

Management and Sanitation Measures on Solid Household Waste: A Threat to Gbadolite Municipality, Nord-Ubangi, DRC

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Abstract

Man is the main virus of its environment and, since the 70-planet earth is facing the problem of pollution by waste from human activities. The collection of household waste is one of the most difficult issue faced by urban authorities in of developing countries. The main aim of this research was to identify the solid waste management system and analyze some of these shortcomings then propose a sustainable solution for the environment. A survey was carried out among 400 households in Gbadolite municipality, across its five districts. The structured interview was used as method by administrating questionnaires to the respondents. The findings show that 78% of households have garbage cans that are garbage wells, but these garbage are not sorted out while 100% of households mix their garbage (organic and non-biodegradable). The majority of households either dump in illegal landfills (which can be found be everywhere in the city), incinerate or dump in inappropriate locations their wastes. This is due to the lack of space in their vicinity that is why these wastes are deposited in public places. The management of household waste as practised in Gbadolite municipality is of the "classic type", not contributing to the sustainable development of the environment. The sanitation situation remains worrying in this area and the environment is polluted. This situation puts the health and well-being of populations at risk on a daily basis. The management of solid household waste in Gbadolite municipality requires effective and sustainable solutions, from which it is essential to put in place strategies for a good management in this area.

Keywords

Management, Measures, Household Waste, Sanitation, Gbadolite

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1. Introduction

In general, cities in developing countries, and particularly in African countries, are among the cities where environmental management issues are relevant. The collection of household

waste is one of the most difficult issue faced by urban authorities in these cities. These difficulties are reflected in the accumulation of household waste, the creation of many unauthorized landfills and the stagnation of wastewater and rainwater in many districts [1]. Housing insalubrious

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conditions remain a major concern in most cities around the world, but this problem seems to be more prevalent in cities of developing countries. The Democratic Republic of the Congo (DRC) is not spared even if its population would be indifferent to this subject. The significant progress of urbanization, which brings about changes in the environment through human activities, has brought risks to human and animal health [2].

According to Luwesi *et al.* [3], poverty is the most serious of the health threats in both urban and rural areas. He also pointed out that the insufficient disposal of solid waste is a major factor in the spread of diseases as a result of the proliferation of insects and rodents used as vectors. The lack of space (promiscuity) favors the spread of aerosol transmissible infections. These shortcomings are marked by the lack of human resources and techniques necessary for the formulation of an integrated policy for urban waste management. Gbadolite municipality experienced an incomparable demographic explosion over years. Following the annual reports of the 2014 administration, decentralization and security of the Town Hall and Gbadolite municipality with 142080 inhabitants in 2014 while in 2010, it had only 108136 inhabitants. This shows an increase of 33 944 inhabitants in the 5-year period, or an annual growth of 23.8%. Among the major environmental problems can be mentioned pollution and nuisances, which affect the human health, the congestion that requires the development of the municipality.

Today, the problems of household waste management, environmental planning and management are very complex and attract the attention of environmental managers because of their effects on health and sustainable development [4-5]. Fearing the danger facing the population of Gbadolite, in the coming years, the power and intellectual elite of the environment are all called upon to seek appropriate solutions to the problems that concern the municipality of Gbadolite in the field of solid household waste management.

The DRC Constitution of 18 February 2006, in its article 53, stipulates the following: "Everyone has the right to a healthy environment conducive to his full development and has the right to defend it. The State shall ensure the protection of the environment and the health of the population".

However, Leakey and Lewin [6] assert that after billions of years of evolution and only a few tens of billions of years of human use, the environment is now experiencing increasing pollution. Following the aforementioned statements, the municipality of Gbadolite is not spared, being an urban-rural agglomeration, from the difficulties of waste management. In fact, Gbadolite has neither controlled landfills nor waste treatment infrastructures, not a well-structured cadastral

urbanization plan with a landfill. The environmental degradation due to solid household waste found everywhere throughout the streets of Gbadolite municipality, some corners around public squares and many more in all parts of the municipality is subjected to unhealthy environmental life. To date, no one seems to be concerned about this situation, even less the risks faced by the inhabitants of Gbadolite. The management of the environment by solid household waste in all corners and especially in this municipality is of the high relevance.

