasting site. The different topographic units have quite varied classes of slopes that can influence the evolution of the urban front. Spaces with a low slope are the easiest to develop and are usually found in valleys (swampy areas). Areas of steep slope (more than 15%) are hillsides that are difficult to access and subject to erosion, landslide and landslide phenomena. These areas located 70% northwest of Yaounde are erected as a mountain range that constitutes a natural barrier. Steep slopes are an obstacle to urban settlement that results in increased land pressure in more easily urbanizable areas (OlembaOlemba P.F., 2011).

The slopes remain difficult spaces to develop. On Mount Mbankolo, the best known in Yaounde, neighbourhoods such as Febe village, Mbankolo and Carriere were created at the risk and peril of the inhabitants. In these places, the slopes sometimes exceed 30%. There is regularly a sudden lowering of the slopes tending to a steep embankment which, in one stroke, ensures the transition between the top of the plateau and the valley floor. Despite the roads that run through some sections of the neighbourhoods, the collection and transport of waste is absent. HYSACAM trucks, operating with a hydraulic system when lifting the tanks, cannot manoeuvre on slopes greater than 15%. The rugged nature of the sites also does not favour the extension of mobile collection in these neighbourhoods because HYSACAM trucks are not powerful enough to manoeuvre and climbing the strong and long enough hills every day is not easy.

These challenges from the terrain limit access to some areas of the town. HYSACAM personnel have complained about such effects from the different manoeuvres of the truck that often leave them tired at the end of their work shift. Also, rapid urbanization in Yaounde II has made the populations to build on slopes of difficult terrain further making waste collection in such areas difficult.

2.8.5 Lack of appropriate technology and equipment

The pre-collection tools are inappropriate and unsuitable, the logical impact is that the collection rate is low; Wastewater management faces severe obstacles such as the precariousness of the wastewater collection system and the failure to maintain the sewerage systems; and the incivility of the population is the major obstacle to good waste management in the city of Yaounde II. In an interview with an HYSACAM employee on the quantity and performance of the machines they have, he underscored that,

"The trucks we have here are no longer as performant as they should. They are very old. Some PWCs are also old and dilapidated. We are not the ones buying them. We have given reports on the areas that have old PWCs and all we can do is wait for the authorities to

buy them. Meanwhile, the areas with such dustbins, people start piling dirt by those areas which are usually by main roads. When it is time for us to pass by and collect no matter how we try the dirt would continue stacking up. It is very discouraging but what can we do other than wait? These are some of the reasons why they are not usually able to meet up with their duties."

2.8.6 Internal problems

Irregular payments of salaries, lack of transparent internal communication, too many customer complaints, neglect of workers needs such as; work clothes, protection equipment such as masks and shoes are some of the internal problems faced by HYSACAM workers. More interviews with the HYSACAM employee, on the constant problems they face in their organisation, he revealed that,

"*we are even afraid to talk to our manager or even ask questions because the least mistake you make here, they sack you and this is where we get our daily bread. But when we do this as a group as we doing now, we hope that they would give a listening ear. The work we do is not easy. It is not only tedious, but risky for our health*."

These lapses are usually felt not just by these workers but also the populations as they are forced to device methods to deal with the piling wastes at their various homes hence uncontrolled dumping by streets, roads and even footpaths.

2.8.7 Lack of collaboration among the stakeholders involved.

The management of public waste in Cameroonian cities is done upstream to downstream by several public actors who, in an organized system, should take turns to constitute a complementarity on the ground. From decision-making actors to implementers, there are about ten public administrations involved in the household waste management chain. Table 23 provides some examples to better understand the real situation of certain public actors. Despite the presence of so many actors involved in the waste management sector there is little or no collaboration between them. This is one of the main causes of poor waste management in Yaounde II as there is little or no compliance hence low levels of law enforcement due to lack of clarity in the definition of responsibilities.

Neglected penal codes or sanctions and little or no knowledge about them

In Cameroon today, it is uncommon to see someone in court because he threw dirt on a particular place where he did not have to do so. When interviewed some respondents said "when people see the notice which reads *"ne pas verser vos ordures ici/do not throw dirt here"* that is where you would notice people throwing dirt whereas the dustbin might even be close". Most of them laughed and said they were not aware of the fact that people could actually go to

court for throwing dirt somewhere. This is just to show how little people are aware of the existence of most of these penal codes on the management of waste. The simple reason for this is the absence of constant awareness and sensitization campaigns.

Conclusion

The objective of this chapter was to show the institutional framework of waste management in Cameroon. We found out that most of the conflicts in the waste management sector are generated by the number stakeholders involved and the type of laws that we have.

Testing of hypothesis 2, analysis and discussions of results.

The hypothesis attempts to establish a link between the waste management policies, institutions involved and waste management in Yaounde II. The responses of both the responses and stakeholders involved in the waste management process paved the way for the verification of the hypothesis (table 17). In a bit to establish the degree of relationship between variables, a contingency table was developed and a null and alternative hypothesis were equally stated.

Our contingency table. **(SEE APPENDICE 5)**

Source: Table based on Chi square statistics

$$X^2 = \frac{(O-E)2}{E}$$

Degree of freedom (df) = (c-1) (r-1) = (4-1) (14-1) = 3x13 = 39

Null Hypothesis (Ho): Ineffective policies and institutional framework is independent of the management of domestic waste in Yaounde II

Alternative Hypothesis (Ha): Ineffective policies and institutional framework have largely influenced the management of domestic waste in Yaounde II

We now have our chi square statistic ($X^2 = 6012.5$), which is the calculated value, our predetermined alpha level of significance (0.05) and our degree of freedom (df = 39). Situating the Chi square distribution table at 39 degrees of freedom and reading along the row we find that the value ($X^2 = 6012.5$) is above critical value 54.572. Since our calculated value of ($X^2 = 6012.5$) is far above the critical value is far above the critical value of 54.572 we can that rejected the null hypothesis which states that: Ineffective policies and institutional framework is independent of the management of domestic waste in Yaounde II and retain the alternative

hypothesis which states that: Ineffective policies and institutional framework have largely influenced the management of domestic waste in Yaounde II.

During the field investigations, it was revealed that there were too many laws and institutions without specifically defines roles involved in the waste management domain. This is in line the opinions of some researches such as Ngambi Jules (2014) who attested that the institutions involved in waste management in Yaoundé II and Cameroon as a whole were too many making work less effective since most institutions are assigned with same roles and responsibilities. that is, one institution might think the is doing his job and the other institution is thinking same. In the end no one is doing anything making the waste management process less efficient and effective.

In Cameroon, the decrees that allow the creation of creation of institutions and assigning them missions in matters concerning domestic waste are diversified. But their denotation is sometimes confusing. We notice that, a law gives the same attribution to many institutions. This imprecise situation has facilitated a similarity in power and the inactivity of certain state stakeholders. This simply means that there are no signs of solidarity amongst the various institutions involved in waste management because there are no signs of collaboration between them so as to ensure the implementation of common projects hence better outcomes to domestic waste management in Yaounde II. Many people are not even aware of the existence of the sanctions related to poor waste practices. To render the strategies of waste management more effective, it is indispensable that environmental laws that set the bases for waste management is followed by decrees. This would explicitly define that role of each stakeholder involved at any level of waste management thus; facilitate the integration of the civil society in the public process waste management.

Waste producers, formal and informal groups, the waste management company, HYSACAM, together with the government though the city councils and external support agencies should fully get involved in trying various strategies which would help solve the problem of domestic waste management in Yaounde II. While the increase in the demand for better equipment and technology to better manage waste in Yaounde is desirable, it is limited by the access road and other problems such as climate. Thus, increasing efforts have to be made towards involving waste generators in the management of the waste that they produce and generate. The next chapter gives an assessment on the effects of poor waste management on the environment as well as public health.

CHAPTER 3

THE EFFECTS OF DOMESTIC WASTE MANAGEMENT ON THE ENVIRONMENT OF YAOUNDE II

Introduction

Domestic waste management in the Yaounde II municipality has several effects on the environment as well as public health. A study by the United Nations (1992) points out that in a total of 5.2 million deaths that results annually from increases urban waste generation, over 4 million children die of cholera, diarrhoea, malaria etc. in different parts of the world. We notice the presence and continuous proliferation of several uncontrolled dumps in the town which poses threats to health. This chapter therefore seeks to investigate the effects of domestic waste on the environment of Yaounde II. This chapter attempts to answer the third specific research question of the study which is in line with hypothesis 3 which states that "inadequate domestic waste management has largely impacted the environment of Yaounde II".

This chapter therefore, is subdivided into four main sections. The first section discusses the effects domestic waste management on the environment. The second section analyses the effects domestic waste management on health. The third section examines the positive effects of domestic waste management. Despite these challenges, the inhabitants try to cope with these challenges by adopting a series of strategies which will make the fourth section of this chapter. This chapter is finally crowned by a conclusion which recapitulates the main ideas raised and discussed in the chapter.

3.1 The negative effects of domestic waste management on the environment of Yaounde II

Poor domestic waste management constitutes a source of nuisance. Many people do not really measure the consequences of waste production and poor DW management on the environment as well as on their own health. Environmental problems associated attracts mosquitoes, with waste management are closely related to the bad state of most collection and storage bins. These bins are mostly too old, without covers hence attracts bad odours, mosquitoes, rates, domestic animals and leaking waste water (leachate). This poor management of waste favours the proliferation and transmission of illnesses and environmental degradation.

Table 26: Respondents views on the effects of domestic waste management on the environment in Yaounde II

Neighbourhoods	Number of respondents	Do you think that domestic waste management negatively affects the environment of Yaounde II?	
		Yes	No
Ekoudou	13	13	0
Azegue	6	6	0
Briqueterie	18	18	0
Cite verte	9	9	0
Messa	14	14	0
Madagascar	5	5	0
Carriere	13	13	0
Mokolo	8	8	0
Nkomkana	17	17	0
Ntougou	10	10	0
Oliga	11	11	0
Tsinga	6	6	0
Mbankolo	6	6	0
Febe village	1	1	0
Total	**137**	**137**	**0**
%	**100%**	**100%**	**0**

Source: Field work, 2020

A waste management scheme that falls short of the performance standards of the ideal approach negatively impacts the environment. According to our survey, it was found out that poor waste management in Yaounde II had a number of effects on the environment (table 26).

Table 27: Respondents views on the effects of domestic waste management on the environment

Neighbourhoods	Number of respondents	In your opinion, what are some environmental problems caused by the waste produced in Yaounde II					
		Water pollution	Soil/land pollution	Air pollution	Blocked drains	Aesthetic pollution	Others
Ekoudou	13	2	1	4	0	6	0
Azegue	6	1	0	1	2	2	0
Briqueterie	18	4	0	6	0	8	0
Cite verte	9	0	2	2	2	3	0
Messa	14	0	0	4	0	10	0
Madagascar	5	0	0	1	1	3	0
Carriere	13	0	0	4	6	3	0
Mokolo	8	2	0	2	1	3	0
Nkomkana	17	0	2	0	7	8	0
Ntougou	10	0	2	2	0	6	0
Oliga	11	0	0	6	0	6	0
Tsinga	6	0	0	6	0	0	0
Mbankolo	6	1	0	1	0	4	0
Febe village	1	0	0	0	0	1	0
Total	**137**	**10**	**7**	**38**	**19**	**63**	**0**
%	**100%**	**7%**	**5%**	**28%**	**14%**	**46%**	**0%**

Source: Field work, 2021

From the table above, we notice that all the respondents uphold that domestic waste is not properly managed in the town. They all equally have an idea of the environmental effects of poor waste management practices. According to their, 26% affirm to suffer from air pollution. When waste in disposed of and is not immediately collected, unpleasant odours emanates from these deposits. This makes people very uncomfortable in their environments. Concerning aesthetic pollution, 46% of the inhabitants consider it as a big problem. Uncollected waste lying haphazardly by roads, streets and even homes destroys the view. Blocked drains and water pollution represented 14 and 7% respectively. Poorly disposed waste and littering causes blocked drains which in turn causes floods and dispersed waste by streets. Water is also polluted in the process. The remaining 5% corresponds to soil pollution due to excess toxic materials in the disposed in the soil.

