Institut International d'Ingénierie de l'Eau et de l'Environnement
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CONTRIBUTION TO THE BEST MANAGEMENT OF SOLIDWASTE IN KIGALI CITY: CHALLENGES AND OPPORTUNITIES

MASTER OF SCIENCE THESIS IN WATER AND ENVIRONMENTAL ENGINEERING

OPTION: ENVIRONMENT AND SANITATION ENGINNERING

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PROMOTION [2010/2011]

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Joining an academic life in a foreign country could be a big challenge, which challenge becomes a bit more daunting when you leave a young family you love and care for so much.

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SUMMARY

During our research process we mainly focused on descriptive characteristics of existing domestic sanitation systems; their physical infrastructure as well as social-economic and technical management practices. Therefore, challenges and opportunities for the solid waste management in Kigali City were discussed.

Kigali City is occupied by 70% of informal settlements (Interview with the Energy, Water and Sanitation Authority: EWSA) most of which are found in poor neighbourhoods. In these areas there are poor municipal sanitation infrastructures.

More than 92.9% of the study area population has stated that, the establishment of Community Based Organizations (CBOs) that deal with solid waste management can improve municipal waste management in the city even in informal settlements. CBOs can create markets in solid waste management services in Kigali. The only issue to be thought about is regarding the transport infrastructures.

The majority (89.4%) of the study area citizens have the opinion that the CBOs can provide good services at affordable charges if the government put in place a formal structure of managing solid waste in Kigali City and in other districts.

However, the CBOs are still dependent on local governments support which helps in recovering bills and raising awareness among the citizen.

There is a poor infrastructure for municipal wastewater and runoff in Kigali in general. Only 30% of Kigali is covered by paved runoff water infrastructure and all this is found along main roads and in the city centre. This was observed while conducting this research and Nyabugogo center is facing a special challenge on this.

In poor neighbourhoods, lack of runoff water and drainage systems costs the citizen their structures and causes trenches resulting from soil erosion.

The majority of the citizen (total of 97.9%) in poor neighbourhoods have the opinion that they are willing that the construction of collection centers can improve the management of solid waste in Kigali City.

Key words:

1 – Quantification

2– Environment

3 – Sanitation

4 –Solid waste

5 - Households

RESUME

Lors de notre recherche, nous nous sommes basés sur les caractéristiques descriptives des systèmes existants de l'assainissement dans les ménages.

Les infrastructures physiques ainsi que les pratiques de gestion socio-économique et technique de l'assainissement dans la ville de Kigali ont été aussi analysés. Défis et opportunités pour la gestion des déchets solides dans la ville de Kigali ont été discutés. Selon l'interview que nous avons eue avec l'Office de l'Energie, de l'Eau et Assainissement EWSA) 70% de l'espace de la ville de Kigali est occupé par des bâtiments non planifiés et informels, dont la plupart se trouvent dans les quartiers précaires. Dans ces localités, il y a l'insuffisance des infrastructures d'assainissement municipal.

Plus de 92,9% des enquêtés, ont confirmé que la création d'organisations communautaires qui s'occupent de la gestion des déchets solides peut améliorer la gestion des déchets municipaux dans la ville de Kigali, y compris dans des établissements formels et informels.

Ces communautés peuvent créer des marchés de services de gestion des déchets solides dans la ville.

La majorite (89,4%) des citoyens de la zone de l'étude sont d'avis que les organisations communautaires peuvent fournir de bons services à des prix abordables si le gouvernement met en place une structure formelle et institutionnelle de gestion des déchets solides dans la ville de Kigali.

Cependant, les organisations communautaires sont encore dépendantes des entités administratives locales. Le succès des services de ces organisations dépendent de l'aide de ces entités dans le recouvrement des factures et la sensibilisation de la population.
Il y a manque d'infrastructures pour la gestion des eaux usées municipales et du ruissellement en général dans la ville de Kigali.

Seulement 30% de la partie est couverte par les infrastructures de gestion des eaux usées

(Caniveaux) et se trouvent le long des routes principales. Dans les quartiers précaires, le manque des systèmes de collecte des eaux de pluie est l'une des causes de l'érosion du sol. Dans les quartiers précaires 97,9% des personnes rencontrées ont confirmé qu'ils sont prêts à contribuer dans la construction de centres de collecte et gestion des déchets solides dans la MVK.

Mots clés**:**

1 - Quantification

2 - Environnement

3 - Assainissement

4 - Déchets solides

5 - Ménages

LIST OF ACRONYMS

AfDB	African Development Bank
CBOs	Community Based Organizations
COOPED	Coopérative pour la Promotion de l'Environnement et du Développement
EDPRS	Economic Development and Poverty Reduction Strategy
EWSA	Energy, Water and Sanitation Authority
KDS	Kampala Declaration on Sanitation
MDG	Millennium Development Goals
MINALOC	Ministry of Local Government
MINECOFIN	Ministry of Finance and Economic Planning
MINEDUC	Ministry of Education
MININFRA	Ministry of Infrastructure
MINIRENA	Ministry of Natural Resources
MINISANTE	Ministry of Health
MVK/COK	Mairie de la Ville de Kigali/ City of Kigali
NGO	Non Government Organisation
PPP	Public Private Partnerships
RBS	Rwanda Bureau of Standards
REMA	Rwanda Environment Management Authority
RURA	Rwanda Utility Regulation Agency
UNICEF	United Nations for Children Fund
WHO	World Health Organization
WSS	Water Supply and Sanitation

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1. INTRODUCTION

Rwanda is a land locked country, located in the great lakes region of East Africa. Its neighboring countries are Uganda in the North, Tanzania in the East, Burundi in the South and Democratic Republic of the Congo in the West. The country covers an area of 26,338 Km^2 and an estimated population of 8.8 million people in 2005, with an annual population growth rate of 3.1 % (MINECOFIN, Rwanda 3rd General Census for Population and Housing: 2002).

The population density is 310 inhabitants per square kilometer, making Rwanda one of the most populated countries in Africa. Population trends projects 9.3 million people in 2007 and that by the year 2020, Rwanda will have a population of 12. 9 million people (MININFRA, Water supply and Sanitation Report: 2006)

The country possesses water in abundance (lakes, rivers and swamps). Surface water covers 211,000 hectares equivalent to 8% of the total national territory, with rivers occupying an area of 7,270 hectares and 22, 300 natural springs that feed into rivers and lakes. These rivers meanders between hills and ridges scattered all over the country, the reason why Rwanda is famously known as the "country of a thousand hills".

Rwanda's hydrology is divided by divide the line called Congo- Nile ridge. The Congo basin to the west covers 33% of the territory and receives 10% of the water. The Nile basin covers 67% of the territory and receives 90% which is drained towards east of the ridge where several small rivers and streams pour their water in big rivers of Nyabarongo and Akanyaru.(MININFRA, Water supply and Sanitation Report : 2005)

These big rivers join in the south of Kigali to makeup Rusumo river, which is latter called Akagera River as it approaches Lake Victoria where it pours. The two rivers of Akanyaru and Nyabarongo which originates in Nyungwe Forest Reserves in South-west Rwanda are now believed to be the true source of Nile River, according to 2006 new expedition of

British and New Zealand researchers Neil Mc Grigor, Cam Mc Leay and Garth Mac Intyre.

The annual rainfall varies from 700 mm to 1400 mm in the East and in low lands of the West, from 1200 mm to 1400 mm in central plateau and from 1300 mm to 2000 mm in the high altitude region with an average of 1200 mm per year (www.kigalicity.gov.rw).

2. BACKGROUND INFORMATION

This study was conducted in the City of Kigali, the capital and commercial city of the Republic of Rwanda. The city covers an area of 730km^2 with about one million inhabitants. Kigali is located in the center of the country with a status of a province, one of the five provinces in the country.

Kigali is built in hilly landscapes sprawling across ridges and wet valleys in between. Big

structures like the universities, banks, hotels, international organizations, embassies, government offices, commercial buildings and residential areas of affluent people tend to be built on top of the ridges while the poorer people live down towards the valley. Other poor neighborhoods are located on the hills which can be seen in the fringes of the city.

The fringe-neighborhoods have grown fast over the recent years due to the growing population in the city, and implementation of decentralization policy which have resulted in the adoption of some semi-urban areas which were previously not part of the Kigali City Council.

Compared to other African cities, the size and population growth of Kigali has until early nineties trivial, but its demographic profile was seriously affected by the 1994 genocide which claimed the lives of about 1,000,000 million Tutsis and moderate Hutus country wide. Since then it is estimated that there has been over 800,000 old refugees of 1959 returning from exile in neighboring countries of Uganda, Democratic Republic of Congo , Burundi, Tanzania, Kenya and overseas, with a big number of them opting to settle in the capital for employment and security reasons (Santiago, P, A: 2002) & (Musahara H.and Huggins:2005).