The urbanization of the Gbadolite municipality is gradually leading to the deterioration of its environment. The problem of solid household waste management is very acute and necessitates an intervention [7].

We are all aware that solid household waste pollutes all households in all districts of the urban-rural areas in developing countries to such an extent that some plots no longer have free space to dig a waste well or a pit for sanitary installations [8] and this situation is also observed in Gbadolite municipality. Unplanned household construction in almost all parts of Gbadolite means that residents do not have a place to deposit solid household waste. The solid household waste disposal system is "underground burial" while this waste is a permanent danger to the population [9]. In all level of the Congolese administration, there is a structure and organisms responsible for sanitation and health. However, this structure is somewhat negligent in the management of solid household waste or simply absent in the municipality. The way which Gbadolite population manages solid household waste is the significance of this research.

Following questions were asked: (i) in the absence of an appropriate landfill and without the use of a modern waste management process, how is solid household waste managed in Gbadolite municipality? (ii) What are the problems related to the management of solid household waste in Gbadolite municipality? (iii) What measures should be taken to improve this management?

The main aim of this research was to identify the solid waste management system and analyze some of these shortcomings then propose a sustainable solution for the environment.

2. Materials and Methods

This study was carried out in Gbadolite (4°17' north latitude; 21°2' east longitude; altitude: 500m above the sea level) and its surroundings (Nord-Ubangi, DR Congo). The climate is of type AW₂ according to Köppen's classification [10-11].

A survey was carried out in different districts of Gbadolite having a sample size of 400 respondents selected randomly notably: Lite district (100 respondents), Kaya district (100

respondents), Moanda (50 respondents) and Pangoma (50 respondents).

A total of 400 people were interviewed using a survey sheet. It is divided into two parts: Socio-demographic data (age and sex of the respondents, level of education, family situation) and information on household waste management in the municipality of Gbadolite. Traditional descriptive statistical methods were used to analyze the results.

3. Results

The socio-demographic characteristics of respondents are presented in the figure below.

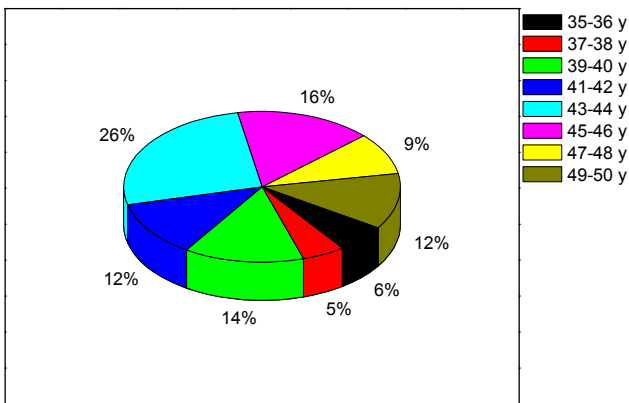


Figure 1. Distribution of respondents according to age.

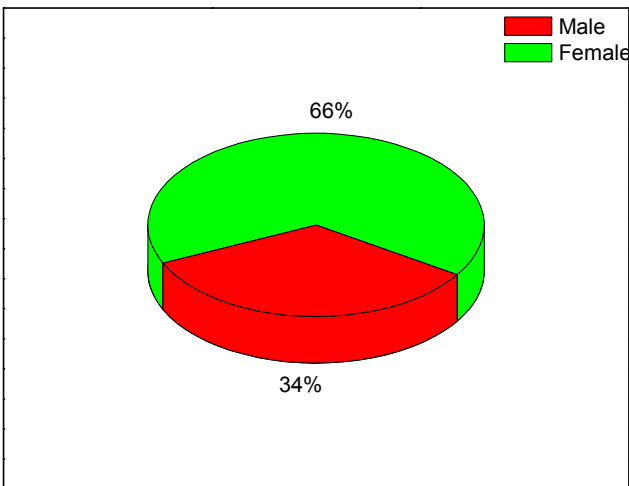


Figure 2. Distribution of respondents according to gender.

The overall age range was between 35 and 50 years and the following age groups namely: 49-50 years, 47-48 years, 45-46 years, and 43-44 years constitute 63% of the population surveyed while the remaining was the least represented

The distribution of respondents according to gender is presented in Figure 2.