3.1.1. Air pollution/Odours

One of the types of pollution to which humans are sensitive to is certainly air pollution. From the response of the respondents (table 26), 28% of them affirm to be victims of air pollution. Nearby areas to the open dump sites are affected due to the emission of unpleasant scents coming from these dumps. Discharges and methane abundantly generated by the decomposition of organic matter significantly contributes to the greenhouse and is even explosive in certain contributions as well as pose a threat to health. According to a report written by a committee of experts belonging to the World Health Organization (WHO) in 1991, about 500 thousand people in developing countries are exposed to atmospheric pollution especially in urban areas.

In the Yaounde II, burning or incineration of waste in both formal and informal waste dumps cause air pollution and poses a menace to human health and the environment in general. In addition to the unpleasant smoke produced by the incineration process, it also produces mineral fibres (hydrochloric acids, nitrogen hydrocarbons etc.) From our field investigations, we noticed that incineration is a practice adopted by the most of the populations of Yaounde II notably in neighbourhoods such as Febe village, Carriere, Madagascar, Mokolo, Tsinga, Briqueterie, Mbankolo and some parts of Cite Verte. This activity causes illnesses and reduces visibility. We also discovered that it is not only the populations who burn waste but HYSACAM does so too. Theirs is even worse because they who are supposed to be showing the example by either carrying the waste far from the community. They burn it directly where the PWC is standing. That is, they light fire inside the PWC and let it burn right there in the

midst of people. It is important to note that, most of these PWC's are by the roadside. This act is strictly prohibited by the law n° 96/12 of the 5th August 1996 on the framework law relating to the management of the environment. The inhabitants do not yet have the reflex to report these fires to HYSACAM and even less to try to extinguish the fire because many people say with irony *"it is only a garbage bin"*. It is not easy to find those responsible for these acts of vandalism. This observation is often made at night and sometimes, before HYSACAM arrives, the tank is already damaged by flames. This does not only lead to pollution, health risks and destruction of aesthesis but equally destroys the PWC (which are usually not enough for the community).

The storage of waste equally leads to the release of unpleasant odours and is usually inconvenient to the surrounding populations. "Polluted air is responsible for the death of 2.4 million people around the world. It decreases the life expectancy of men and causes heart problems as well as respiratory diseases such as asthma. It also affects the reproductive health of humans as well as some plants and animals" (UNEP, 1999). They consider that around 50% of chronic respiratory illnesses are caused by air pollution.

3.1.2 Soil pollution and land degradation

According to the information presented in table 24, 5% of the respondents believe that poor waste management causes land/soil degradation. This is a main source of destruction of aesthetics. Stagnation, uncontrolled dumping by streets and roads and infiltration of waste water into the soil are factors that influence the degradation of the environment. Soil acidification by toxic wastes notably non-biodegradable waste causes the death of many animal and vegetal species. We noticed that many plastic bags are haphazardly disposed of. Plastic bags are particularly a permanent danger to natural resources and animals. Plastic is a non-biodegradable material. When poorly managed, they pollute the soil, attack vegetation, reduces infiltration of rain water and waste water. It is important to note that plastic bags take about 100 to 400 years to degrade (WWF, 2012). It is therefore necessary to see into that its management is efficient (image 1).

Photo 1: Soil/land degradation

The image above was taken at Briqueterie directly behind some houses. We notice, poor waste disposal which prevents the growth of plants because the soil is saturated by non-biodegradable products. When biodegradable products are deposited, they are broken down by uncontrolled anaerobic conditions. If they are not exploited, landfill or exhaust gas is released and escapes into the atmosphere. This gas contains methane, a greenhouse gas that is more dangerous that carbon dioxide. Photos taken by Ndabuf, September 2021, at 11am.

Another observation we made was that despite the sanitary conditions, land values in terms of high rents and selling prices did not change. When interviewed on the reason why even though the prices of rents and land in Yaounde II was still very much high considering the sanitation of the areas close to their homes, they all gave the same reason that '*we are in the political capital'*. It is either you take it or you leave it; and if you live it someone else would still take it. So, they don't have much choice.

3.1.3 Water pollution

According to field investigations and interviews, it was found out that water pollution is an environmental effect of poor waste management as 7% of the respondents equally attest to it. We observed that most of those living close to streams and other water bodies usually dispose of their waste around these areas. Waste disposal around water bodies is a very current practice in most developing countries (Belaid, 2010). This practice is strictly prohibited in Cameroon in article 12 on the framework law n^0 96/12 of August 5^{th} 1996 related to environmental management. Unfortunately, this law is not respected in urban areas. Nevertheless, domestic waste must be evacuated so as to permit the environment and the populations from their negative effects.

We also observed that leachate produced from open dump sites causes serious pollution to water bodies (plate 6). Leachate is known to be contaminated waste that percolates through waste. The presence of these toxins, no matter how minute, can cause serious damage to soil

and water resources and consequently to man. Research from municipal solid waste has shown that it includes a high level of organic components from household waste. Leachate is characterized by a high concentration of ammonia and organic nitrogen compared to uncontaminated water. The leaching of household waste that is untreated can produce a substance with a high biochemical oxygen demand (BOD) which has a negative effect on neighbouring water sources. According to a key informant contacted on the effects of poor waste disposal he said that

"The main source of water in Yaounde II is CAMWATER. The households which are unable to pay for pipe born water get their water from other sources such as wells and streams which are not often treated. The contamination of these water resources has enormous effects on the health of the consumers in a manner which I don't think people are truly aware of".

Plate 6: Water pollution

Photo A above show a stream in Briqueterie, where the inhabitants throw dirt. Photo B depicts a similar situation where people are disposing their waste in a water body. We notice a huge amount of household waste as well plastic bottles and bags that is, biodegradable and non-biodegradable waste. Also, both of these water bodies are found directly by homes. Photos taken by Ndabuf, September 2021, 12pm and 2pm respectively

3.1.4 Blocked drains

Dumping in drains causes blockages and standing water in which disease-carrying mosquitoes and insects breed. In some neighbourhoods such as Briqueterie and Mokolo, some gutters are no longer visible since they have been totally covered with dirt. The situation is even worse when rain falls. These blockages create flooding and unhygienic conditions in these areas. This greatly supports the mosquito breeding which spread diseases like malaria and cholera, the destruction of aesthetics as well as the destruction of public infrastructures such as

roads. The proportion of waste especially food waste in the open dumps and waste drains also provide an attractive shelter for rats and other rodents.

The obstruction of movement in such areas cannot be under-rated. Most of the respondents did not hide their feelings about the socioeconomic nuisance of these blockages. On the one hand, some people were very disappointed and when interrogated they said that the traffic is really uncalled for and can be sorted in less than no time. But since the government officials do not use most of these itineraries as much as we do, these places would might remain the way they are for a long time.

On the other hand, people like hawkers said the situation has either positive or zero impacts to their businesses. That is, they were rather happy with situation as it delays people and the flow of vehicles and so, they can sell their products in the traffic (plate 7).

Plate 7: Waste disposed in gutters

Photos A and B shows gutters/drains along a main road filled with poorly discarded waste by the road at Ekoudou and Azegue respectively which after several accumulations of waste have been blocked. This does not only wedge the easy flow of water, but also influence the proliferation of rats, flies, mosquitoes and cockroaches which affects the people of the town. Photos taken by Ndabuf, September 2021, 08am and 9:30am respectively

3.1.4 Aesthetic pollution

From our field investigations, 46% of our respondents are of the opinion that poor waste management causes aesthetic pollution. Apart from the most talked-about land, air and water pollution, there are other forms of pollution that affect us in a subtle yet significant way. It is also known as visual pollution. It refers to the impacts of pollution that impair one's ability to enjoy a pleasant view. One of the most consistent forms of visual pollution is uncontrolled dumping by streets and road sides. When we look around, our first impression of any environment is the visual environment. In Yaounde II, it is very common to notice haphazardly

discarded waste by streets, homes, offices etc. we observed that such poorly discarded waste clutters sidewalks and roads. This tarnishes the image of the city. This is very noticeable in all 14 neighbourhoods of Yaounde II. Another observation we made was that roadside open dumps which are very common in Yaounde II create heavy traffic. With the recent strike of HYSACAM, roads have been flooded with waste up to the level where cars now drive on dirt. The town is very dirty. Even areas that were known to be the reference of cleanliness have now been submerged by waste. Litter along transport routes, heavily sized waste containers in the Yaounde II municipality and the emission of offensive odours around these facilities and cause and innate human reactions of anxiety, depression and other psychological reactions. (Hirshfeld et al. 1992; Omubo-Pepple et al. 2010) (Plate 8).

Plate 8: Aesthetic degradation of the surrounding by an overflowed PWC

Source: Ndabuf, 2021

Photo A shows poorly disposed waste in Mokolo and photo B shows a full and overflowing PWC at Mbankolo. All these cause aesthetic and visual pollution which destroys the beauty of the town. Photos taken by Ndabuf, November 2021, 08am and 2pm respectively

3.1.5 The Impacts of Domestic waste management on Health in Yaounde II

Poor waste management constitutes on of the irrefutable sources of harm to human health**.** The effects of poor domestic waste management practices on the environment are overwhelming because life is dependent on water, soil and air which are the main constituents of the environment. So, if these life supporting factors are contaminated or polluted by the poor operation of these management phases, then one can imagine the magnitude of devastation that it could cause the ecosystem especially man. When not well managed, they attract animals such as stray dogs, cats, rats, mice etc. pests like mosquitoes', flies and cockroaches. As Diabete said (2001), "these insects constitute the dominant factor of the creation of nests for the

production of vectors offering bio-ecological conditions favourable to the development of pathogenic germs which are responsible for many diseases like malaria, asthma, hepatitis, fever, typhoid, diarrhoea, cholera etc." Another reason for constant health issues is the fact that people sell food stuff directly by PWCs. The dirt and odours coming from such surroundings causes health hazards (photo 2).

Photo 2: Selling of consumables by public waste containers

The photo above depicts a situation where people are selling meat directly in front of a public waste container at carrefour Mbankolo. This causes food poisoning which is a serious threat to health. Photo taken by Ndabuf, December 2021 at 10:23am.

According to our field investigations, our respondents attest to have been victims of ill health due to poor waste management (table 26).