There has also been momentous migration of people resulting in drastic increase of population in Kigali. Besides war and genocide, the immigration to Kigali from late 1990s may be a manifestation of more employment and business opportunities there, compared to other Rwandan towns.

Demographic dynamics as a result of all the above mentioned factors, Kigali City which only covered an area of 112km^2 with 140,000 inhabitants in 1991 is believed to have a population of about 1,000,000 people living in an area of 730 km2 in 2006.

Table 1: Population growth and Area coverage trends of Kigali city

Year	Area	Number of inhabitants
1907	8ha	357
1945	250ha	6,000
1991	112km^2	140,000
1996	112km^2	358,200
2001	314km^2	605,000
2006	730km^2	1,000,000

source : www.kigalicity.gov.rw

Sustainable delivery of basic services continues to be an elusive goal for water and sanitation operators in developing countries. At present access to sanitation in the world is markedly less than water supply both in urban and rural areas. According to WHO and UNICEF (2006) mid-term assessments, 1.1 billion people in the world don't have access to improved water sources, while 2.6 billion lack access to sanitation.

As a result, 6, 000 children die every day due to diseases linked to lack of sanitation and 1.3 billion remain parasitized (UNICEF Repot, 2006). MDGs were adopted in early 90s by all the world's governments as a blue print for building a better world in the 21st century. MDG 7 (Environment sustainability) covers among others, improvement of accessibility to sustainable and safe water and sanitation; and the targets are to halve the proportion of people without sustainable access to safe drinking water; and to halve the proportion of people without access to improved sanitation, all by 2015.

The situation in Africa demonstrates the biggest challenge ahead in meeting the MDGs. The continent has the lowest water supply and sanitation coverage of any region in the World. More than 1 in 3 Africans residing in urban areas currently lack access to adequate services and facilities. In the year 2000, coverage levels for water supply and sanitation were 62% and 60% respectively. Besides having less or not invested in urban infrastructure, Africa is urbanizing faster than any other region.

Between 1990 and 2025, the total urban population is expected to grow from 300 to 700 million; and by 2020, it is expected that over 50% of the population in African countries will reside in urban areas.

According to the World Health Organization (WHO), in order to meet the established millennium development goal of halving the unsaved population by 2015; urban Africa will require an increase of 80% in the numbers of people served.

This objective would require about 6,000 to 8,000 new connections every day. Political commitment to these goals, backed by resources and action, is essential if utilities are to prevent a widening of the gap between saved and unsaved households.

Rwanda is one of the countries located in Sub-Saharan Africa, in the East African great lakes region, where according to 2006 MDG report much effort must be put by governments in order to meet the target. Besides the Government of Rwanda's commitment and willingness to provide its citizen with essential services, the aftermath of the war and 1994 genocide still makes it difficult to overcome social-economic problems.

Unique demographic dynamics as a result of influx of old case refugees who returned to their home land after 35 years in exile and new case refugees of the war and genocide have exaggerated the problem of water and sanitation infrastructure in urban areas where most of returnees opted to live for security and employment reasons.

The results of all those aspects are the uncontrolled construction of resident and business houses. 70% of the houses in Kigali City were constructed without taking care of sanitation infrastructures.

The 2006 country water and sanitation sector performance report indicates slight increase in water supply between 2001 and 2005 from 58% to 62% respectively, but the supply did not go along with increased area coverage of water infrastructure in urban areas because

most returnees and immigrants mentioned above, built their houses within old settlements, next to old plots, so that they could easily connect their houses to electricity and water supplies.

This was possible because the city council did not have a settlements master plan which could leave a room for organised expansion of the city; this also contributes to the presence of large parts of informal settlement in urban Rwanda.

For addressing all those issues raised above; the Rwandan Vision 2020 program has been elaborated and highlights that the rural and urban areas are to have sufficient sewerage and disposal systems. Each town is to be endowed with an adequate unit for treating and compressing solid wastes for disposal. Households will have mastered and be practicing measures of hygiene and waste disposal (MINECOFIN,Vision 2020: 2000).

Also, the EDPRS put an emphasis on sustainable management of Water Resources, access to safe drinking water and Sanitation services. It is clearly stated that "it is planned to improve access to sanitation services that meet hygienic standards. Measures will be taken to increase the proportion of schools, health centers and rural households with appropriate latrines. The collection and processing of solid waste will be extended to more households and institutions" (MINECOFIN, EDPRS: 2008-2012: 2007).

Theretofore, many developing countries including our Government put more efforts on the Water supply component and sanitation services have been left behind. The health impact of improved water supply alone is known to be limited without adequate attention for sanitation and hygiene awareness. Safe management of liquid and solid waste as well as storm water is an issue of both environmental health and the protection of water resources.

Today, no national policy or harmonized regulatory framework addresses solid waste

management, leaving the task to households, communities, NGOs, the private sector, community associations and district authorities operating with limited technical and financial means. However, Kigali and other towns are undertaking considerable efforts to maintain the urban environment clean and plastic bags are banned within the country.

Problems arise at all stages of waste collection and disposal. Kigali's waste contains still 70% of organic, biodegradable waste and in rural areas this portion of waste may reach more than 95%. However, waste sorting, composting and recycling activities are at the very beginning and until now, Rwanda did not invest in environmentally safe landfills.

The only operating dumpsite in Kigali receives about 400 tons per day of solid, not sorted waste or 140'000 tons per year. Deep seated fires, methane explosions, landslides and leachates threatening rivers and groundwater are some of the common problems of such dumpsites.

If there are no strategic measures are taken in the area of solid waste management, there will be enough wastage of resources and in few years the country can be a source of contamination of our environment.

Sanitation encompasses, according to the 1997 Kampala Declaration on Sanitation (KDS), "the isolation/management of excreta from the environment, maintenance of personal, domestic and food hygiene, safe disposal of solid and liquid wastes, maintaining a safe drinking-water chain and vector control". For the purpose of this declaration, sanitation as part of Water Supply and Sanitation (WSS) services is understood as the collection, transport, treatment and disposal or reuse of human excreta and domestic and industrial waste, both liquid and solid, as well as storm water.

Poor management of solid waste from households or businesses can undermine endeavors of economic development and spread disease and discomfort. Priority shall be given to the minimization of waste and the implementation of an integrated solid waste management in

urban areas. Today, a wide array of technologies is available for waste collection, treatment and disposal. However, implementing activities shall be based on concepts, and technologies are to be evaluated within the integrated policy framework in terms of social acceptance, financial and technical feasibility.

3. ANALYSIS STRATEGIES

3.1 Problem statement

Rwanda is facing significant challenges in relation to solid waste management. Waste generation is increasing, while a sizeable portion of it is disposed on improperly located and operated dumpsites, resulting in adverse impacts on environment and health. The country has a backlog in waste legislation enforcement as well as in coordination and promotion of existing efforts to recycle and dispose waste properly.

Provision of adequate sanitation and water facilities in urban areas is an important investment which safeguards health and well-being of the people living in cities, as well as protection of the environment.

In 2005, the Government of Rwanda adopted the first ever organic law determining the modalities of protection, conservation and promotion of environment in Rwanda. The law covers all aspects concerning people's health, natural environment and ecosystems.

In order to comply with this organic law and of course meet the MDGs, the City of Kigali will require heavy investments in the installation of sanitation infrastructures both social and technical. Choices will have to be made on different approaches and alternatives of solid waste management systems basing on available funding, the landscape in terms of existing infrastructure, topography and demographic distribution.

This study investigates the existing sanitation systems and the social-technical

establishments which govern these systems. The study will also depict in-depth information about the solid waste collection, transportation and its valorization for provision of sustainable sanitation services. The findings will contribute in providing the basis for policy makers and other actors involved in improving sanitation services in Kigali City and all other urban centers throughout the country to make informed decisions on which approaches fits for Rwandan situation.

3.2 Conceptual design

3.2.1 General and Specific objectives

The General objective of this study is to explore the challenges and potentials for improving solid waste management by promoting the collection and the valorization techniques of solid waste in Kigali, particularly in poor neighborhoods.

In order to realize this objective, the following specific objectives were devised, and these were to:

- Determine socio-technical solid waste management systems that exist in Kigali
- Quantify the solid waste in Kigali City and propose the appropriate and economically reasonable techniques for the valorization

3.2.2 Main research questions

The following main research questions were formulated in order that their answers could address issues raised in research objectives:

- What are the social and technical solid waste management systems and regimes that exist in Kigali?
- What are policies and regulations on solid waste management in Kigali City?
- How the populations of Kigali City collect the solid waste at household level?
- What is the final destination of the collected solid waste?