It is observed that 66% of household heads are female and

34% are male. This is justified by the fact that females produce and manage large quantities of solid household waste in Gbadolite municipality while males are in the field or in the office.

Figure 3 shows the distribution of household heads following the education level.

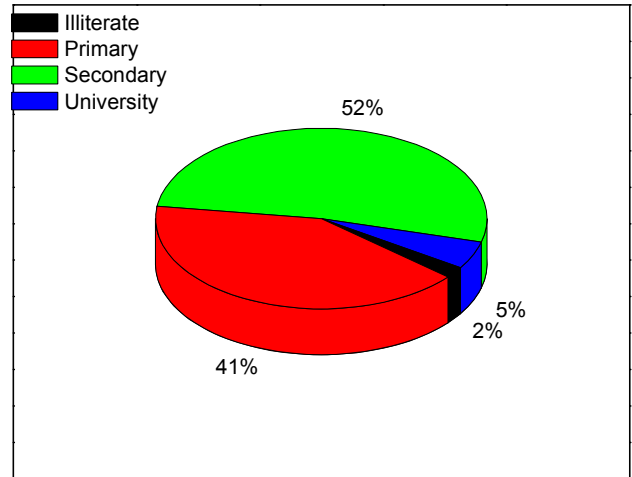


Figure 3. Distribution of respondents according to the education level.

The education level of household heads is of the secondary level (52%), while 41% primary, 5% university, then 2% do not have the ability to read. These results agree that 55% of our respondents are literate and have the ability to answer to the questionnaire.

The size of the household investigated is given in the figure below.

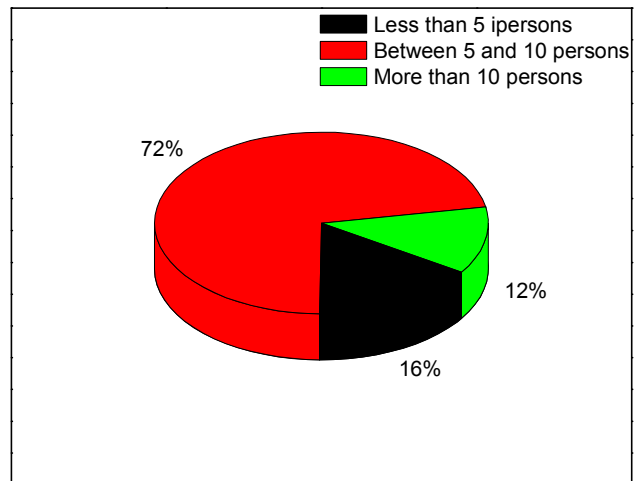


Figure 4. Size of households.

As observed, 72% of households have a size between 6 and 10 people, 16% have less than five people and 12% of households have more than 10 people. The amount of solid household waste is very important given the size of each household. Thus, waste wells are quickly filled and when

they are renewed, waste is deposited either along the streets or in uncontrolled landfills, leading to the proliferation of vectors and various odours.

Figure 5 shows the number of respondents who own garbage cans within their households.

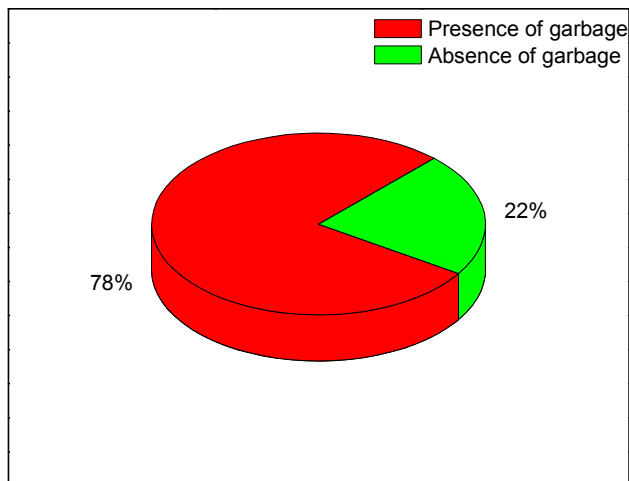


Figure 5. Possession of garbage cans within households.