Table 28: Perception of the populations on the prevalent diseases in their households in Yaounde II

Neighbourhoods	Number of respondents	In your opinion, is poor waste management a cause of illnesses		If yes, what are the most common diseases you have in your household						
		Yes	No	Malaria	Typhoid	Intestinal worms	Cholera	Diarrhoea	Skin diseases	I don't know
Ekoudou	13	13	0	3	7	3	0	0	0	0
Azegue	6	6	0	3	1	1	0	0	1	0
Briqueterie	18	18	0	10	4	4	0	0	0	0
Cite verte	9	9	0	5	0	0	1	1	2	0
Messa	14	14	0	9	3	0	2	0	0	0
Madagascar	5	5	0	1	1	1	1	0	0	0
Carriere	13	13	0	5	2	2	2	2	0	0
Mokolo	8	8	0	4	2	1	0	1	0	0
Nkomkana	17	17	0	10	0	4	3	0	0	0
Ntougou	10	10	0	5	3	2	0	0	0	0
Oliga	11	11	0	0	7	5	0	0	0	0
Tsinga	6	6	0	3	2	1	0	0	0	0
Mbankolo	6	6	0	6	0	0	0	0	0	0
Febe village	1	1	0	1	0	0	0	0	0	0
Total	**137**	**137**	**0**	**65**	**32**	**24**	**9**	**4**	**3**	**0**
%	**100%**	**100%**	**0**	**47%**	**23%**	**18%**	**7%**	**3%**	**2%**	**0%**

Source: Field work, 2021

Table 26 shows the various health issues suffered by the inhabitants of Yaounde II. We noted that all the respondents are aware of the fact that poor waste management has an impact on their health. The table shows a majority of the respondents suffer from Malaria and is represented by the 54% on the table. This is explained by the mosquitoes that constantly breed on open dumps and standing water. Some of the causes of Malaria in Sub Saharan African regions are poor sanitation and indiscriminate dumping of refuse (Kobina et al, 2010; Tchobanoglous et al., 1977). These uncontrolled dumps, poor dumping practices, dilapidated of waste bins, leachate from long standing waste etc. favours the development of such vectors which in turn migrates to household water sources like wells, boreholes and streams. Also, in all of the sampled households, one could contract any of the above-mentioned diseases especially Malaria about 1-20 times during a period of one year. This is in line with the findings of Molez (1999), who said that the African continent is the historical cradle of malaria and its strong frequency in the studied neighbourhoods would be related to its endemic nature.

Concerning typhoid, 24% of the respondents attest to have suffered of this illness. It is mainly due to polluted and contaminated food or water. We noticed that many people consumed cooked food along road sides such as meat and fish which were exposed and not

well preserved. Most of these selling points were usually close to dustbins or other unhygienic places. It is usually in such areas that you will find a great number of customers. All these unconcerned habits exhibited by the populations greatly affect their health.

Intestinal scored 13% as per the respondent's responses. Children are particularly susceptible and typically have the largest number of worms as confirmed by the medical reports of the Yaounde Central hospital. When questioned on why they do not try to inculcate hygiene habits in their homes so as to avoid intestinal worms one lady underscored that, they do so but they are not with the children when they go to school or other places they usually go to, such playing grounds. They go to those places and pick anything and put in their moths without necessarily washing their hands or minding the environment from which they pick those things. When they do so, intestinal worms are unavoidable.

Cholera comes next with 5%. This disease spreads when people consume water that is contaminated with faecal material or leachate from long standing waste materials. According to our key informant form the Central hospital in Yaounde II, there were Cholera cases for quite some time but with the recent strike that caused HYSAM to stop working, Cholera suddenly resurfaced. He said that it is a very bad disease and puts in the patient into so much pain which could lead to death. Two other respondents attested to the fact that they had lost two of their family members to cholera and this had forced to be extremely careful with the way they handle whatever they eat and how they keep their environments.

Skin diseases recorded just 2% and Diarrhoea scored 3%. Diarrhoea causes a person to lose both water and electrolytes, which leads to dehydration and, in some cases death. (Tende et al, 2020). It is therefore mandatory for authorities to sensitize the populations on their waste disposal habits as well as improve their collection strategies so as to curb the situation.

To have even more relevant answers to our questions, we visited the central hospital to have more precise answers on the most prevalent diseases related to waste management. According to them, the most common diseases are Malaria, Typhoid, Cholera, Pneumonia and Bronchitis. Also, they affirm that there is strong positive correlation between prevailing illnesses and indicators of efficient waste collection and disposal in the sampled neighbourhoods. In Yaounde II, this situation is clear as from the month of April where we notice high rates of consumption of agricultural products in markets which eventually leads to a mess around collection bins. This increase together with humidity attracts flies. There are

certain species of flies some of which include; the faecal fly, the vinegar fly, the blue meat fly, grey fly and the biting fly

According to our key informant, Dr Njiki from the Central Hospital, open dumps of waste are a serious threat to human health and sanitation. Health issues related to waste are complex and gives rise to numerous debates. From our investigations, most participants agree on the fact that waste mismanagement has enormous effects on human health aware the fact that poor waste management can cause Pneumonia and Bronchitis. Dongo (2008) affirms that according to the WHO, about half of the city dwellers in Africa, Asia and Latin America are affected by either one or more illnesses associated to water depletion or adequate sanitation. Uncollected waste and illegal dumps are at the origin of diffusion of illnesses such as malaria, tuberculosis, yellow fever, intestinal and respiratory infections. This simply means that inefficient waste collection favours the proliferation of parasites that generates illnesses (table 27).

Table 29: Prevalent diseases in Yaounde II as reported by the Central Hospital

Disease	Parasite	Disease vector	Breeding ground
Malaria	- plasmodium vivax - Salmonella typhoid	- Mosquitoes from disposal sites	- Standing water - Untreated landfills - Open dumps
Cholera	-Vibrio cholera	-Mosquitoes from disposal sites	- Standing water - Untreated landfills - Open dumps
Typhoid	- Salmonella typhoid	- Infection of humans by flies and contaminated food and water	- Water borne pathogens - polluted air
Pneumonia	- Mycoplasma pneumonia	-Inhalation of contaminated air	- Polluted air
Bronchitis	- Salmonella paratyphoid	- Sucking blood from humans and infected merozoite	- Polluted air - Open dumps

Source: Central Hospital Yaounde, 2021

According to Dr Njiki, one of our key informants, he said Malaria and Typhoid are the most prevalent diseases in Yaounde II and is caused by poor waste management practices. He explained that Cholera that was already dormant has recently resurfaced amongst us and he believes it is partly because of the insanitary conditions of Yaounde in general. He said

"look at what the HYSACAM crisis or strike caused. We could barely see the tar or the roads. Cars were practically rolling and driving on dirt and people were equally trampling on dirt. The whole town was smelling. Mosquitoes, flies, rodents and unpleasant smells that are produced in these dumps are equally factors that lead to the increased cases of such diseases. It is now that we should really appreciate what HYSACAM workers do. Before this, we used to complain that they are not working but this type of situation has rarely ever happened before where the whole town is decorated with dirt. So, we can notice that at least they are really doing something. It is a disgrace for a country that is even preparing for a championship where

people from other countries would come and not just witness this mess but are likely to contract illnesses".

According to him, there are two factors that contribute to sanitation in Yaounde II. They include; physical and human factors;

Physical factors

It is worthy to note that the inter-tropical zone favours the lifespan of insects such as mosquitoes, flies, and cockroaches etc. which are a nuisance to public health. The climatic conditions of the area (hot and humid) favour the proliferation of pathogens.

Human factors

Man is the master of the environment. He modifies it through his activities; his needs require constant development or preservation aimed at improving on quality of life. Inculcated habits and traditions on hygiene and sanitation have transformed the environment hence poses a serious threat to their own health.

Most of the respondents denied that illnesses like cancer, asthma and birth defects, cannot be caused by poor waste management. This continues to prove the point of ignorance in many inhabitants. Most of them think such illnesses are hereditary and cannot be contracted due to insalubrious environments.

3.2 Other negative effects

In further interviews conducted on the effects of domestic waste management, it was revealed that, the social and economic aspects of the lives of the respondents were also affected. Most of the sampled population, revealed that they were frustrated about the incessant dumping. Burning of waste by road sides and by homes and poor waste management has highly contributed to making their environment dirty and thereby creating an ugly scenario. The effect of living in an unclean and messy environment may lead people to become demoralized and less motivated to improve conditions around them. Waste attracts more waste and generally leads to less hygienic behaviours. We observed that the social effects are colossal but the sad part is that there is little or nothing most of the inhabitants can do since collaboration between stakeholders and inhabitants are not felt or literally non-existent. For example, people living near such areas would be seen as dirty even when they are not. Some people even said they feel reluctant to invite people to their homes because of the presence of these dumps that might make not just them uncomfortable but the invitee too.

Most of our informants were of the opinion that poor waste management has economic effects on them. Some said it affected their businesses as they now get less patronage due to the presence of huge dumps close to their business places. They complain that the dirt stinks and that, they cannot withstand the odours so, they prefer looking for other areas to continue doing their business which is usually not easy.

3.3 Positive effects of domestic waste management in Yaounde II

The perception of waste whether in linear management or in the circular economy sectors remains a problem. This is the case in Yaounde II and therefore in Cameroonian society. Waste in general corresponds to an overall negative image. Waste is not always perceived as a useful element but rather a Carriere of nuisance, misfortune and becomes for its holder a feeling of shame and contempt (Bretel-Deleuze S., 2003). As hard as it may seem, DWM equally yields positive effects.

According to the questionnaire sheet, it was established that the respondents sustain that there are positive aspects in domestic waste management (table 28).

Table 30: Respondents' perceptions on positive effects of waste management in Yaounde II

Neighbourhoods	Number of respondents	In your opinion, can anything positive come from waste management?				
		Agriculture	Scientific innovations	Creation of jobs	Promotes collaboration between stakeholders	I have no idea
Ekoudou	13	2	3	4	4	0
Azegue	6	2	1	1	2	0
Briqueterie	18	4	2	8	4	0
Cite verte	9	3	3	1	2	0
Messa	14	8	0	6	0	0
Madagascar	5	1	1	1	1	1
Carriere	13	2	2	3	3	3
Mokolo	8	1	1	3	2	1
Nkomkana	17	4	3	8	2	0
Ntougou	10	2	0	2	5	1
Oliga	11	0	5	5	0	1
Tsinga	6	2	0	3	1	0
Mbankolo	6	2	2	1	1	0
Febe village	1	1	0	0	0	0
Total	**137**	**34**	**23**	**46**	**27**	**7**
%	**100%**	**25%**	**17%**	**34%**	**20%**	**5%**

Source: Field survey, 2020

3.3.1 Creation of jobs

As illustrated by Table 28, 34% of the respondents are of the opinion that waste management leads to the creation of jobs. The waste management sector has gradually become

a source of employment which has led to the blossoming of certain social classes as well as the blossoming of some families. These jobs could be in the public, private, legal or illegal sector. In an interview with a key informant from Option; a pre-collection service in Yaounde II, he said that, people are more and more aware of their existence and are even more willing than before to subscribe to their services. This has helped them to employ more people. Also, if things continue going well for them, they would expand the agencies and to other parts of Yaounde as well as other tons in the country. According to him, this activity is no longer reserved to men and as women and even children have taken up the activity. In concentrated and populous towns like Yaounde, waste collection has become a means of making money. He also said that, they are happy with what they do and the plus is that they are paid for their services. They are happy that they can fill in the gaps in their own little way. He further explained that they there is still much to be done in the waste management sector especially when it comes to sorting of waste but they know that little by little they would one day get to a stage where waste would not be seen as a burden to people as it is the case today. In our society, recovery and waste valorisation is carried out by garbage collectors, rag pickers etc. this is usually their main source of income and they have made this makes the informal sector to prosper through market exchanges

According to a study carried out by L'Agence de l'environemment et de la Maitrisse de l'Energie (ADEME) and cited by Sotamenou (2005) on separation of waste collection (which is absent in Cameroon) generates employment 10 times more than incineration and 30 times than landfilling (like in Cameroon). Separate collection of waste leads to an increase in personnel of around 5 and 10% depending on the density of the area. If collection itself brings little changes in terms of employment, sorting, which is an indispensable complement induces more positive engagements.