3.2.3 Sub-research questions

In order to further address the issues raised in the main research questions, the following specific research questions were developed:

- Who are key actors in solid waste management in Kigali City and what are their roles, responsibilities and their views in adopting community based sanitation infrastructure?
- What are institutional, policy legal frameworks that are currently governing sanitation in Kigali, and what are their strengths and weaknesses?
- What are the solid waste management approaches that are currently used in Kigali City; and what are strengths and weaknesses of their physical functioning?
- What can we do for improving the current solid waste management approaches?
- What are the solid waste valorization technologies that are currently in Kigali City?

4. MATERIALS AND METHODS FOR DATA COLLECTION

The work presented in this thesis, makes this study one of its kind in that, unlike other studies; it bases its research on poor neighbourhoods of Kigali city.

The study is mainly descriptive on the characteristics of existing domestic sanitation system, their physical infrastructure, and management practices. The work goes further with the use of a survey to search for primary data on accessibility to sanitation services, basing on households solid waste management practices in Kigali City.

Reasons for inaccessibility of sanitation services, and willingness of people in a study area to participate in the management of community based sanitation infrastructure in their neighbourhoods were analyzed. Sanitation policies and other national policies that link up with water and sanitation sector have been identified and their strength and weaknesses studied. Also the study analyses the existing processes of policy making and

implementation at cellule, sector, district, city council and at the national level.

In the end, the opportunities for solid waste separation and valorization as an entry point of the best management of the solid waste will be discussed and particular structures for the best management of the solid waste at the national level will be suggested for Kigali.

4.1 Materials

The following materials have been used:
Scales (3): We used 3 scales for quantifying the solid waste
GPS (1): It has been used for positioning the waste pollution points
Groves (30): They have been used for hand protection
Hide noises (60): For noises protection
Buckets (3): For helping in measurement
Garbage bags (360): For solid waste collection

4.2 Methods of data collection

Primary data sources are data that are not in previous existence but are acquired directly from field. In social science, primary data can be obtained through key informants or other respondent interviews, survey questionnaires and field observation. Secondary data are normally sourced from contemporary literature, official documents, as well as relevant web sites.

In this study a combination of all these methods was used to complement one another so that comprehensive answers for the research questions could be achieved. Three sectors with a considerable number of clients to COOPED (a solid waste management cooperative) in Kigali City were selected for data collection. Those are Kimihurura in Gasabo district, Nyarugenge sector in Nyarugenge District and Niboye in Kicukiro District.

4.3 Target population

The populations targeted are households of different socioeconomic standards of living; reside in different areas of the 3 sectors of Kigali City. The study concerns the characterization of the household rubbish produced by these populations. Evaluation of the organic fraction (leftovers) of garbage, which is valued at the household level and is produced daily for 7 days.

Using the systematic sampling, 40 households have been chosen in each sector (Kimihurura, Nyarugenge and Niboye) and a total of One hundred and twenty (120)

households have been surveyed on the current solid waste management practices. The total population of Kigali City is one hundred thousand households (100,000). Our pitch was 825 in Kimihurura Sector,1200 in Nyarugenge and 729 in Niboye sector. This means that our sampling frame was 100, 000 households in the whole study area.

4.4 Survey questionnaires for households

In conducting our survey, our base was at the household level and a sampling plan used was "systematic random sampling". Systematic random sampling is a technique whereby random sampling from the sampling frame and a starting point is chosen at random, and thereafter at a regular intervals. This technique is usually used to control extraneous variables and at the same time ensures representativeness because each unit in a sample population has equal chance or probability of being chosen (Punch K.F, 2005).

Another reason for choosing this sampling strategy is that systematic random sampling method extends a sampling frame and therefore covers larger areas that also have an advantage on representativeness and this will provide us with the opportunity to generalize the findings to poor neighborhoods in Kigali City.

The questionnaires have been responded by the people selected in 3 sectors of 3 districts of Kigali City. Those sectors have been chosen for their special criteria for having the population who have the contracts of collecting and transporting the solid waste with COOPED (Private firm which has the mandate of solid waste management). And we thought that they have a basic knowledge on solid waste management; since COOPED told us that they conducted trainings on solid waste management within their stakeholders.

According to those figures we can resume that our sampling was representative and reasonable to generalize the findings on the whole population of the Kigali City. Under my chairmanship the quantification of the solid waste in those households has been

conducted by two research assistants (with secondary studies certificates). The questionnaire has been responded by the household heads trough a structured interviews.

4.5 Reconnaissance and field observation

For getting more information on the current situation of solid waste management practices in Kigali city, several reconnaissance and field observation have been conducted. We first of all visited the national dumpsite. The characteristics of this site can be imagined through the mixed of liquid and solid waste in the same area. The solid waste dumped in this area it is not also separated. This dumpsite has been used since 1987 and today is receiving more 4,000 tons of mixed solid waste. It is really full of and need to be closed. Regarding the liquid waste, they simply dig a small hole and dump the liquid waste and studies should be conducted to determine whether this waste is contaminating the surface and the underground water resources and other environment aspects.

We visited some markets (Kimironko,Nyabugogo and Nyamirambo) that are the great and very known markets to have a great number of goods by day In Kigali City. We asked them some question for getting an idea on how they are managing the solid waste that are being produced by day.

Some public and private institutions have been visited also for getting the idea on how they are aware of the solid waste management practices in Kigali City. Households were also observed during a survey conducted in poor neighborhoods.

4.6 Literature review and official documents for the study.

Since I was a government official and having good relationship with different officials in different public and private institutions, it has been a chance for me to have access to a good number of the publications. Those publications include the national policies and

laws governing water and sanitation in republic of Rwanda. Those documents are like silent on solid waste management in our country and especially in our study area (Kigali city).

The only guideline has been drafted by RURA (Rwanda Utilities Regulations Agency). This document is also very weak and even there are no mechanisms which show the implementation process and the monitoring and evaluation of solid waste management projects.

There are no formal channels of working groups among stakeholders and projects funding mechanisms.

4.7 Methods of data analysis

This survey forms it's kind of being a very informative document for strategic planning in different institutions both public and private. We firstly drafted the survey questionnaire and structured interviews guidelines. After gathering all those information, every day we drafted a report summarizing the findings on the ground for keeping the originality of our information.

Using the Excel package we transformed our qualitative data collected in a survey into quantitative data. That program produced statistical figures and different graphs.
To make powerful analysis excel helped enough in exploring data and show trends, changes & different states of solid waste management in the study area. The various aspects to influence the solid waste management approaches have been also analyzed:

- Explore, visualize and test sample distributions.
- Find changes & differences between groups and samples.
- Identify trends and uncover relationships to make predictions.
- Extensive charts for making a very deep analysis and clear results.