It is observed that 78% of households have a garbage can and 22% do not have a garbage can. These bins are in large numbers, garbage holes dug behind households and which must constantly be renewed. Since the majority of the study population is composed of female, they must necessarily have garbage cans to dispose of their solid household waste.

Figure 6 shows the nature of garbage cans used at the

household level.

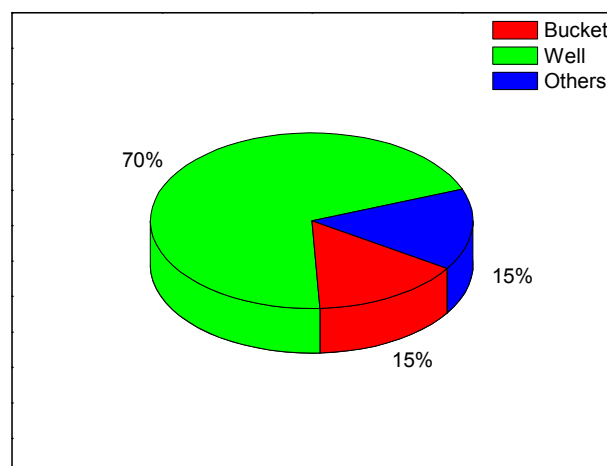


Figure 6. Nature of bins.

The above figure displays that 70% of households use the waste wells that bury their garbage, 15% use the bucket storage system before disposal and 15% do not have a place to deposit their solid household waste. This already presents a danger in the management of this waste, because many respondents are married with a minimum of 6 to 10 people, their waste is either deposited in a corner of the street or in the vicinity of public or private institutions. To this end, it is necessary to add the 15% of those who use the seal, because disposal is a problem.

The sorting out process of waste and their recycling is presented in table 1.

Table 1. Sorting out and valorization of waste per household.

Variables	Frequency (n=400)	Percentage (%)
Sorting out of waste		
Respondents who don't sort out their waste	400	100
Respondents who sort out their waste	-	-
Waste recycling of per household		
Recycling waste	344	86
Non-recycling waste	56	14

As observed, 100% of households do not sort out their waste before their placement in the garbage. These results provide sufficient evidence that our respondents have a low level of knowledge of sorting information. Even the 70% of households that use waste wells are at risk when it comes to renewing these wells, because all materials (biodegradable or not) are buried in the same well. However, non-biodegradable materials are a permanent danger because they will be brought to the surface when digging in the same area due to lack of space. These results are as follows: 86% of households do not recycle their waste and 14% at least recycle it. The type of recovery used is composting for household gardens, local soap making, and traditional salt. This refers to their gender and level of education.

Figure 7 gives the respondents' opinion on solid household waste management methods.

From the figure above, it is observed that 97% of solid household waste is managed by conventional processes using traditional management techniques (landfilling, incineration, illegal landfills and dumping in inappropriate locations). In this process, 68% is landfilling in garbage holes. This technique occupies a large part of the spaces.

Figure 8 shows the frequency of garbage disposal at the household level.

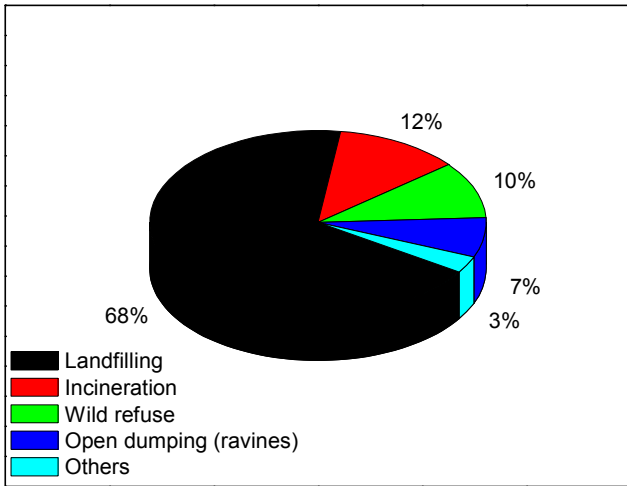


Figure 7. Solid household waste management method.