There is the need for a complete rethinking of waste i.e. to analyse if waste is indeed waste. This change in the state of mind calls for waste to become wealth, refuse to become a resource and trash to become to become cash.

3.3.2 Science and Innovations

In the scientific milieu, waste is at the centre of several great research axes. The 17% of respondents who established that the waste management sector is a lucrative sector especially in the scientific field is justified by the fact that they are aware of some innovations that have been established in this domain. This equally permits people to change the totally

negative perception they have on waste as it is more and more considered as a resource that can be transformed. In an interview with an inhabitant of Cite Verte, he said,

"we have seen on the news on many occasions how young Cameroonians have established unbelievable technologies to process waste into more useful things. I recently saw a young man on CRTV in the Northwest region who was presenting a machine that produces natural gas, manure and even feed just by processing waste. The best part of it is that, it is environment friendly and very easy to use that even a layman can use without assistance from the demonstration he displayed. If this our government was really serious won't this boy be taken into a good office or laboratory to produce more of these things?".

This therefore implies that, if sustainable innovations are integrated into our society the obtained results would permit people to come up with even greater innovations (waste treatment techniques and valorisation) and tools that permit authorities to take/make decisions (management strategies, legislation etc.). This would permit the migration from linear waste management to loop management which is more durable and environmentally friendly.

3.3.3 Agriculture

Again, table 28 established that 25% of the population is of the opinion that waste is useful in the agricultural sector. Field investigations revealed that, when waste is recycled, it plays an important in the agricultural sector. Compost is the decomposed form of domestic waste and plays an important role in soil fertilization. A market woman whom we interviewed explained that, organic substances from waste notably biodegradable waste fertilize the soil and favours the production of some crops such as yams, plantains, garden products as well as feed for fowls, pigs and other domestic animals. It is worthy to note that the valorisation of waste dates back to antiquity. The first use of waste, particularly household waste took place in agriculture. In the ancient cities market waste was taken up by market gardeners (Leeroy, 1999). This tendency has since been continued by many sub-Saharan countries notably Cameroon. The advent of agriculture in urban areas such as Yaounde and other African cities therefore created a link between domestic waste household and agriculture. This is also interesting as household waste especially food remnants pose little or no threats to the environment as well as human health when properly used in this sector.

3.3.4 Increase collaboration between stakeholders

According to table 28, 20% of the respondents believe that an increase collaboration between stakeholders would have a positive effect on waste management and the environment. The respondents explained that if they are given the floor to tart in the waste management process, things would definitely be better. One of our key respondents said that the populations

are those who have better information of the field than any other person. They know the nooks and cranes of their neighbourhoods; they know the way things function in their neighbourhood's better they live there. If they collaborate with these stakeholders, waste management would definitely be made easy for HYSACAM. One lady said from Carriere accentuated that,

"by now the government or HYSACAM should have understood that if they collaborate with us and tell us how we can help we would do it. We don't like sitting inside dirt. If we are involved in the process we would obviously work. They can set a day where all inhabitants are obliged to participate in a cleaning campaign. It would really help".

When we questioned her on why they must wait on HYSACAM before they do something, she said,

"My daughter the thing is, we have tried to do collective clean-ups in our neighbourhoods but problem we face is that after we've gathered all the dirt we do not know where to throw them since the dustbins are always full. The dirt is usually humid so we cannot even burn all of it. There is what they call keep clean in Yaounde II but you barely see anybody working during those hours that they are supposed to be keeping the pace clean. If HYSACAM or those in charge of waste management collaborate with us we can either help them with the activity in or own little way".

Another lady from Mbankolo when questioned on the same topic said that,

"these people should talk even with the quarter heads. Tell them how we should help and even organize sensitization campaigns. We can even sort our waste but the thing is observing from the way HYSACAM collects waste they themselves don't sort it so it's going to be of no use if we do. They would still mix it up in their trucks".

Just 6% indicates those who have no idea about the positive effects of waste management.

3.4 Adaptation Strategies of the Populations in Yaounde II

In any challenging environment that man finds himself, he tries to modify the environment to suit his way of life. According to our investigations the Yaounde II inhabitants try to cope with the challenges they face on a daily basis by adopting a series of methods and strategies that will make them survive the poor waste situation so as to live in conducive environments.

During our investigations, we found out that the inhabitants had devised a series of strategies due to the irregular collection of waste and constant full PWC so as to be able to cope with the daily challenges that they have to endure (table 29).

Table 31: Respondents views on coping strategies they adopt in Yaounde II

Quarter	Number of respondents	In the face of the waste management challenges, how do you cope with your waste?								
		Water bodies and streams	Roads and streets	Open spaces/bushes	Burn	Pit holes	Recycle	Pre-collection services	Runoff	Others
Ekoudou	13	6	4	0	0	2	1	0	0	0
Azegue	6	1	2	1	1	1	0	0	0	0
Briqueterie	18	0	8	2	4	2	2	0	0	0
Cite verte	9	0	1	0	4	1	3		0	0
Messa	14	0	10	0	4	0	0	0	0	0
Madagascar	5	0	1	0	1	1	1	1	0	0
Carriere	13	2	2	0	4	3	2	0	0	0
Mokolo	8	0	5	0	0	0	1	0	2	0
Nkomkana	17	0	9	0	2	3	2	0	1	0
Ntougou	10	0	0	0	7	0	0	3	0	0
Oliga	11	0	4	0	4	3	0	0	0	0
Tsinga	6	1	1	1	1	1	0	1	0	0
Mbankolo	6	1	0	0	2	1	1	1	0	0
Febe village	1	0	0	0	1	0	0	0	0	0
Total	**137**	**11**	**47**	**4**	**35**	**18**	**13**	**6**	**3**	**0**
%	**100%**	**8%**	**34%**	**3%**	**26%**	**13%**	**9%**	**4%**	**2%**	**0%**

Source: Field survey, 2020

With respect to the field survey instrument that was taken to the field, it revealed that the inhabitants of Yaounde II adopt a series of strategies to survive their daily challenges. We found out that, 34% of the inhabitants throw their waste by the road or the streets. When questioned on why they chose to do so one lady said

"You know what they say na? Desperate situations call for desperate measures. We have no option. HYSACAM usually comes and carries the dustbin away and does not bring it back on the same day. When they go like that what do we do? We just come and throw it there so that when they bring back the dustbin they would carry and put in inside".

One HYSACAM personnel on the other hand, whom we questioned during the focus group discussions on how they react to such cases said,

"Public places such as markets, avenues in the city centre and major crossroads are for us a real ordeal. We do not just come and carry the PWCs and go with it because we like. Do they think we go back home with it to make soup? There is a procedure we follow. The works we do is too much and extremely time consuming. I think people despise us because they have no respect for our work. We may clean up at night, but the next day it's the same. And then people are surprised that Yaounde is still dirty. But we're doing our job."

Table 29 also shows that 26% burn their waste by their homes, bushes or around other public areas. Despite the fact that this act is prohibited by the law, many people in Yaounde II still do so. When interviewed, one resident said,

"we are tired of the situation but burning the dirt is all we can do since HYSACAM is not regular. We cannot just sit and wait for them. When the public trash cans are already full what do we do with the dirt? Some of us know that burning dirt in public is not good but we cannot keep it at home. So, it is either we burn it or force ourselves to be uncomfortable with it in the house or since we chose comfort, we prefer to burn the dirt".

Another 3% re throwing their waste in open spaces and bushes while 4% pay for pre-collection services. Furthermore, 9% affirm to throw their waste in water bodies and streams. The table also shows that 13% dig pit holes around their homes to throw waste in them. When questioned on why they do so they said that it reduces distance and stress for them. Another 2% resulted to throwing their waste in runoff. That is, when rain is to falling, they pour their dirt in running surface water. This runoff carries their waste and goes and dumps in other areas of the quarter and even by other houses. This is a form huge but neglected form of pollution. Others said they adopt other strategies such as loading their waste inside their cars and carry to other locations with available PWCs.

The stakeholders involved in the waste management sector in Yaounde II especially the Yaounde II council and HYSACAM have been trying to put heads together to ensure that these impacts are attenuated but little results are felt on the community as the situation keeps being the same day after day and year after year. In an interview with the mayor of the Yaounde II council, he emphasized that the council has been doing a lot to contain some of their setbacks such as poor roads and poor state of public trash cans, organization of sensitization campaigns so as a to provide a sound environment for living and operation. He also emphasized on the projects they (the council) and the Ministry of Housing and Urban Development have been undertaking so as to make the neighbourhoods more accessible.

Conclusion

The third specific objective was based on the assessment of domestic waste management on the environment of Yaoundé II. It was revealed that domestic waste had great effects on air, water, aesthetics, and land which is detrimental to harm the environment as well as public health.

Testing of hypothesis 3, analysis and discussions of results.

This hypothesis sets out to assess the effects of waste management on the environment of Yaounde II. The responses of the respondents on the effects were exploited and they paved the way for verification and validation of the hypothesis (table 25).

Our contingency table **(SEE APPENDICE 6)**

Source: Table based on Chi square statistics

$$X^2 = \frac{(O-E)2}{E}$$

Degree of freedom (df) = (c-1) (r-1) = (2-1) (14-1) = 1x13 = 13

Null Hypothesis (Ho): Insufficient domestic waste management has not affected the environment of Yaounde II.

Alternative Hypothesis (Ha): Insufficient domestic waste management has largely affected the environment of Yaounde II.

We now have our chi square statistic ($X^2 = 22.362$), which is the calculated value, our predetermined alpha level of significance (0.05) and our degree of freedom (df = 12). Situating the Chi square distribution table at 12 degrees of freedom and reading along the row we find that the value ($X^2 = 22.362$) is above critical value 137.1. Since our calculated value of ($X^2 = 22.362$) is far above the critical value is far above the critical value, we can then rejected the null hypothesis which states that: Insufficient domestic waste management has not affected the environment of Yaounde II and retain the alternative hypothesis which states that: Insufficient domestic waste management has largely affected the environment of Yaounde II.

In all stages of history, waste has always been present and continues till date to be a subject of reflection on several dimensions. This has been demonstrated as being the case in Yaounde II where the available facilities are not sufficient to ensure the proper running waste management. Domestic waste is dumped uncontrollably along homes, road sides, streets and other public spaces which are responsible for water, air and aesthetic pollution as well as health hazards. However, in the face of these challenges brought about by the poor management of waste, the majority of the populations are not indifferent as they try to adopt a series of coping strategies to find their way in the mist of these drawbacks.