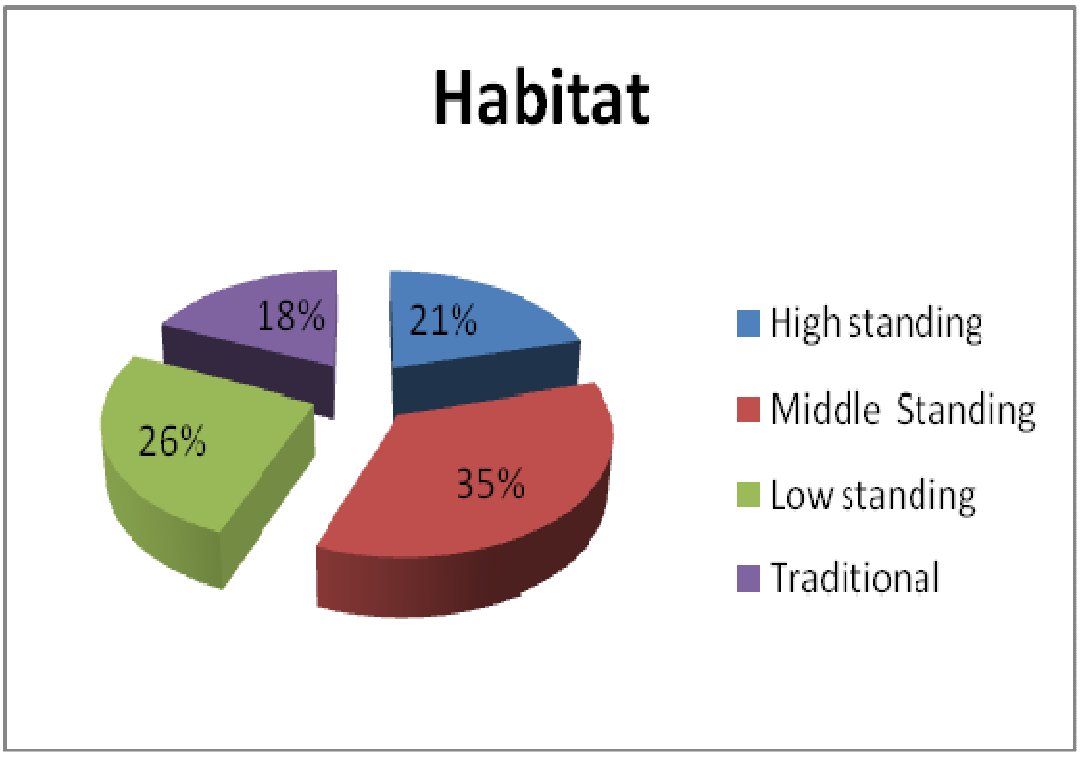
- Outline of thesis Report

Apart from the Chapter one regarding introduction which includes background information, area of the study, the rest of this thesis report is organized as follows: Chapter two is based on strategic analysis which include : problem statement, conceptual design, problem statement and definition of objectives; the chapter three is concerned to methods and materials used to collect and analyze data. Chapter Four describes the main results of this research and thereafter proceeds with providing discussions, conclusions and recommendations.

5. RESULTS

5.1 Habitat Situation

Chart 1: Habitat Situation

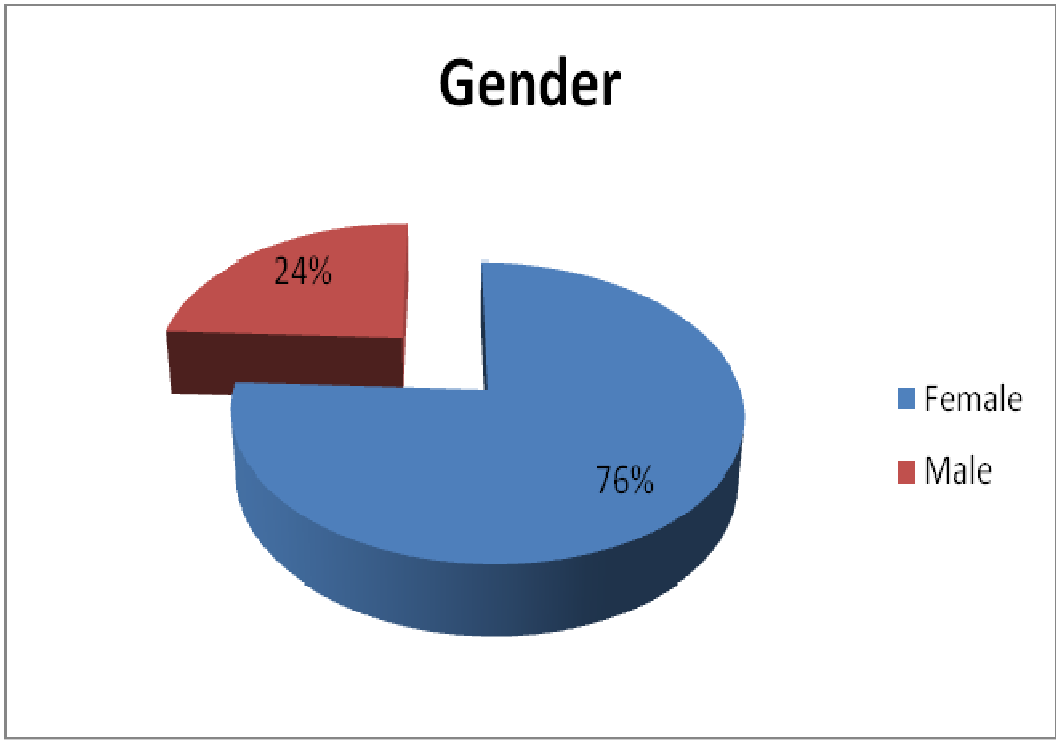


The habitat description has been appreciated through field observations and investigations done on the households. The household is defined as all persons living in one house and are depending on the household head expenses. In 3 Sectors, the materials for construction vary from the household to another.

According to the finding during this survey the majority 42 :(35%) has been qualified middle standing, followed by low standing 31: (26%), thirdly high standing 25: (21%) and fourthly traditional with the rate of 18% this means 22 households out of 120 households.

5.2 Gender analysis

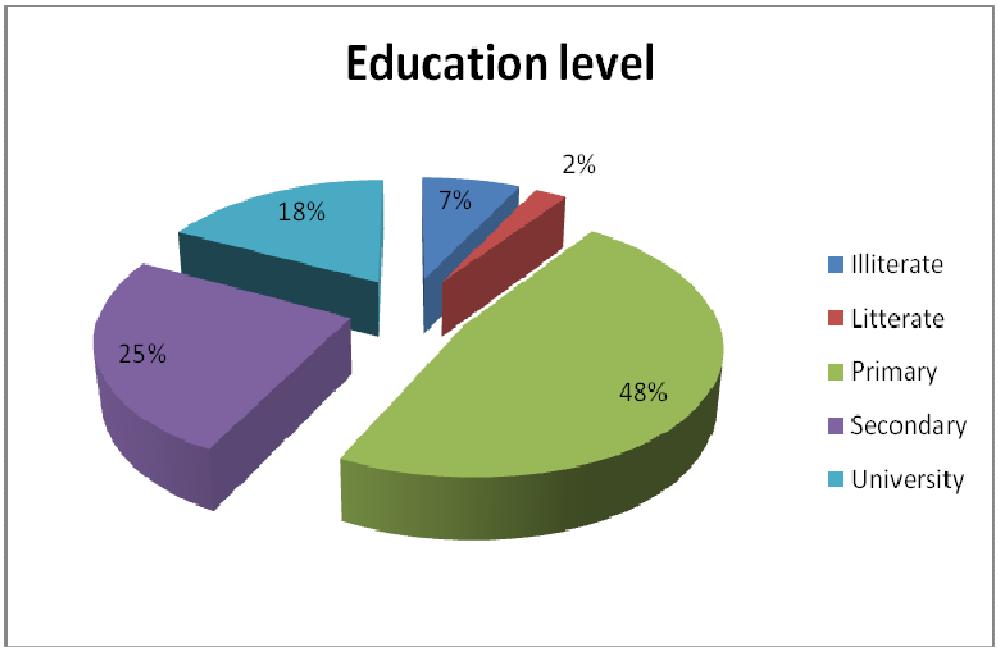
Chart 2: Gender Analysis



Within our study area 76% of our respondents are females and only 24% were males, the reason should be that many of households females do not have income generating activities and stay home most of time.

5.3 Education

Chart 3: Education Level



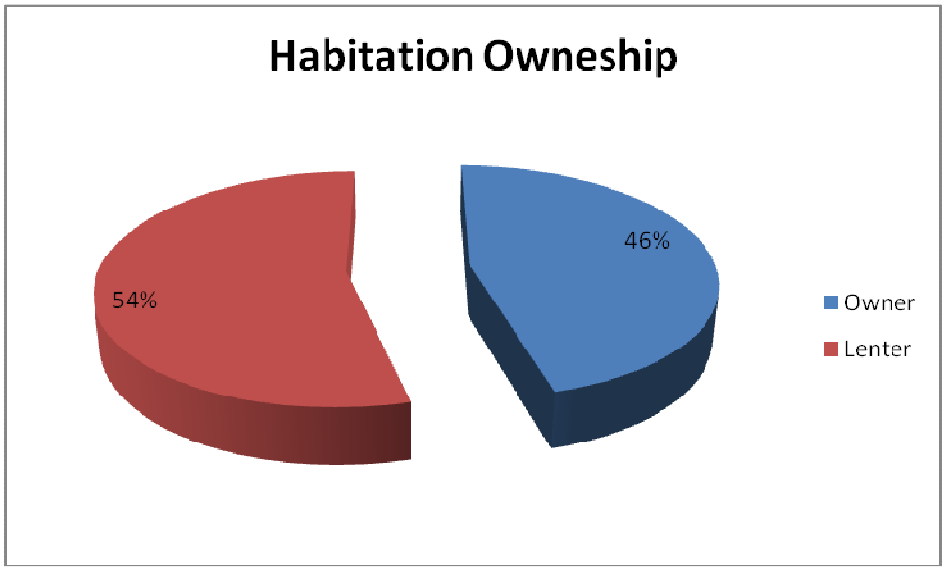
This indicator should also have a link with employment. Since in our Country, only university cadres secure the formal job from the public and private sector. This shows that 48% of surveyed population have only a primary school level and this can not allow them to secure a formal employment.