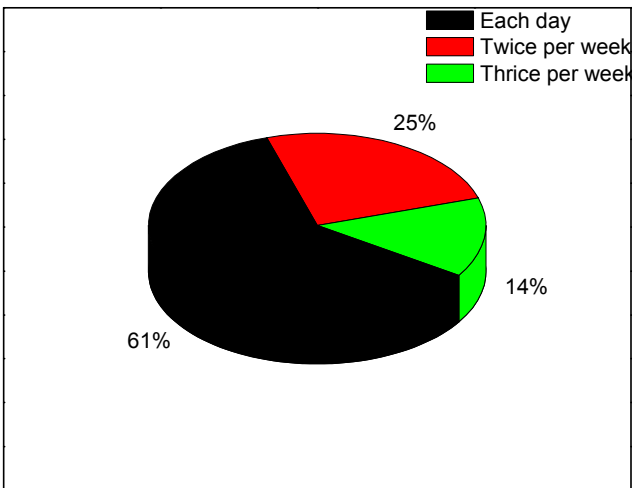


Figure 8. Frequency of waste disposal.

The frequency of household waste disposal is 61% daily, 25% twice a week and 14% three times a week. This is the basis for the proliferation of insects and others. Daily disposal must have a positive impact on the health of the population if waste is deposited in controlled landfills. Otherwise, it becomes a nuisance for the population living in and around the area.

Figure 9 shows the availability of space for burying garbage within households.

From the above figure, it is shown that 61% of our households no longer have enough space to dig waste wells and 39% still have the space. One can estimate that after five years, the inhabitants of Gbadolite municipality would lack the space to bury their solid household waste and it could create the problem of total insalubrity in this community. These findings justify the technique much more used in waste management, 68% of which is landfilled in wells and these wells are filled each time. Due to lack of space, households are required to recreate in the same place,

exposing non-biodegradable materials on the surface, while these materials pose a permanent danger to the population and much more, to children.

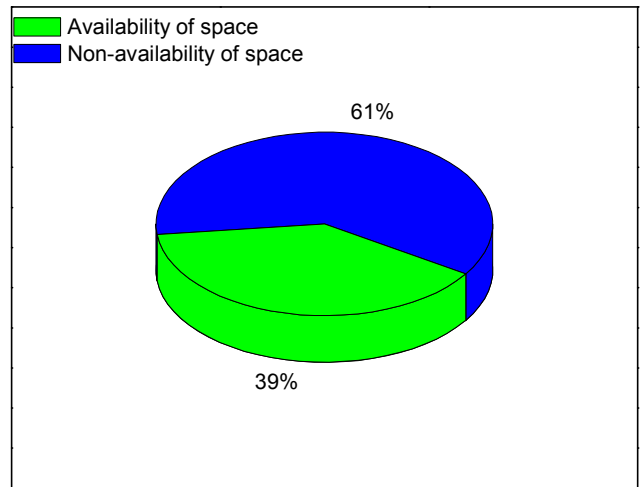


Figure 9. Availability of space for waste disposal.

Figure 10 shows the respondents' opinion on the proposal to install the public health service.

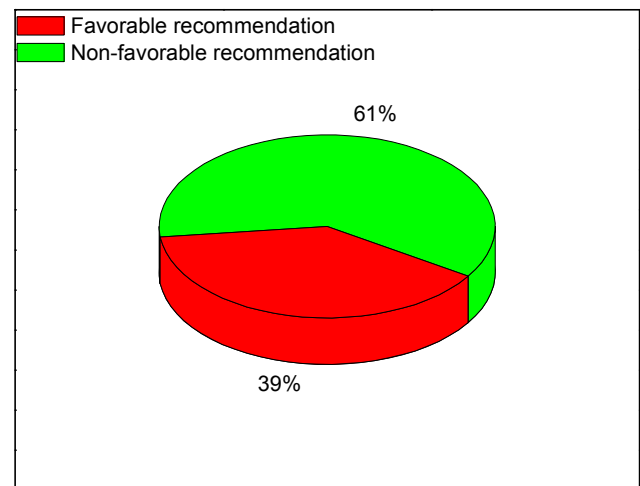


Figure 10. Proposal to install a public health service.

The above figure shows that 61% of our households are in favour of the public health service facility that will handle solid household waste and 39% are still unaware of its usefulness. The 23% who do not know justify their level of education. That is why we will ask the authorities to get involved in raising awareness among the ignorant population.