GENERAL CONCLUSION

SUMMARY OF FINDINGS AND RECOMMENDATIONS

Summary

This study concentrates on the sources of waste production and its effects on the environment of Yaounde II. In an attempt to sufficiently diagnose the problem which is based on the increase in waste production and its effects on the environment of Yaounde II, a general objective and specific objectives were formulated. These objectives had as main goal to evaluate the sources of waste production, how they are managed, the policies and institutions that govern the sector and how they affect the environment. Data on these objectives were obtained and presented in three chapters of this study. This same data is used for the testing and validation d the stated hypothesis.

The sources of domestic waste production are different. Such sources include household activities, markets, administrative establishments. These sources have been intensifying over the years rendering the management of waste difficult and efficient. This is visible through the rapidly filled PWCs, constant heaps of waste by roads open spaces and drains. Furthermore, the policies and institutions involved in the management of this waste are perceptibly latent. This is visible by the number of stakeholders involved with no specifically defined roles, the low levels of law enforcement and the abandonment as well as laxity in carrying out their functions. All these leads to environmental problems such as air, water, aesthetic, land and soil pollution hence health risks. This study recognizes that to obtain successful DWM, there must be transparency in the management of public affairs, timely information, reliability, intensification of public participation and awareness raising campaigns.

SUGGESTIONS OR RECCOMENDATIONS

To properly handle the striking issues hindering the smooth functioning of the waste management sector in Yaounde II from adequately contributing to the sanitation of the town, a plethora of suggestions are necessary to all stakeholders involved in this sector. These proposals are addressed to the government, the council, HYSACAM and to the populations.

To the government

Laws are very important instruments when it comes to improvement environmental quality standards and proper waste management. In Cameroon, most of the laws on waste

management regulations are on paper and not visible on the field. Corruption has made most of the laws to be silenced. These laws should be enforced, implemented and supervised. Appropriate legislations for a comprehensive waste management law should be enacted in Cameroon. The law should allow harmonization of the functions of the different ministries and other stakeholders involved in the waste management sector.

Implementation of waste management legislation should be limited to fewer agencies whose roles are well defined. Institutional strengthening and cooperation between these agencies should be enhanced with the aim of reducing excessive bureaucratic requirements and introducing transparency and accountability will have to be encouraged. (E.g. Wilson et al. 2005).

Based on our observations, there is low public participation in waste management activities in Yaounde II. The population are very important factors that have to be considered in the waste management activities. They are the ones who produce and generate waste and so should be aware of the various means they can manage their own waste. To achieve sustainable waste management therefore, education and awareness should be key drivers. Education can be used to promote awareness. The government should frequently organize waste management campaigns. This would create awareness to the local people who have little or no knowledge on waste management. This will help to change people's attitudes and behaviours toward waste management. For the effective use of education and awareness in Cameroon, the target should be primary, secondary schools.

Strengthening of private-public partnerships in waste management is required. Such successful partnerships can be forged in the areas of materials recovery and community composting. Such partnerships should in turn encourage private investments in the delivery of waste recycling and recovery facilities. Public and private partnerships offer interesting alternatives to MSW services, particularly in terms of innovation (Ahmed and Ali, 2006). For such partnership to be established, there is need for major participative consulting through facilitated workshops involving all key stakeholders i.e. municipal councillors, government agencies, waste contractors and community groups or representatives i.e. (Wilson et al., 2005; henry et al., 2006) during which all perspectives regarding sustainable waste management can be developed, consensus built and policies and services implemented. Public–private partnerships

The much-neglected pre-collection services should be integrated as a full sector of waste management in Cameroon. Pre-collectors can and should be used as ambassadors of proper waste management practices such as waste separation of biodegradable form non-biodegradable waste as well as recycling. People engaged in the pre-collection sector work in close collaboration with the communities. That is, they go to people's homes freely to collect dirt etc. if these people are used to alleviate the waste collection weight on HYSACAM and other sectors, the sector would definitely know a great wind of change.

To HYSACAM

The current collection service is reaching only a fraction of the study area population and in response to this; the populations employ unsustainable disposal methods to dispose of their waste. The inadequate services are of great concern to the inhabitants. In light with the concern of the residents, and the expressed need for improved and increased services, HYSACAM should work closely with the communities to establish a collection schedule that meets the needs of the community by matching the disposal cycle of the residents.

The study equally suggests that HYSACAM strengthens information, education and communication on the impacts of poor waste management through broadcasting, debates, door-to-door sensitization, forum theatres, movie projections etc. this would raise public awareness of hygiene rules hence and incite real change in behaviours

Large areas of the city are inaccessible to collection vehicles, especially where agriculture is most practiced. Since distance and access to paved roads are major waste disposal deterrents, transfer stations would be very useful for reducing transport costs and, in some cases, reducing the environmental impact of MSW management (Chalot, 2004; Bovea et al., 2007). The transfer stations could be located in underserved areas but next to a paved road. They would enable urban dwellers and urban farmers to deposit their waste. Sorting and recycling operations would be easier and would benefit from a higher participation of inhabitants, who would then benefit from composting opportunities presented by transfer stations. Urban and peri-urban farmers would be able to improve the output and quality of their agriculture. Transfer stations would also be a 'visible" example of good MSW disposal practices and thus increase local participation (Bolaane, 2006).

To the Yaounde II council

Faced with the undesirable effects of poor domestic waste management in Yaounde II, this study therefore recommends that a community-based management organ to collect and dispose waste in Yaounde II is mandatory. In this way, waste will be collected regularly and disorganized dumping will be avoided, hence a health friendly environment. Added to this, the clean-up campaigns should not only be respected but should involve the populations and sanctions meted on defaulters. This would cause the populations to cultivate proper domestic waste disposal habits and learn to keep the environment clean.

Strengthen the capacity of the actors in the management of waste, namely HYSACAM through training, equipment, educational movies, audio-visual kits, sanitation and personal protective equipment (glasses, boots, gloves, dust masks, rakes, coats, brooms, shovels etc.)

The implementation of the 4Rs i.e. recycle, reuse and recovery would equally be an added advantage: The transformation of paper into fuels for cooking, melting and mixing plastic bags with fine sand for making pavers. This technique is increasingly being adopted in many parts of the world notably Kenya where the technique has been used to pave the streets of the town in Kaya. Through this, the populations of Yaounde II would be educated on the necessity to reduce the quantity of waste they dump in the environment. The unavoidable ones such as aluminium and iron rods should be reused through sorting and recycling. Also, domestic waste could further be recovered through the creation of biogas plant.

Another suggestion to HYSACAM is that they should set up sanitation brigades that would be responsible for the collection of household waste. This would help reduce their work load and make promote sanitation.

To the general public

As earlier mentioned, waste could be of use if seen from another angle. The populations should learn how to transform their waste into more useful things. For example, transforming aluminium into dishes and pots, convert biodegradable waste into compost for agriculture fields, thus reducing the use of some chemical fertilizers which are harmful to human health. The populations should equally learn how to separate their waste, recycle, reuse and recover waste so as to make their environments more health and friendly.

These recommendations and more if implemented will rescue the Yaounde II environment and health from poor domestic waste management practices.

Conclusion

The overriding problems of domestic waste management in Cameroon, notably in Yaounde II includes poorly formulated legislation and ineffective policy implementation, inefficient collection and disposal practices, insufficient facilities and lack of appropriate technology. While collection can be improved through the involvement of public and private partnerships, public engagement and training as well as disposal remains a problem.

In this study, domestic waste management and its effects on the environment of Yaounde II as well as the management policies were presented. Though there are several waste management statutory orders that should ensure proper waste management practices like collection, disposal, recycling, transportation and treatment are still severely lacking. Delivering sustainable domestic waste management through consensus building, consultation, encouragement and openness must be developed prior to maximizing the potential available for waste reuse, recycling and recovery in Yaounde II. For this to be achieved there is the need for a radical refurbishment of the current policy and regulatory systems in Cameroon.

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APPENDICES

The Chi Square Statistics

There are basically two types of random variables and they yield two types of data: numerical and categorical. A chi square (X^2) statistic is used to investigate whether distributions of categorical variables differ from one another. Basically, categorical variable yield data in the categories and numerical variables yield data in numerical form. Responses to such questions as "What is your major?" or do you own a car?" are categorical because they yield data such as "biology" or "no." In contrast, responses to such questions as "How tall are you?" or "What is your G.P.A.?" are numerical. Numerical data can be either discrete or continuous. The table below may help you see the differences between these two variables.

Data Type	**Question Type**	**Possible Responses**
Categorical	What is your sex?	male or female
Numerical	Discrete- How many cars do you own?	two or three
Numerical	Continuous - How tall are you?	72 inches

Notice that discrete data arise from a counting process, while continuous data arise from a measuring process.

The Chi Square statistic compares the tallies or counts of categorical responses between two (or more) independent groups. (Note: Chi square tests can only be used on actual numbers and not on percentages, proportions, means, etc.)

2 x 2 Contingency Table

There are several types of chi square tests depending on the way the data was collected and the hypothesis being tested. We'll begin with the simplest case: a 2 x 2 contingency table. If we set the 2 x 2 table to the general notation shown below in Table 1, using the letters a, b, c, and d to denote the contents of the cells, then we would have the following table:

Table 1. General notation for a 2 x 2 contingency table.

	Variable 1		
Variable 2	Data type 1	Data type 2	Totals
Category 1	a	b	a + b
Category 2	c	d	c + d
Total	a + c	b + d	a + b + c + d = N

Note: notice that the four components of the denominator are the four totals from the table columns and rows.

Suppose you conducted a drug trial on a group of animals and you hypothesized that the animals receiving the drug would survive better than those that did not receive the drug. You conduct the study and collect the following data:

Ho: The survival of the animals is independent of drug treatment.

Ha: The survival of the animals is associated with drug treatment.

Table 2. Number of animals that survived a treatment.

	Dead	Alive	Total
Treated	36	14	50
Not treated	30	25	55
Total	66	39	105

Applying the formula above we get:

Chi square = $105[(36)(25) - (14)(30)]^2 / (50)(55)(39)(66) = 3.418$

Before we can proceed we need to know how many degrees of freedom we have. When a comparison is made between one sample and another, a simple rule is that the degrees of freedom equal (number of columns minus one) x (number of rows minus one) not counting the totals for rows or columns. For our data this gives (2-1) x (2-1) = 1.

We now have our chi square statistic ($x^2 = 3.418$), our predetermined alpha level of significance (0.05), and our degrees of freedom (df =1). Entering the Chi square distribution table with 1 degree of freedom and reading along the row we find our value of x^2 (3.418) lies between 2.706 and 3.841. The corresponding probability is $0.10<P<0.05$. This is below the conventionally accepted significance level of 0.05 or 5%, so the null hypothesis that the two distributions are the same is verified. In other words, when the computed x^2 statistic exceeds the critical value in the table for a 0.05 probability level, then we can reject the null hypothesis of equal distributions. Since our x^2 statistic (3.418) did not exceed the critical value for 0.05 probability level (3.841) we can accept the null hypothesis that the survival of the animals is independent of drug treatment (i.e. the drug had no effect on survival).

Table 3. Chi Square distribution table.

	probability level (alpha)					
Df	0.5	0.10	0.05	0.02	0.01	0.001
1	0.455	2.706	3.841	5.412	6.635	10.827
2	1.386	4.605	5.991	7.824	9.210	13.815
3	2.366	6.251	7.815	9.837	11.345	16.268
4	3.357	7.779	9.488	11.668	13.277	18.465
5	4.351	9.236	11.070	13.388	15.086	20.517

Chi Square Test of Independence

For a contingency table that has *r* rows and *c* columns, the chi square test can be thought of as a test of independence. In a test of independence, the null and alternative hypotheses are:

Ho: The two categorical variables are independent.