However, they can be fruitful in informal sectors where they can manage small and medium cooperatives. 25% have a secondary school level and 18% have a university level. This number has beeen recently increased due to the accreditation of private universities in different regions of the country and all intellectuals from different corners want to secure places in Kigali City.

These illiterate (7%) and literate (2%) are natural (Kavukire) and housekeepers.

5.4 Ownership of the houses

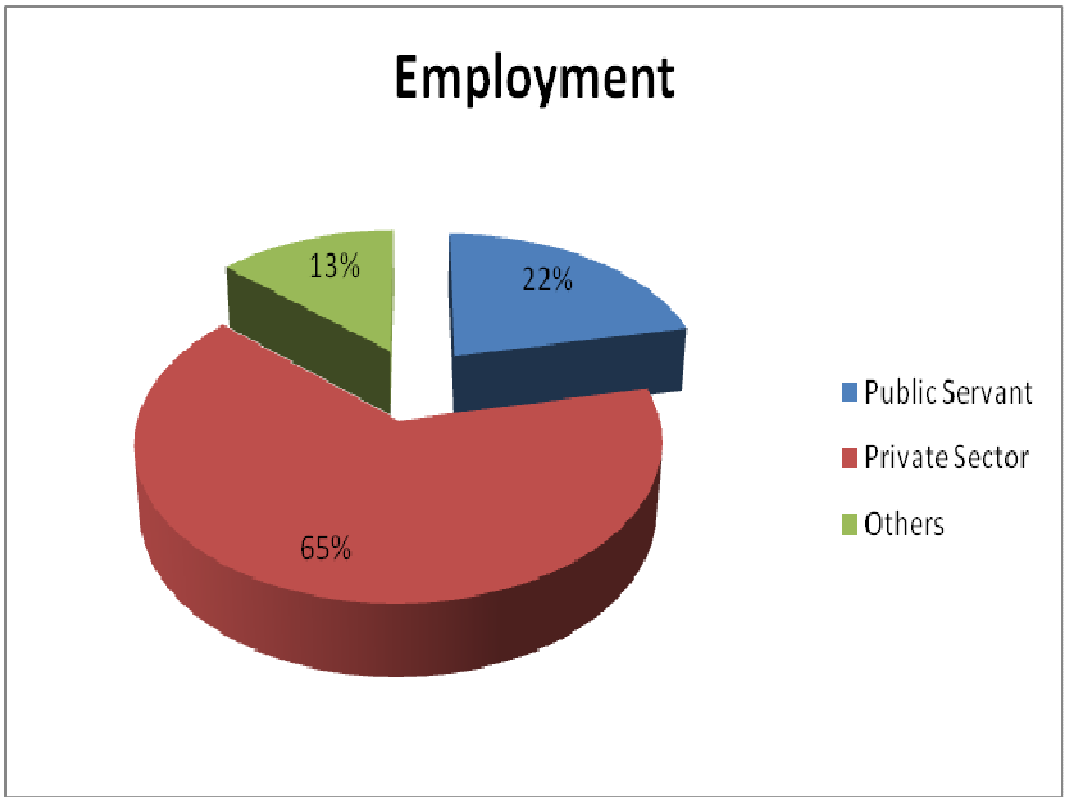
Chart 4: Habitation ownership



This indicator has also a link with the sanitation issues. The ownership of the house should increase the sanitation level at the household level. 54% of the population are lenters and 46% are the owners of their house. This rate is good in the town. The only issue that is critical is that the economic infrastructures within the Kigali City have been constructed in unplanned manner.

5.5 Employment

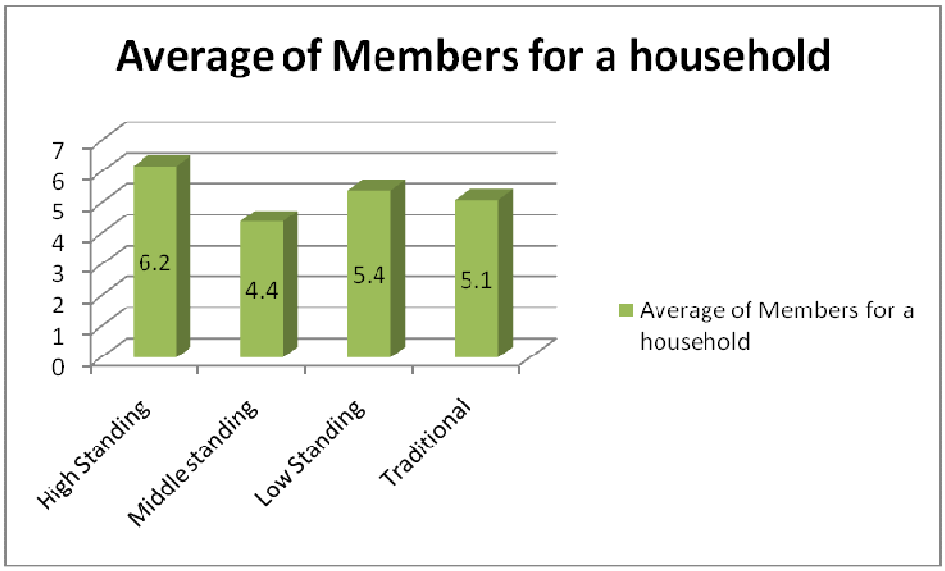
Chart 5: Employment



Talking about the employment in, the economy in Kigali is made at 65% by the private activities and 22% are working in Public Institutions at different levels (Village, Cell, Sector, District, Province, Ministry …..)

5.6 Average of the members per household

Chart 6: Members by standing



The average of members of household in our study area is estimated at 5.3 and this is high according to the National Policy of having not more than 3 members by a household.

The maximum is observed in high standard household and this can be caused by the revenues for the chair of the household. The rates for Low standing and traditional are based on the ignorance. Only the middle standing has a raisonnable number of members by households. This may be lead by the education level of this stratum.

5.7 Basic information on Solid Waste Management in Kigali City

Table 2 : Total production of Solid waste within 7 days in 120 households

Standing	**Biodegradable Waste (Kgs)**	**Cartons and Papers (Kgs)**	**Plastics (Kgs)**	**Land and Sand (Kgs)**	
High Standing	520.2	60.6	40.7	282.6	
Middle Standing	753.8	44.4	31	409.4	
Low Standing	546.3	31	26.4	296.5	
Traditional	343	22	17	257.7	
TOTAL	**2,163.3**	**158**	**115.1**	**1,246.2**	**3,682.6**
%	**59%**	**4%**	**3%**	**34%**	**100%**

Table 3 : Production of biodegradable waste

STANDING	**PRODUCTION OF BIODEGRADABLE WASTE DURING 7 DAYS (KGS)**	**PRODUCTION PER HH PER DAY (KGS)**	**PRODUCTION PER PERSON PER DAY (KGS)**
High standing	520.2	3	0.5
Middle standing	753.8	2.6	0.5
Low standing	546.3	2.5	0.6
Traditional	343	2.2	0.4
Total	**2,163.3**	**2.6**	**0.5**

The production of biodegradable waste is high in middle and low standing. Therefore, in high and traditional standings the production is considerable. This should be caused by that in our country, the agriculture productivity is good and this has helped our country to face the economic crisis.

Table 4 : Production of cartons and papers waste

STANDING	PRODUCTION OF CARTONS AND PAPERS WASTE DURING 7 DAYS (KGS)	PRODUCTION PER HH PER DAY (KGS)	PRODUCTION PER PERSON PER DAY (KGS)
High standing	60.6	0.3	0.06
Middle standing	44.4	0.15	0.03
Low standing	31	0.8	0.04
Traditional	22	0.14	0.03
Total	158	0.2	0.15

The great number of production of cartons and papers has been identified in high and middle standing and the cause of this is that the most contributor on this waste comprising the journals and other newspapers. The high and middle standing are composed by the members with a secondary and university education level. This means that all the members can read these journals and sometimes eat the food packed into cartons.

Table 5: Production of plastic waste

STANDING	PRODUCTION OF PLASTICS WASTE DURING 7 DAYS	PRODUCTION PER HH PER DAY (KGS)	PRODUCTION PER PERSON PER DAY (KGS)
High standing	40.7	0.23	0.04
Middle standing	31	0.17	0.04
Low standing	26.4	0.15	0.03
Traditional	17	0.1	0.02
Total	115.1	0.16	

These findings show that the high and middle standings are good producers of plastics and this can be caused by the luxurious mode of living for high standing and middle standing.

They used to drink clean water and juices bottled in plastics. These quantities can be recycled or be used for other economic activities.