Figure 11 gives the respondents' opinion on the proposal to create the health control brigade.

With regard to the creation of a sanitation control brigade, 51% of households expressed the wish to create one, 49% found that this service would be a form of harassment and that the brigade would have to sanction either with fine that require the money while the majority is farmers (49%).

These results show the importance given to raising public awareness of solid household waste management.

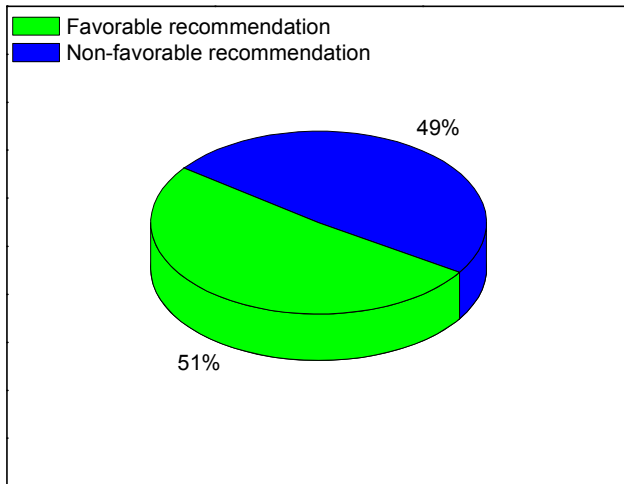


Figure 11. Proposal to create the health control brigade.

4. Discussion

Mbadiko *et al.* [12] reported the major problems related to household waste management in Kimbaseke municipality and proposed strategies for rational household waste management. These are strategies that the author proposed: (i) The poor management of household waste has its origin not only in the absence of garbage cans and public dumpsites but also in the irresponsible behavior of the population. (ii) Without a real commitment from the competent authority to raise awareness and encourage the population to become aware of the state of degradation and pollution that could lead to a state of disruption of the environmental balance. (iii) The recycling of household waste can be the sustainable solution for the sanitation of the city of Kinshasa.

However, what interested us was the waste management techniques and the disposal methods. This means it is imperative to install public landfills throughout Gbadolite municipality according to the sites proposed in this study.

4.1. Management and Remediation Measures for Solid Household Waste in Gbadolite Municipality

The causes of the permanent presence of solid household waste in Gbadolite municipality are the demographic explosion (rapid population growth and rural exodus). At the 5-year interval, there was an increase of 23.8%. In addition to the causes of waste management, there are multiple management constraints namely the lack of controlled landfills and a cadastral plan. Uncontrolled construction in some outlying districts, which host major commercial activities; the absence of a local urban environment management scheme; the lack of collection stakeholders

(NGOs, SMEs, and technical services), the absence of local regulations and legal texts as well as the low education level required.

The solid household waste management system of the city in general and that of the municipality in particular has shortcomings that prevent effective management of the city. These difficulties would be summarized in problems relating to the institutional framework and financial problems. Knowing that the majority of the population is a farmer, planning problems of the municipality, which have not been achieved as the former President Mobutu, the builder of this city wished, problems of technology and infrastructure for valorization, non-participation and insufficient cooperation of the population:

i. Problems relating to the institutional framework

In the DRC, there are institutions and bodies responsible for waste management at all levels of the administration. The accumulation of waste in Congolese cities can therefore be attributed not to the absence of institutions but to shortcomings in their functioning. As far as Gbadolite municipality is concerned, these institutions are almost non-existent to such an extent that the population has serious difficulties in understanding the mechanism of household waste management. Above all, household waste management is not a priority for most of our political and administrative leaders. The management of solid household waste poses another major difficulty because the municipality does not have the technical, financial and administrative resources necessary to ensure its disposal. Henceforth, the environment remains polluted.

ii. Planning problems

The biggest weakness of municipal authorities is the lack of creativity spirit, the privilege of self-interests, the lack of innovation and last the lack of collaboration between them and the population to make planning on their short-, medium- and long-term combat to eradicate once and for all the insalubrity in the municipality.

iii. Insufficient participation of the population

The wellbeing the population, which is essential to good governance, cannot always be taken for granted. First, the population considers that it should not assume any responsibility concerning the collection and disposal of solid household waste because it is a public service i.e. it is the responsibility of the State. Secondly, the population does not take seriously these authorities because they are seen as unwilling in executing their tasks. All these problems deserve special attention from the public authorities, the municipality, the organizations and the population.