Ha: The two categorical variables are related.

We can use the equation Chi Square = the sum of all the $(f_o - f_e)^2 / f_e$

Here f_o denotes the frequency of the observed data and f_e is the frequency of the expected values. The general table would look something like the one below:

	Category I	Category II	Category III	Row Totals
Sample A	a	B	c	a+b+c
Sample B	d	E	f	d+e+f
Sample C	g	H	i	g+h+i
Column Totals	a+d+g	b+e+h	c+f+i	a+b+c+d+e+f+g+h+i=N

Now we need to calculate the expected values for each cell in the table and we can do that using the row total times the column total divided by the grand total (N). For example, for cell a the expected value would be (a+b+c) (a+d+g)/N.

Once the expected values have been calculated for each cell, we can use the same procedure are before for a simple 2 x 2 table.

Observed	Expected	|O - E|	$(O - E)^2$	$(O - E)^2 / E$

Suppose you have the following categorical data set.

Table 2. Incidence of three types of malaria in three tropical regions.

	Asia	Africa	South America	Totals
Malaria A	31	14	45	90
Malaria B	2	5	53	60
Malaria C	53	45	2	100
Totals	86	64	100	250

We could now set up the following table:

Observed	Expected	|O -E|	$(O - E)^2$	$(O - E)^2 / E$
31	30.96	0.04	0.0016	0.0000516

Appendix 1: Chi square statistical table

DF	0.995	0.975	0.20	0.10	0.05	0.025	0.02	0.01	0.005	0.002	0.001
1	0.0000393	0.000982	1.642	2.706	3.841	5.024	5.412	6.635	7.879	9.550	10.828
2	0.0100	0.0506	3.219	4.605	5.991	7.378	7.824	9.210	10.597	12.429	13.816
3	0.0717	0.216	4.642	6.251	7.815	9.348	9.837	11.345	12.838	14.796	16.266
4	0.207	0.484	5.989	7.779	9.488	11.143	11.668	13.277	14.860	16.924	18.467
5	0.412	0.831	7.289	9.236	11.070	12.833	13.388	15.086	16.750	18.907	20.515
6	0.676	1.237	8.558	10.645	12.592	14.449	15.033	16.812	18.548	20.791	22.458
7	0.989	1.690	9.803	12.017	14.067	16.013	16.622	18.475	20.278	22.601	24.322
8	1.344	2.180	11.030	13.362	15.507	17.535	18.168	20.090	21.955	24.352	26.124
9	1.735	2.700	12.242	14.684	16.919	19.023	19.679	21.666	23.589	26.056	27.877
10	2.156	3.247	13.442	15.987	18.307	20.483	21.161	23.209	25.188	27.722	29.588
11	2.603	3.816	14.631	17.275	19.675	21.920	22.618	24.725	26.757	29.354	31.264
12	3.074	4.404	15.812	18.549	21.026	23.337	24.054	26.217	28.300	30.957	32.909
13	3.565	5.009	16.985	19.812	22.362	24.736	25.472	27.688	29.819	32.535	34.528
14	4.075	5.629	18.151	21.064	23.685	26.119	26.873	29.141	31.319	34.091	36.123
15	4.601	6.262	19.311	22.307	24.996	27.488	28.259	30.578	32.801	35.628	37.697
16	5.142	6.908	20.465	23.542	26.296	28.845	29.633	32.000	34.267	37.146	39.252
17	5.697	7.564	21.615	24.769	27.587	30.191	30.995	33.409	35.718	38.648	40.790
18	6.265	8.231	22.760	25.989	28.869	31.526	32.346	34.805	37.156	40.136	42.312
19	6.844	8.907	23.900	27.204	30.144	32.852	33.687	36.191	38.582	41.610	43.820
20	7.434	9.591	25.038	28.412	31.410	34.170	35.020	37.566	39.997	43.072	45.315
21	8.034	10.283	26.171	29.615	32.671	35.479	36.343	38.932	41.401	44.522	46.797
22	8.643	10.982	27.301	30.813	33.924	36.781	37.659	40.289	42.796	45.962	48.268
23	9.260	11.689	28.429	32.007	35.172	38.076	38.968	41.638	44.181	47.391	49.728
24	9.886	12.401	29.553	33.196	36.415	39.364	40.270	42.980	45.559	48.812	51.179
25	10.520	13.120	30.675	34.382	37.652	40.646	41.566	44.314	46.928	50.223	52.620
		13.844									
26	11.160		31.795	35.563	38.885	41.923	42.856	45.642	48.290	51.627	54.052
		\\									
27	11.808	14.573	32.912	36.741	40.113	43.195	44.140	46.963	49.645	53.023	55.476
28	12.461	15.308	34.027	37.916	41.337	44.461	45.419	48.278	50.993	54.411	56.892
29	13.121	16.047	35.139	39.087	42.557	45.722	46.693	49.588	52.336	55.792	58.301
30	13.787	16.791	36.250	40.256	43.773	46.979	47.962	50.892	53.672	57.167	59.703
31	14.458	17.539	37.359	41.422	44.985	48.232	49.226	52.191	55.003	58.536	61.098
32	15.134	18.291	38.466	42.585	46.194	49.480	50.487	53.486	56.328	59.899	62.487
33	15.815	19.047	39.572	43.745	47.400	50.725	51.743	54.776	57.648	61.256	63.870
34	16.501	19.806	40.676	44.903	48.602	51.966	52.995	56.061	58.964	62.608	65.247
35	17.192	20.569	41.778	46.059	49.802	53.203	54.244	57.342	60.275	63.955	66.619
36	17.887	21.336	42.879	47.212	50.998	54.437	55.489	58.619	61.581	65.296	67.985
37	18.586	22.106	43.978	48.363	52.192	55.668	56.730	59.893	62.883	66.633	69.346
38	19.289	22.878	45.076	49.513	53.384	56.896	57.969	61.162	64.181	67.966	70.703
39	19.996	23.654	46.173	50.660	54.572	58.120	59.204	62.428	65.476	69.294	72.055
40	20.707	24.433	47.269	51.805	55.758	59.342	60.436	63.691	66.766	70.618	73.402

41	21.421	25.215	48.363	52.949	56.942	60.561	61.665	64.950	68.053	71.938	74.745
42	22.138	25.999	49.456	54.090	58.124	61.777	62.892	66.206	69.336	73.254	76.084
43	22.859	26.785	50.548	55.230	59.304	62.990	64.116	67.459	70.616	74.566	77.419
44	23.584	27.575	51.639	56.369	60.481	64.201	65.337	68.710	71.893	75.874	78.750
45	24.311	28.366	52.729	57.505	61.656	65.410	66.555	69.957	73.166	77.179	80.077
46	25.041	29.160	53.818	58.641	62.830	66.617	67.771	71.201	74.437	78.481	81.400
47	25.775	29.956	54.906	59.774	64.001	67.821	68.985	72.443	75.704	79.780	82.720
48	26.511	30.755	55.993	60.907	65.171	69.023	70.197	73.683	76.969	81.075	84.037
49	27.249	31.555	57.079	62.038	66.339	70.222	71.406	74.919	78.231	82.367	85.351
50	27.991	32.357	58.164	63.167	67.505	71.420	72.613	76.154	79.490	83.657	86.661

14	23.04	9.04	81.72	3.546
45	36.00	9.00	81.00	2.25
2	20.64	18.64	347.45	16.83
5	15.36	10.36	107.33	6.99
53	24.00	29.00	841.00	35.04
53	34.40	18.60	345.96	10.06
45	25.60	19.40	376.36	14.70
2	40.00	38.00	1444.00	36.10

Chi Square = 125.516
Degrees of Freedom = (c - 1) (r - 1) = 2(2) = 4

Table 3. Chi Square distribution table.

Probability level (alpha)

Df	0.5	0.10	0.05	0.02	0.01	0.001
1	0.455	2.706	3.841	5.412	6.635	10.827
2	1.386	4.605	5.991	7.824	9.210	13.815
3	2.366	6.251	7.815	9.837	11.345	16.268
4	3.357	7.779	9.488	11.668	13.277	18.465
5	4.351	9.236	11.070	13.388	15.086	20.517

Reject Ho because 125.516 is greater than 9.488 (for alpha = 0.05)

Thus, we would reject the null hypothesis that there is no relationship between location and type of malaria. Our data tell us there is a relationship between type of malaria and location, but that's all it says.

Chi Square,

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ATTESTATION DE RECHERCHE

Je soussigné, **Pr. PAUL TCHAWA**

Chef du Département de Géographie, atteste que

Mademoiselle: ***NDABUF BEMSIMBOM MBONG***

Matricule: **18Z896**

Est inscrit(e) au cycle de : MASTER II (2019-2020)

Spécialité : Marginalité et stratégies de developpement
ET prépare une thèse sur le sujet **:Domestic waste management and its impacts on the Yaoundé II environment.**

A cet égard, je prie toutes les ressources et tous les organismes sollicités de lui réserver un bon accueil et de lui apporter toute l'aide nécessaire à la réussite de cette recherche dont la contribution à l'appui au développement ne fait pas de doute.

Fait à Yaoundé le.....09 SEPT 2020.....

UNIVERSITE DE YAOUNDE I
Département de Géographie
Le Chef de Département
FACULTE DES ARTS, LETTRES ET SCIENCES HUMAINES

LE CHEF DE DEPARTEMENT

UNIVERSITY OF YAOUNDE I

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POST GRADUATE SCHOOL FOR THE SOCIAL AND EDUCATIONAL SCIENCES

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DOCTORAL RESEARCH UNITE FOR SOCIAL SCIENCES

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FACULTY OF ARTS, LETTERS AND SOCIAL SCIENCES

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DEPARTMENT OF GEOGRAPHY

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UNIVERSITE DE YAOUNDE I

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CENTRE DE RECHERCHE ET DE FORMATION DOCTORALE EN SCIENCES HUMAINES SOCIALES ET EDUCATIVES

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FACULTE DES ARTS, LETTRES ET SCIENCES HUMAINES

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DEPARTEMENT DE GEOGRAPHIE

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DOMESTIC WASTE MANAGEMENT AND ITS IMPACTS ON THE YAOUNDE II ENVIRONMENT

A SURVEY QUESTIONNAIRE

TOPIC: DOMESTIC WASTE MANAGEMENT AND ITS EFFECTS ON THE ENVIRONMENTOF YAOUNDE II

NB: All information gathered is strictly for academic purpose and will be subjected under confidentiality to serve the purpose it deserves

GENERAL CHARACTERISTICS OF THE RESPONDENT

1- *Please tick the responds in the correspondent boxes and state answers where necessary. (please choose only one answer per question)*
2- Locality/quarter ……...
3- Age group: (A) 15-20 ☐(B) 21-30☐ (C)31-40 ☐ (D) 41-50 (E) 50 and above ☐
4- Sex: (a) female ☐ (b) male ☐
5- Marital status: (A) single ☐ (B) married ☐ (C) divorced ☐ (D) others ☐
6- Educational level: (A) none☐(B) FSLC ☐(C) GCE O/L ☐ (D) GCE A/L☐ (E) Bachelors ☐ (F) masters ☐ (G) others……
7- Religion: (A) Roman Catholic ☐ (B) Presbyterian ☐ (C) Muslim ☐ (D) Baptist ☐(E)others…….
8- Region of origin……
9- Others?.....
10- How long have you lived here? (A)0-3months ☐(B)more than 6months ☐(C)1-5 years (D)5-10 years ☐(E)more than 10 years☐