Table 6 : Land and sand waste waste

STANDING	**LAND AND SAND WASTE PRODUCTION DURING 7 DAYS**	**PRODUCTION PER HH PER DAY (KGS)**	**PRODUCTION PER PERSON PER DAY (KGS)**
High standing	282.6	1.6	0.26
Middle standing	409.4	1.4	0.3
Low standing	296.5	1.36	0.25
Traditional	257.7	1.7	0.3
Total	1,246.2	1.5	

Some surveyed households have managed to control land and sand waste because their grounds are paved with cement. However where it not paved you receive a great number of waste. This waste is not valorized and sometimes is rejected in the fields and the sand cause the low agriculture productivity. Kigali City is increasing the roads infrastructures and is facing a crisis of land and sand for roads construction. The study should be done and confirm they are good materials to build strong and comfortable roads.

Table 7: Projections of the biodegradable waste in kigali city by 2030

	2011	**2015**	**2020**	**2025**	**2030**
Population	1,200,000	1,380,000	1,587,000	1,825,050	2,098,808
Total production by day (t)	600	690	793.5	912.5	1,049.4
Annual Production (t)	219,600	252,540	290,421	333,984	384,082

In Rwanda, especially in the city of Kigali produces a great number of biodegradable

waste (600 tons/ Day). Unfortunately this waste is dumped in Nyanza Landfill with other waste (sand, solid bottles, glasses, metals…) as shown in the following photos taken during the site visit.

5.8 Waste is dumped in Nyanza Landfill

The Nyanza dumpsite is overloaded and is mixing up the two types of waste: Liquid and solid wastes.

The solid waste is not separated and receives more than 40,000 tons of waste per day.

The observation of the site give the picture of waste of resources in different ways: Polluting the environment and underground water resources, human resources, money, and the waste should be given a value.

A number of doing things at this dumpsite have to be changed, we can mention for example the workers at this dumpsite do not have the material of protection and they work at high risk.

Photo 1 and 2 : Mixed waste in Nyanza dumpsite

5.9 SOCIO-ECONOMIC ASPECTS FOR SOLID WASTE MANAGEMENT IN KIGALI CITY.

Only 3% of the head of households stated that they have a second activity and this generate income.

100 % of the surveyed persons acknowledged the importance of saving money but only 67% stated that they have an account into saving and credit banks. The remaining party doesn't have an account because they do not have extra money (subsistence life). The surveyed persons did not disclosure the amount that can be put on their account on monthly basis.

34% of our surveyed population stated that there is another person who has an activity

that generating economic income. Only 0.5% stated that they receive external financing aid and the amount received on monthly basis has not been disclosure.

100% of the surveyed population stated that they collect their solid waste by using one classic dustbin and this means that all wastes are mixed and the majority put the container on the ground in front of the house and this produce bad smells.

71% of the surveyed population said that they have agreements with the Civil Based Organizations collecting waste in Kigali; 15% responded that they had contracts but they failed to pay the service and 14% stated that they do not have any information on the existence of those organizations. The amount paid was between 5,000 and 3,000 Rwandan Francs per month. These amounts are fixed according to the usual solid waste produced at household level.

The suggested cost is realistic for 47% of the surveyed households, 23% suggested that the charge can be reduced and 30% said that they do not have any comment on this.

87% stated that are not satisfied with the service because the collectors do not collect the solid waste on regular intervals and this cause the bad smells of the collected waste that can generate the un environmentally conditions including many movements of the flies.

5.9.1 Ministry of Infrastructures

In our interview with the Coordinator of Energy, Water and Sanitation, he mentioned that the focus was on the policies and strategies elaborated for supporting the water supply and sanitation in Kigali City, many efforts have been deployed to the supply of clean water to the population. He first of all informs us that there has been developed a policy and strategic document on Energy, Water and sanitation. He mentioned that there is a component of solid waste management in the water supply and sanitation policy. He pointed out that RURA, the department of sanitation developed the regulations for guiding the solid waste management services.

He mentioned also that at the district level, there is no institutional arrangement for waste management.

He therefore mentioned some challenges including:

- ✓ Low involvement of the private sector in the solid waste management projects
- ✓ Understaffing of the unit of sanitation
- ✓ Lack of skilled personnel in solid waste management
- ✓ No sufficient of solid waste management infrastructures
- ✓ Lack of data for the best strategic planning

We need a lot of research and studies in this area but as a quick solution we need to raise the awareness of the population on the best practices of the solid waste management and we will build a new dumpsite in next 3 years because the existing one is causing negative effects to our environment. We can conclude that there is no Social and Technical Solid Waste systems and regimes that exist in Kigali City (Waste collection, sorting and valorization systems).

5.9.2 Rwanda Environment Management Authority (REMA)

According to the Interview I had with the directorate for regulations and pollution control, he stressed that the management of solid waste is a cross cutting issue and this demand the interventions of all stakeholders.He mentioned that the Ministry of Infrastructures set the policies and regulations for guiding the solid waste projects.

5.9.3 Energy Water Supply Authority

Energy, Water Supply Authority (EWSA), is a very important stakeholder in the area of sanitation services. During our interviews with the public institutions, Researcher and environment Expert in EWSA mentioned that, the institution is new and the mandate of managing the solid waste should be assumed by the Kigali City (reference made to the Water Supply and Sanitation (WATSAN) Policy and Strategy).

5.9.4 KIGALI CITY

In Kigali City, the staff in charge of waste management stated that the collection and transportation of solid waste in Kigali City is organized by local cooperatives. Those cooperatives do not have adequate materials.

During our interview, she mentioned that there is an open dumpsite at Nyanza where the all solid waste is transported.

Asking the staff if the waste transported whether has been separated at the source site, she responded that the mixed waste is transported and dumped there.

We found that there is no valorization idea of the local cooperatives and if it is the case it can be at the small scale.

She mentioned a number of consequences of the Nyanza dumpsite like a cross contamination and waste of resources.

Speaking on the contamination, we found that there are lixiviates which contaminate the soil and underground water resources in the area surrounding the dumpsite.

There has been several fire fighting activities. This fire comes from the bio-methanization phenomenon.

So far we achieved a lot, she mentioned and we among the real achievements:

- ✓ We collected the solid waste and a full compaction has been made followed by land cover to reduce the gases in those wastes.
- ✓ We made also some holes for collecting the gases

Some training has been conducted for raising awareness of the population on how the solid waste is collected at the production level (Leaders from the cell to the district level, transportation companies, Restaurants and hotels managers, market committees and we intend doing some radio communications.

The companies that are transporting the wastes also mix up the waste and now are advised to separate the collected waste and they are advised also to buy new and adequate materials

At the Kigali City level also, we encourage the companies to invest in the valuation of the

solid waste (Recycling or re-use).

Mentioning the challenges in this area, She said that the poverty level of the population and the high cost of the solid waste collection services are challenging the best management of the waste.

In next 3 years we intend to close it and the feasibility study of the construction of the new dumpsite will begin in few days.

5.9.5 COOPED (COMPAGNIE POUR L'ENVIRONMENT ET DEVELOPPEMENT)

Speaking to the manager of COOPED he stated that they a joint action forum with the Kigali City and Green Wise Company for waste separation at source. The purpose of this joint action is the best management of the environment also contributing to the poverty reduction. But this initiative it is at its inception phase.

We use three R (Reduce, Re-use and Recycling) before dumping the final waste.

When we begun our services we used one plastic bag and now if we got the clients we gave them the procedures manual on solid waste management and three plastic bags with different colors (blue, yellow and black) for facilitating the waste collection and separation. Our observations on the field are that the sorting culture is not introduced at household level.

The representative of the COOPED highlighted that they begun with the selective approach, not only because they want to do the selection simply because the price was very high and is not affordable by everyone.

We offer a good service and we have a program of collecting and transporting the solid waste of our clients. Among the challenging issues which we are facing we can state like the population that are not aware of the pollutions of the environment by solid waste.

The other challenge is that the Kigali City is not considering the solid waste management as a priority in their plans.

The infrastructures of solid waste management (public dustbins or waste Transit centers) also have not been taken under consideration during the past time.

We do not cover the whole population and we do not work with other small cooperatives. Even our current clients pay us after a long process of asking them to pay (no willingness pay).

We are doing our best in valorization of solid waste and we have a plastic solid waste valorization and RADA, OCIR Café and MINAGRI in general are our potential clients of those products.

In our projections, we will urgently build a solid waste transit center at Nyanza site. The major challenge of this site is that is far from the producers and it will still be considered as the final dumpsite and the transportation cost will be high.

Our interventions are in the whole city of Kigali but we have a great number of clients in the sectors of Narugenge in Nyarugenge District, Kimihurura in Gasabo District and Niboye in Kicukiro District.