iv. Measures for the sustainable sanitation of solid household

waste in the municipality of Gbadolite

Within this specific framework, the current trend can only be reversed by implementing the following measures:

1. Improve governance in solid household waste management: With regard to waste management, most problems stem from poor governance. To achieve this, it is necessary to avoid the disparity between rulers and the governed, which is what promotes trust between both parties.
2. Implement priority actions to mobilize the community and obtain its participation: In the municipality, the waste management system is not sustainable, particularly because of the limited capacity of public and responsible institutions to finance their operating costs. The situation should be reviewed in depth and appropriate measures need to be taken to significantly increase the cost recovery through funds and taxes.
3. Promote the waste recycling system: To ensure better citizen engagement, urban solid waste management facilities should be established and shared equitably in all corners of the municipality in terms of income and geographical location. The objective should be to eliminate at least 90% of waste throughout the municipality. Solid household waste management should be considered both a responsibility and a service of public interest in which all residents should be able to contribute and benefit.
4. Elaborate sustainable development plans for public landfills which, at other times, were on the Kambo road; consider urbanization and its corollaries, in particular waste management in a global way. All types of land use (housing, transport, water and electricity supply, waste generation and disposal) should be considered as subsets of a major planning system. It is therefore necessary to establish an extensive system of public information on important issues such as the methods of collecting, storing and transporting waste to landfills, as well as the risks posed by indifference to solid household waste.
5. Properly complete the development plan for Gbadolite municipality: Many improvements could be made if leaders and citizens worked together to determine how to solve waste problems. For the solid waste collection system to be effective, citizens must know their daily responsibilities, the behaviors to adopt, collection schedules, standard procedures and the location of appropriate sites.
6. Enforce the law and harmonize institutions: There are gaps in the enforcement of laws, policies and programs to monitor and protect the environment. To reverse this trend,

legislation should be reviewed in order to determine its relevance, timeliness and applicability and to ensure strict enforcement of those that are actually relevant.

7. Creation of a central body in charge of waste management: If, through municipalities such as Gbadolite, waste management services can be organized there, another at city level should be responsible for centralization for the whole city, which would in turn be under the supervision of the national coordination.

4.2. The Installation of Landfills

These are proposed during our field surveys, we have retained:

1. For Block A bis, along the Nganda-nganda swamp to be used as compost;
2. The Kaya and Mbanza districts, towards the road leading to Kamba, in the old landfill;
3. The Lite, Moanda and Pangoma districts, the landfill can be placed behind the concession that wanted to serve the establishment of the company Stella Artois.

This part has just given theoretical and practical solutions and, subsequently, a development plan for public landfills. The theoretical solutions were given on the basis of the behaviors observed in the field during the study. This concerned the application of existing texts, appropriate training of agents, raising public awareness and controlling population growth. The practical solution was to set up landfills according to open spaces and access roads at different locations. All these solutions are a major asset for us that the authorities can use in practice to address social problems.

5. Conclusion and Suggestions

The aim of this study was to identify the solid waste management system and analyze some of these shortcomings then propose a sustainable solution for the environment. The findings showed that 70% of households have garbage cans which are wells, but these garbage are not sorted out (all wastes are mixed either organic or non-biodegradable) while most of households do not recover their waste. The rest of the household waste is either dumped in illegal landfills, incinerated or dumped in inappropriate locations. As for the disposal method, landfilling is the most commonly used method by households. However, some households deposit their garbage in street ravines and other in inappropriate places and in the streets. However, it was observed that lots of households have no longer enough space to dig wells, this explains why wastes are deposited in streets and along the vicinity of public and private establishments.

The management of household waste as practiced in Gbadolite municipality is of the "classic type", not contributing to the sustainable development of the environment. The sanitation situation remains worrying in this area where the environment is seriously polluted. This situation puts the health and well-being of populations at risk on a daily basis. The management of solid household waste in the municipality of Gbadolite requires effective and sustainable solutions. Henceforth, it is essential to put in place strategies for the sustainable management of solid household waste in Gbadolite municipality.

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