H1 Increasing waste production have surpassed management capacity in Yaounde II

11- In your opinion, what are some of the sources of waste production in Yaounde II (i) household activities ☐ (ii) road side commerce/and emergence of markets (buyam-sellam) ☐ (iii) transport system and services (garages, bus station activities)☐ (iv) health, education and administrative establishments☐
12- Do you believe that the waste management organs have the capacity to manage all the waste produced in Yaounde II?
13- How many of you live in your house (i) 0-4 ☐ (ii) 5-10 ☐ (iii) more than 10 ☐
14- Has this number increased within the five last years? (i)Yes ☐ (ii) no ☐

15- If yes, with the increase number of people in your home, has the quantity of food you cook increased?
16- How do you store waste in your house? (i)closed container ☐ (ii) open container ☐ (iii) basket ☐ (iv)plastic bag ☐ (v) pile in the yard☐ (vi) carton ☐
17- Do you have a public trashcan in your locality? (i) yes (ii) no
18- If no, where do you throw your dirt? (i) HYSACAM truck (ii) streams and other water bodies (iii) by roads or streets (iv) bushes (v) pit holes (vi) other……
19- How far is this public trash can form your home? (i) 10 to 100 meters (ii) more than 100 meters
20- How often does the collection company pass by or empty the containers in your area? (i)everyday ☐ (ii)5-10 days☐ (iii) weekly ☐ (iv) monthly ☐ (v)irregular ☐
21- Is there any fix program on how you go and empty your dustbins (i) yes (ii) no?
22- How best would you evaluate the collection of waste in your locality (i) very good ☐ (ii)good (a) fair/mediocre ☐ (iii) bad ☐

Hypothesis 2: Ineffective policies and institutional framework has largely influenced the management of domestic waste in Yaounde II

23- Do you think that the polices and institutional framework put in place to manage domestic waste are efficient?
24- Have these policies and institutions influenced proper domestic waste management?
25- Do you know that the Cameroonian law states that you can get a fine of 25 thousand a risk of 2 to 6-month imprisonment if you are caught dumping your waste around certain areas of the town/streets? (i) yes ☐ (ii) no ☐
26- Have you ever had any form of sensitization/education on waste management? (i) yes ☐ (ii) no ☐
27- If yes, through what medium were you sensitized (i)radio ☐ (ii) television ☐ (iii) community meetings ☐ (iv) school ☐ (v) posters or sign boards ☐ (vi) others…….
28- Who organized it? (i) The ministries ☐ (ii) NGO ☐ (iii) the council ☐ (iv) HYSACAM ☐ (v) scholars ☐ (vi)community ☐ (vii) others……

Hypothesis 3: Inadequate domestic waste management has largely impacted the environment of Yaounde II.

29- Is the waste produced in Yaounde II well managed by the authorities concerned? (i)yes (ii) no

30- In your opinion, what are some environmental problems caused by the waste produced in Yaounde II (i) air pollution ☐ (ii) water pollution ☐ (iii)soil pollution (iv)aesthetic pollution (v)blocked drains/gutters (v) others……

31- In your opinion, is poor waste management a cause of illnesses (i) yes ☐ (ii) no ☐

32- If yes, which are the most common diseases you have in your household (i) diarrhoea ☐ (ii) malaria ☐ (iii) cholera ☐ (iv) typhoid ☐ (v) others……

33- In your opinion can anything positive come from waste management? (i) yes ☐ (ii) no ☐

34- If yes, what? (i)jobs ☐ (ii) innovations ☐ (iii)agricultural practices ☐ (iv)others ☐

35- In the absence of PWCs, how do you manage to cope with these? (i) I throw my waste in a pit hole by house ☐ (ii) runoff (iii) burning ☐ (iv) buying large plastic bags ☐ (v) throw or stand it by the roadside (vi) throw around streams and bushes by the house (vii) recycle (viii) subscribed to pre collection services (viiii) others…..……

THANKS FOR YOUR COOPERATION

ANNEX 3: The guiding principles of the national waste management strategy in Cameroon

- **Principle of sustainable development**

"Sustainable development" (or sustainable development) is, according to the definition proposed in 1987 by the World Commission on Environment and Development in the Brundtland Report1: "development that meets the needs of the generations of the present without compromising the ability of future generations to meet their own. Sustainable waste management would therefore mean a rational use of resources and the reduction of the volume of waste produced. "Polluter pays" principle. This principle means that it is the polluter who must bear the cost of pollution. It is one of the principles underlying environmental management in Cameroon as prescribed in Article 9 paragraph (c) of the Framework Law on Environmental Management. Thus, the costs resulting from measures to prevent reduce and combat pollution must be borne by the polluter. The application of the "polluter pays" principle can be envisaged from a twofold perspective: to make waste producers bear the cost of financing waste management according to the quantities and nature of their waste (in particular the external ecological costs); encourage producers to be more preventive.

- **Principle of hierarchical waste management:**

Hierarchical waste management is in fact the order of priority in waste management practice. Any guidance or activity in the field of waste management should try to best meet these priorities. The national waste management strategy follows the hierarchical approach as described below. Prevention / reduction of the production and harmfulness of waste Prevention consists in ensuring the development of clean technologies that are more economical in natural resources and by placing on the market products that generate less waste. Waste recovery Waste must, as far as possible, be recovered as a matter of priority with a view to its reintroduction into the economic circuit.

- **Disposal of waste**:

The disposal of waste which is not susceptible to recovery must be carried out in accordance with the best available technology which does not entail excessive costs. Principle of information and awareness (of the right to information) In order to achieve a reduction in the amount of waste, it is necessary to raise awareness among every citizen from an early age and to inform every one of the environmental consequences of poor waste management. Ecological

waste management requires everyone to be aware of their responsibilities with regard to their individual behaviour.

- **The concept of quality must be inherent in all stages of waste management.**

It must apply both to the producer of the waste and to that of the persons responsible for collection, transport, recovery or disposal. Through its behaviour, the waste producer takes responsibility for ensuring better prevention or maximum recovery of the waste produced, in particular by providing clean secondary raw materials that allow the production of new products of high quality and that can therefore remain on the competitive market. The quality of the services and measures implemented for the collection, transport, recovery and disposal of waste must guarantee better protection of the environment and human health. Finally, the products resulting from the recovery of waste must meet the defined and generally recognized quality standards to stimulate their use.

- **Principle of the execution of the most practical environmental options**:

The principle of the most practical environmental options is a systematic and optional decision-making process. The Most Practical Environmental Options Process identifies for defined goals and circumstances, an option, or combined options resulting in the highest benefit or smallest environmental damage. Principle of proximity In terms of disposal, waste must be treated or deposited as close as possible to its place of production. This implies in principle that the waste must be sent to "... approved installations", within the meaning of Article 43 of Law No. 96/12 of 5 August 1996 on the framework law on Environmental Management. If suitable facilities do not exist on the national territory, this waste must be transported to the nearest facilities operating with the best available technology. Given the inadequacy of treatment sites at national level, and their proximity to large cities, the application of the principle of proximity must be seen in cooperation with regions beyond our borders, so as to guarantee long-term waste disposal.

- **Principle of coherence and coordination:**

Administrative organisation and our economic development require that any waste management policy be coherent and coordinated throughout the national territory. This implies that the various decision-making centres direct their activities according to common guidelines. National coordination of waste management is an essential condition for streamlining the collection, sorting and treatment of waste and for optimising existing and future structures. The logical consequence is a better use of both material and financial resources. In areas where the

need is felt, existing structures should be examined for coherence and, if necessary, changes, modifications or new elements should be made to remedy this situation.

- **Principle of equity:**

By relying on a notion of natural justice, separated from the rules of law in force, the principle of equity induces the search for the best economic efficiency, that is to say the control and optimal development of resources. Equity comes in an "intergenerational" way (today's levels of well-being must not be higher than tomorrow's) and also "intergenerational" (the well-being of the entire current population is a goal in itself; economic inequalities must be combated).

APPENDICE 4: Contingency Tables

Contingency table for hypothesis 1

Observed value	**Expected value**	**O-E**	**$(O-E)^2$**	$\frac{(O-E)2}{E}$
0	1	-1	0	0
13	1	12	13	13
0	1	-1	0	0
6	1	5	6	6
0	1	-1	0	0
18	1	17	18	18
0	1	-1	0	0
9	1	8	9	9
0	1	-1	0	0
14	1	13	14	14
0	1	-1	0	0
5	1	4	5	5
0	1	-1	0	0
13	1	12	13	13
0	1	-1	0	0
8	1	7	8	8
0	1	-1	0	0
17	1	16	17	17
0	1	-1	0	0
10	1	9	10	10
0	1	-1	0	0
11	1	10	11	11
0	1	-1	0	0
6	1	5	6	6
0	1	-1	0	0
6	1	5	6	6
0	1	-1	0	0
1	1	0	1	1

APPENDICE 5: Contingency table for hypothesis 2

Observed value	Expected value	O-E	$(O\text{-}E)^2$	$X^2 = \frac{(O-E)2}{E}$
5	0.4	4.6	21.16	52.9
8	0.4	7.6	57.76	144.4
8	0.4	7.6	57.76	144.4
5	0.4	4.6	21.16	52.9
2	0.4	1.6	2.56	6.4
4	0.4	3.6	12.96	32.4
4	0.4	3.6	12.96	32.4
2	0.4	1.6	2.56	6.4
0	0.4	-0.4	0.16	0.4
18	0.4	17.6	309.76	774.4
18	0.4	17.6	309.76	774.4
0	0.4	-0.4	0.16	0.4
6	0.4	5.6	31.36	78.4
3	0.4	2.6	6.76	16.9
3	0.4	2.6	6.76	16.9
6	0.4	5.6	31.36	78.4
7	0.4	6.6	43.56	108.9
7	0.4	6.6	43.56	108.9
7	0.4	6.6	43.56	108.9
7	0.4	6.6	43.56	108.9
0	0.4	-0.4	0.16	0.4
5	0.4	4.6	21.16	52.9
5	0.4	4.6	21.16	52.9
0	0.4	-0.4	0.16	0.4
0	0.4	-0.4	0.16	0.4
13	0.4	12.6	158.76	396.9
13	0.4	12.6	158.76	396.9
0	0.4	-0.4	0.16	0.4
0	0.4	-0.4	0.16	0.4
8	0.4	7.6	57.76	144.4
8	0.4	7.6	57.76	144.4
0	0.4	-0.4	0.16	0.4
4	0.4	3.6	12.96	32.4
13	0.4	12.6	158.76	396.9
13	0.4	12.6	158.76	396.9
4	0.4	3.6	12.96	32.4
1	0.4	0.6	0.36	0.9
9	0.4	8.6	73.96	184.9
9	0.4	8.6	73.96	184.9
10	0.4	9.6	92.16	230.4
11	0.4	10.6	112.36	280.9
11	0.4	10.6	112.36	280.9
0	0.4	-0.4	0.16	0.4
0	0.4	-0.4	0.16	0.4
4	0.4	3.6	12.96	32.4
4	0.4	3.6	12.96	32.4
2	0.4	1.6	2.56	6.4
2	0.4	1.6	2.56	6.4
4	0.4	3.6	12.96	32.4
4	0.4	3.6	12.96	32.4
2	0.4	1.6	2.56	6.4
0	0.4	-0.4	0.16	0.4
1	0.4	0.6	0.36	0.9

1	0.4	0.6	0.36	0.9
0	0.4	-0.4	0.16	0.4
				6012.5

APPENDICE 6: Contingency table for hypothesis 3

Observed value	**Expected value**	**O-E**	**$(O-E)^2$**	$\frac{(O-E)2}{E}$
0	1	-1	0	0
13	1	12	13	13
0	1	-1	0	0
6	1	5	6	6
0	1	-1	0	0
18	1	17	18	18
0	1	-1	0	0
9	1	8	9	9
0	1	-1	0	0
14	1	13	14	14
0	1	-1	0	0
5	1	4	5	5
0	1	-1	0	0
13	1	12	13	13
0	1	-1	0	0
8	1	7	8	8
0	1	-1	0	0
17	1	16	17	17
0	1	-1	0	0
10	1	9	10	10
0	1	-1	0	0
11	1	10	11	11
0	1	-1	0	0
6	1	5	6	6
0	1	-1	0	0
6	1	5	6	6
0	1	-1	0	0
1	1	0	1	1
				137.1

APPENDICE 8: An example of service contract issued to associations, NGOs and CIGs by the municipality of Yaoundé.