5.9.6 KIMIRONKO MARKET

Speaking to the chair of the Kimironko market, he told us that they collect the waste (cartons, plastic bags and biodegradable waste).

We have 45 workers (ordinal workers and loaders) and they have gloves, masks, boots and the adequate clothes.

We have a washing room and other facilities for our workers.

Regarding the contribution of our clients, they are expected to contribute 3000 Rwandan francs by month and we think this cost can be affordable.

In our site visit, we realize that the waste at the source is not separated and the container has been destroyed. The lixiviate is too much and is contaminating the people around the market.

Observing the workers, really they do not have any material like gloves. Masks, boots and

so on .We know that these wastes are contaminating the neighbors but we told the Kigali city that the container is very old. What we try to do in these days is to put some chemicals in collected waste for disinfection.

Talking about the challenges he stressed that: the infrastructures of Kigali city are not arranging them in their daily to daily work, and they request their clients to get a dust bin for collecting the waste produced. They will be proud of contributing to the construction of new infrastructures for waste collection and transit centers. Asking them if the waste is collected in separation manner they replied “No”.

5.9.7 NYAMIRAMBO MARKET

Visiting the Nyamirambo market, we witnessed that the waste is collected on the ground and is also mixed. The COOCEN (Cooperative pour la Conservation de l’Environnement) administration said that the waste is transported every day.

5.9.8 NYANZA DUMPSITE

The Nyanza dumpsite is overloaded and is mixing up the two types of waste: Liquid and solid wastes.

The solid waste is not separated and receives more than 40,000 tons of waste per day.

The observation of the site give the picture of waste of resources in different ways: Polluting the environment and underground water resources, human resources, money, and the waste should be given a value.

A number of doing things at this dumpsite have to be changed, we can mention for example the workers at this dumpsite do not have the material of protection and they work at high risk.

5.9.9 Cooperative for Environment conservation

In our interview with COOCEN (Coopérative pour la Conservation de l'Environnement) they mentioned that they collect the waste from the households since 2002 and they have two main sites: at Nyamirambo market and at their headquarters. They do not have a collection center and for only a reason of transporting the waste every day. We separate the waste after collection and we keep the biodegradable waste and the rest can be dumped to the Nyanza dumpsite.

We have 3502 clients, and we should have a great number of clients, unfortunately the local leaders do not help us in recovering the contribution of 3,000 Rwandan Francs telling them that it is too expensive.

The bars and hotels pay between 15,000 to 30,000 francs and for the households the price

change between 3,000 to 5,000 francs according to the services we offer our clients.

The representative of COOCEN highlighted the following challenges:

- ✓ The low involvement of the local leaders
- ✓ Many people are not covered by the collection and transportation of the solid waste and there are many uncontrolled dumpsites
- ✓ No harmonized cost of the services
- ✓ Low coordination of the stakeholders intervening in the solid waste management services
- ✓ Mixed waste

They are really very supportive of the sanitation infrastructures and especially for solid waste transit centers and solid waste valorization centers. We can propose that the waste should be separated and collected by zone. They will take even the lead of construction of the solid waste collection centers by zone.

They are projecting the construction of the valuation center and what they need from the government is that if they produce briquettes, our leaders should adopt policies and laws supporting the consumption of our products and this is very easy since is environmental friendly. They are cooperating with ISF (Ingénieur Sans Frontiers) for technically equipping us in this area of solid waste management.

5.9.10 Association des Agriculteurs (AGRUNI)

This association that is intervening in the environment management in Kigali City especially in waste collection.

They first of all request their clients to buy the dustbin and those who are unable to buy them they distribute them on their charges.

They buy the containers and they sell them to the population at a “reasonable cost”.

They do not really separate the waste and the final destination is the dumpsite of Nyanza.

What they disagree with the local leaders because the planning of solid waste management is being done without consultations with local CBOs.

We cover almost the whole city and we have some challenges:

- ✓ Clients are not paying
- ✓ No specific policy for solid waste management
- ✓ No regulations rules for the solid waste management cooperatives
- ✓ High cost of dumping the waste in Nyanza dumpsite

6. DISCUSSION

Urbanization continues to take place; the management of solid waste is becoming a major public health and environmental concern in urban areas of many developing countries. The concern is serious, particularly in the capital cities; which is often gateways to the countries for foreign diplomats, businessmen, and tourists. Poor visual appearance of these cities will have negative impacts on official and tourist visits and foreign investors.

Recognizing its importance, a number of developing countries have requested collaboration of development partners, both bilateral and multilateral, in improving solid waste management in their cities in the last 20 years or so. Although some projects succeeded in providing lasting positive impacts on the management of solid waste in the recipient countries and cities, many failed to continue activities after the development partners ceased their support. This unsustainability of collaborative projects is due to various technical, financial, institutional, economic, and social constraints faced by both the recipient countries/cities and development partners.

Such constraints vary from country to country and from city to city, as developing countries and cities within them differ in solid waste management problems and they and external support agencies have different, and often limited, resources available to resolve the problems. Therefore, in order to ensure the sustainability of collaborative projects, the various constraints of both developing countries and external support agencies should be carefully examined and an approach is developed to remove such constraints within the context of the collaborative projects.

Our project managers have enough skills in planning and budgeting. They know also the principles of project management. But they tend to accept whatever resources are provided to them without due consideration to subsequent resource requirements. The development partners have limitations in the amount of resources they can provide and the mandates and modes under which they can operate projects. Sometimes, projects are initiated with specific aims and expected outputs, but their scopes are not comprehensive enough to consider external factors influencing them. The development partners are challenged by socio-economic, cultural, and political factors that they do not often understand and this should guide the best selection of solid waste management projects. In other cases, very limited follow-up support, including human resource development activities necessary to sustain the project implementation, is provided by the external support agencies.

Some projects were successful in producing lasting impacts on the improvement of solid waste management in developing countries. A number of solid waste management projects have been carried out in developing countries, in collaboration with external support agencies. In developing countries many projects could not support themselves or expand further when the development partners discontinued their support. The following factors can contribute to the failure to sustain the projects: technical, financial, institutional, economic, and social, and they vary from project to project.

These problems and constraints associated with external support agencies' collaboration with developing countries in solid waste management can be minimized, and the sustainability of such collaborative projects improved by packaging efforts of external support agencies; defining clear roles of relevant agencies and improving their coordination in Kigali City; creating key human resources; supporting strategic planning and follow-up implementations; developing self-financing schemes; and raising awareness of the public and decision makers (through sector wide approaches or development

forums).

6.1 Constraints regarding public institutions

A typical solid waste management system in Kigali City displays an array of problems, including low collection coverage and irregular collection services, crude open dumping and burning without air and water pollution control, the breeding of flies and vermin, and the handling and control of informal waste picking or scavenging activities.

These public health, environmental, and management problems are caused by various factors which constrain the development of effective solid waste management systems. They can be categorized into technical, financial, institutional, economic, and social constraints. Each of these constraints is discussed, in relation to the sustainability of solid waste collaborative projects, below.

6.2 Technical Constraints

In Kigali City, there typically is a lack of human resources at both the national and local levels with technical expertise necessary for solid waste management planning and operation. Many officers in charge of solid waste management, particularly at the local level, have little or no technical background or training in engineering or management. Without adequately trained personnel, a project initiated by external consultants could not be continued.

Therefore, the development of human resources in the project intervention area is essential for the sustainability of the project. Another technical constraint in Kigali City is the lack of overall plans for solid waste management at the local and national levels. As a result, a solid waste technology is often selected without due consideration to its appropriateness in the overall solid waste management system.

In some cases, foreign assistance is given to a component of a solid waste management system for which the use of resources may not be most cost-effective. For instance, an external support agency provided its support to improve a general disposal site. However, the coverage of solid waste collection service is so low that solid waste generated is dumped at many undesignated sites (e.g., open areas, water channels, streets, etc.). As a result, improving the disposal site, although it may not be a bad project, would have little impact on the overall solid waste management effectiveness. In such a case, the low collection coverage is a bottleneck in the overall solid waste management system in the city, and it would be most cost-effective to provide resources to upgrade the collection service.

Research and development activities in solid waste management are often a low priority in Kigali City. The lack of research on solid waste management in Kigali City leads to the selection of inappropriate technology in terms of the local climatic and physical conditions, financial and human resource capabilities, and social or cultural acceptability. As a result, the technology selected can never be used, wasting the resources spent and making the project unsustainable. Several worldwide guides/manuals on appropriate solid waste management technologies are available in the literature, and the selection of technology could be made sometimes based on these guides/manuals. However, in most cases, these guides/manuals must be modified to the local conditions prevailing in the country context, and therefore local studies are normally still needed. Such studies can be relatively easily incorporated into a collaborative project and, to the extent possible, should involve local research institutions.