Version 2010

CONTRAT COMMUNAUTAIRE

OPERATION DE PRECOLLECTE ET DE COMPOSTAGE DES ORDURES MENAGERES

Dans le cadre du projet d'assainissement de Yaoundé PADY, de la mise en œuvre du processus de décentralisation et en vue d'impliquer les populations à la gestion et à l'entretien des ouvrages d'assainissement. Il est mis en place un contrat communautaire relatif à l'exploitation et à la gestion d'un projet pilote de pré collecte des ordures ménagères dans la commune de Yaoundé 2. Le PADY assisté par le Bureau International du Travail (BIT) pour l'organisation de la pré collecte est chargé de :

Fournir les équipements de pré collecte.

Définir l'organisation du système.

Former les Organisation communautaire de base OCB.

Rediger et faire signer les contrats communautaires

CONTRAT DE PRESTATION DE SERVICE

Entre La Commune d'Arrondissement de Yaoundé 2 représentée par le M. le Maire , M. Luc Assamba ou son représentant, désignée **La Commune,**

Et le groupement d'associations Sarkan Zoumountsi et AÏDAS Briqueterie représenté par M Mahama Salissou Ibrahim, désigné **le Prestataire,**

Il est convenu ce qui suit :

Préambule

Le présent contrat a pour objet de définir les modalités de gestion de la pré collecte des ordures ménagères au sein des quartiers de la Briqueterie, Ekoudou, Nkom Kana et Tsinga. L'objectif principal étant de lutter contre le rejet des ordures ménagères dans les caniveaux et cours d'eau en créant des emplois pour les personnes défavorisées.

Définition de l'activité pré collecte

La pré collecte consiste au ramassage, au transport et au regroupement des ordures dans les quartiers non viabilisés. Le prestataire fait appel à des pré collecteurs indépendants qui sont chargés de transporter les déchets vers le centre de traitement, avec des portes-tout aménagés. Au centre de traitement, on procède a la valorisation en fabriquant du compost et en recyclant le plastique, les verres et les métaux. Les rebuts sont repris par HYSACAM.

Dans le quartier La Commune avec l'assistance des Comité d'Animation et de développement et de leurs relais qui sont les chefs traditionnels et les chefs de blocs sensibilisent les habitants afin qu'ils remettent leur poubelles lors du passage des pré collecteurs. Le centre de traitement est contrôlé par le responsable de l'hygiène de la Commune de Yaoundé 2.

Rôle du Comité

La Commune de Développement est chargé de :

- Faire le relai avec la CUY qui gère la prestation d'HYSACAM. La CUY est chargée de veiller à la coordination des zones d'intervention entre la collecte et la pré collecte et au contrôle de l'enlèvement des rebuts. Elle est aussi le maître d'ouvrage du Projet d'Assainissement de Yaoundé PADY qui intervient dans les aménagements et l'organisation de cette activité.
- S'assurer que les tas d'ordures sauvages ne persistent pas.
- Contrôler le présent contrat de prestation de service pour exécuter la pré collecte.
- Garantir au prestataire de l'exclusivité de cette activité.
- Veiller à ce que les autorités du quartier participent à la sensibilisation des populations à l'hygiène et au tri sélectif.
- Contrôler les volumes de produits recyclés produits.

Rôle du prestataire

La pré collecte est assurée par le prestataire qui est chargé de :

- Recruter, encadrer et former les agents de pré collecte en nombre suffisant pour couvrir l'ensemble des zones d'habitat spontané. Il est responsable de la gestion du personnel et veille à l'application et au respect des Normes de travail en vigueur (voir article 0)
- Organiser une tournée régulière (entre 6 heures et 12 heures) pour transporter les ordures des quartiers vers le centre de traitement mis à sa disposition.
- De procéder au tri sur le site et de valoriser les déchets en procédant à :
    - La fabrication du compost à partir des déchets bio dégradables, Triant, nettoyant les matières plastiques en vue de leur transformation en billes plastiques,
    - Le chargement des déchets ultimes « rebuts » dans les bacs HYSACAM,
    - Veiller au respect des règles d'hygiène.
- Tenir à jour la comptabilité du centre
- Faire la mise à jour de pièces annexées au présent contrat qui sont :
    - L'inventaire des équipements
    - La fiche de présence et d'activité des pré collecteurs,
    - La fiche de relevé de la consommation en eau et électricité,
    - Le tonnage des produits recyclés.
- Il doit veiller au bon usage du matériel et des installations mis à sa disposition. En cas de détériorations de son fait, les frais de réparation sont à sa charge.
- Il est tenu de signaler sans délai aux responsables de la commune des pannes et autres anomalies constatées.
- Afin de générer des revenus complémentaire, il peut procéder à une extension de son activité sans toutefois détourner l'objectif assigné au contrat.

Moyens

- La commune de Yaoundé 2 mettra à disposition les emprises foncières et aménagements réalisés par le PADY.
- Les formations des prestataires (fabrication du compost, tenue des registres, ...) et la première campagne de sensibilisation sont assurées par l'assistance technique du BIT dans le cadre du PADY.

- Equipement : Il est mis à disposition du prestataire le petit outillage (pelles, balais, brouettes,...), les moyens de transport manuel pour un effectif de 30 pré collecteurs ainsi que des vêtements de travail et des équipements de sécurité pour le personnel. L'entretien et le renouvellement étant à la charge du prestataire pendant la durée du contrat.
- Zone d'intervention : La zone d'intervention correspond aux quartiers voisins du centre de compostage. Le prestataire pourra accroitre le périmètre d'intervention et son effectif en fonction de la participation des ménages.
- Le prestataire aura à sa charge l'entretien, le gardiennage et les consommations en eau et électricité au centre de compostage.
- Le prestataire est autorisé par la commune à proposer ses services aux résidants pour tout enlèvement de matériaux encombrants et déchets de chantier.

Financement

Le financement de l'activité comprendra plusieurs étapes réparties comme suit

Les pré collecteurs indépendants recouvrent pour leur propre compte les cotisations des ménages établies sur la base d'un montant mensuel de 1.300 Fcfa.

Le pré collecteur reversera au prestataire un montant forfaitaire mensuel de 10.000 Fcfa pour la location et l'entretien du matériel de pré collecte et le droit d'exercice.

Le prestataire reversera un montant forfaitaire mensuel de 10.000 Fcfa à la commune pour la location centre et le droit d'exercice de pré collecte.

Le prestataire commercialisera pour son propre compte, tous les produits issus de la valorisation et du recyclage des déchets.

Personnel

Le personnel du prestataire est composé de : composteurs, gardiens, gestionnaire et des pré collecteurs. Les pré collecteurs sont considérés comme des travailleurs indépendants tandis que les autres travailleurs seront des salariés. Le recrutement devra permettre à la population la plus défavorisée d'avoir accès à un emploi décent, ceci sans préjudice du respect des droits relatifs à la non discrimination de genre, de race, de couleur, de croyances ou ethnique. La répartition des tâches sera faite uniquement en fonction des compétences et des capacités physiques et il est interdit d'employer des enfants de moins de 16 ans.

Formation des travailleurs

Le prestataire devra former le personnel à son poste de travail et notamment aux mesures d'hygiène et à la relation avec les usagers.

Au moins 5% des travailleurs locaux doivent avoir la possibilité d'améliorer leurs compétences par une formation sur site. Cette formation doit cibler en priorité les femmes et les plus pauvres.
Il devra sensibiliser régulièrement tous les travailleurs aux risques de maladies infectieuses et notamment le VIH/SIDA.

Sécurité et santé

Le prestataire entretiendra la trousse de premiers soins sur le site formera la ou les personnes compétentes sur le site, pouvant apporter les premiers soins.

Il doit garantir que l'équipement et les outils présentent le moins de danger possible pour la santé et la sécurité des travailleurs et distribuer les équipements de protection individuelles (Bottes, gants, baudrier, masques,...) adaptés aux travaux et veiller à leur port effectif.

Il doit prévoir la mise à disposition d'eau potable gratuite sur le site.

Il est interdit d'employer des enfants de moins de 16 ans pour des travaux dangereux ou nocifs pour la santé, ni pour des travaux nocturnes.

Assurances

Le personnel devra être inscrit à une caisse d'assurance ou mutuelles agrées pour couvrir les risques d'accident du travail.

Engagement

La Commune s'engage à entretenir régulièrement les voies d'accès au centre de traitement de façon à permettre l'accès aux camions d'enlèvement des bennes. A inspecter les zones de pré collecte et verbaliser les usagers qui rejetterai leurs ordures sur la voie publique.

Le prestataire s'engage à exercer l'activité de pré collecte dans un esprit communautaire. C'est-à-dire en tenant compte des préoccupations des habitants en matière d'emploi. Le prestataire peut adapter son effectif en fonction de la participation des ménages pour atteindre un effectif de 32 tout en maintenant l'effectif minimum des 10 pré collecteurs pour assurer le fonctionnement du centre.

Evaluation des résultats

L'activité sera évaluée semestrielle par les parties d'après les indicateurs indicatifs suivants :

Couverture géographique et Nombre de ménages abonnés, Quantité de produits recyclés en volume ou tonnage (Compost, Plastiques, verres, métaux, papiers), Emplois créés, Avis des usagers

Durée

Le présent contrat et conclu pour une période initiale d'un an, il sera reconduit annuellement en fonction de l'évaluation et avec révision des objectifs.

Gestion Des Conflits

En cas de non respect des engagements réciproques inscrits dans le présent contrat, celui-ci sera être soumis à l'arbitrage la CUY maître d'ouvrage. A défaut d'une conciliation amiable le contrat sera résilié de plein droit par l'une ou l'autre des parties, à l'expiration d'un délai de quinze jours suivant l'envoi d'une lettre avec accusé de réception valant mise en demeure.

Fait à Yaoundé en deux exemplaires, le_____

Signature

La Commune

Le prestataire