6.3 Financial constraints

In general, solid waste management is given a very low priority in National Priorities, except perhaps in capital and developed districts. As a result, very limited funds are provided to the solid waste management sector by the government, and the level of services required for protection of public health and the environment are not attained.

The problem is acute at the local government level where the local taxation system is inadequately developed and, therefore, the financial basis for public services, including solid waste management, is weak. This weak financial basis of local entities can be supplemented by the collection of user service charges. However, users' ability to pay for the services is very limited in poorer families, and their willingness to pay for the services which are irregular and ineffective is not high either.

An effective strategy for raising funds needs to be searched in any collaborative project to ensure its sustainability.

In addition to the limited funds, many local entities lack good financial management and planning. The lack of financial management and planning, particularly cost accounting, depletes the limited resources available for the sector even more quickly, and causes the solid waste management services to halt for some periods, thus losing the trust of service users.

6.4 Institutional constraints

Several agencies at the national level are usually involved at least partially in solid waste management. However, there are often no clear roles/functions of the various national agencies defined in relation to solid waste management and also no single agency or committee designated to coordinate their projects and activities. The lack of coordination among the relevant agencies often results in different agencies becoming the national counterpart to different external support agencies for different solid waste management collaborative projects without being aware of what other national agencies are doing. This leads to duplication of efforts, wasting of resources, and unsustainability of overall solid waste management programmes.

The lack of effective legislation for solid waste management, which is a norm in Kigali

City, is partially responsible for the roles/functions of the relevant national agencies not being clearly defined and the lack of coordination among them. Legislation related to solid waste management in Kigali City is usually fragmented, and several laws include some clauses on rules/regulations regarding solid waste management. The rules and regulations are enforced by the different agencies. However, there are often duplication of responsibilities of the agencies involved and gaps/missing elements in the regulatory provisions for the development of effective solid waste management systems. It should be also noted that legislation is only effective if it is enforced. Therefore, comprehensive legislation, which avoids the duplication of responsibilities, fills in the gaps of important regulatory functions, and is enforceable, is required for sustainable development of solid waste management systems.

Because of a low priority given to the sector, the institutional capacity of local government agencies involved in solid waste management is generally weak, particularly in small cities and towns. Local ordinance/by-laws on solid waste management is not also well developed. These weak local government institutions are not provided with clear mandates and sufficient resources to fulfill the mandate.

6.5 Economic constraints

Kigali City has weak economic bases and, hence, insufficient funds for sustainable development of solid waste management systems.

Local industry which produces relatively inexpensive solid waste equipment and vehicles will reduce, or in some cases could eliminate totally, the need for importing expensive foreign equipment/vehicles and therefore foreign exchange. Such local industry can also supply associated spare parts, lack of which is often responsible for irregular and insufficient solid waste collection and disposal services. However, the lack of industry manufacturing solid waste equipment and spare parts and a limited foreign exchange for importing such equipment/spare parts are the rule rather than exception in our country.

Also, waste recycling activities are affected by the availability of industry to receive and process recycled materials. For instance, the recycling of waste paper is possible only when there is a paper mill within a distance for which the transportation of waste paper is economical. The weak industry base for recycling activities is a common constraint for the improvement of solid waste management.

6.6 Social constraints

The social status of solid waste management workers is generally low in Kigali city, but more so in surrounding cities. This owes much to a negative perception of people regarding the work which involves the handling of waste or unwanted material. Such people's perception leads to the disrespect for the work and in turn produces low working ethics of laborers and poor quality of their work.

Because of insufficient resources available in the government sector, collaborative projects often have attempted to mobilize community resources and develop community self-help activities. Results are a mixture of success and failures. (63) Failed projects with inactive communities usually did not provide people in the community with economic as well as social incentives to participate in activities. The social incentive is based on the responsibility of individuals as part of the community for the improvement of the community, and is created by public awareness and school education programs. The lack of public awareness and school education about the importance of proper solid waste management for health and well-being of people severely restricts the use of community-based approaches in Kigali.

In Kigali City there are no adequate dump sites, transfer stations, and street refuse bins, waste picking or scavenging activities around and inside the city. People involved have not received school education and vocational training to obtain knowledge and skills required for other jobs.

7. CONCLUSION

This final chapter presents over all conclusions and recommendation which are based on the finding of this study. These are geared towards addressing issued raised in research questions and consequently objectives of this study.

The city of Kigali is one of the cities which need to improve its water and sanitation infrastructure, since the existing ones are not environmentally friendly and does not provide its citizen with adequate services.

Effective management of solid waste requires the cooperation of the general public. Lifting the priority of, and allocating more resources to, the solid waste management sector needs the support from decision makers. It is, therefore, important to ensure that public and decision makers awareness activities are incorporated into the project budgeting processes. The aim of these activities is normally long term and it takes some momentum to build up before the effects are realized. But, once the interests of the public and decision makers in improving solid waste management are created, the sustainability of solid waste management projects will be significantly improved.

Enhanced awareness of decision makers may lead to changing national socio-economic and industrial development policies and associated government programs in favor of improving solid waste management systems in Kigali City. For instance, more financial support and tax incentives may be introduced to encourage the development of recycling industry and business, or labourers protection programs may be provided to improve wages and working conditions of laborers, including solid waste management workers.

Government's established institutional frameworks for water and sanitation, as well as environmental protection, such as Water and Sanitation Unit newly created in MININFRA, RURA and REMA lacks qualified human resources to provide technical back-up to guide

or help potential polluters like industries, hotels, and farmers,... Inexistence of national guidelines and standards for solid waste management undermines compliance to the organic law for protection of the environmental. This manifests to continued discharge of solid waste to ecologically sensitive environments like wetlands by industries and other businesses.

Different respondents provided different regulators for sanitation in Kigali. This indicates that roles and responsibilities of different actors in sanitation are not clearly defined, and this can be manifested to poor data management in sanitation that was observed throughout this study.

Water and Sanitation Unit in MININFRA which is responsible for sanitation in the country is overstretched by responsibilities. Together with water and sanitation provision and to ensure equitable accessibility by Rwandan population, the unit is also responsible for water availability for agriculture, transportation and all other economic water uses. A lot of responsibilities placed on the sector, holds back its capacity to solve water and sanitation problems.

Planning of municipal sanitation infrastructures is yet to effectively involve the citizen. The existing planning department in the city does not identify and consult end users (citizen) at early stages of projects to formulate the goals.

There is compelling policy and legal framework for water and sanitation geared towards pollution abatement as well as public health order. However, the notion of re-use or nutrients re-cycling (closing-the-loop) is not addressed in both policy and legal documents.

The existing policies and legal frameworks are silent on which sanitation technologies and approaches (forms of management) should be exercised in the country.

The financing of water and sanitation at the national level is not sustainable because, significant amount (58% in 2009) of development budget for their projects is disbursed by external donors. At district level, beside that the ownership of water and sanitation infrastructure was decentralized, districts in Kigali are yet to have capacity to mobilize enough funds from internal sources as stipulated by law, to finance planned projects, including water and sanitation, therefore they are still dependent on funds from central government and international NGOs.

8. RECOMMENDATIONS

Based on the findings of this study, the following recommendations are put forwards:

8.1 Institutional, Legal and Policy framework

There should be human resource capacity building for sanitation staff at national and district level, as well as other staff from key actors such as REMA and RURA. To encourage continuity on issues concerning water, sanitation and environmental protection, districts should instate a qualified person (official) who will be responsible to MINIRENA, REMA and RURA. The role of the district in water and sanitation provision should be revised to cope with demands associated with the ownership and maintenance of sanitation infrastructure in the city

The role of academic and research institution should be enhanced by empowering these institutions with allocation of enough financial resources for sanitation niche experiments and development.

Water and sanitation committees mentioned in Organic law for the protection of the Environment should be established, strengthened and empowered, so

that they can act as active platforms for citizen participation in decision making when planning and implementing water and sanitation projects in their local administrative areas.

8.2 Policy and Legal framework

MININFRA and EWASA should publish guidelines and standards for discharging solid waste from households, businesses and industries in different environments, in order to protect wetlands, surface and groundwater.

8.3 Technical

Technical Innovation and transformation in poor neighbourhoods should be incremental, improving on the existing sanitation systems, so that embedment of improved technologies can be sustainable with the aim to develop re-use and nutrients re-cycling systems. Another reason is that the citizen in these area are poor therefore would not afford brand new and modern technologies Niches to be developed for poor neighbourhoods should be robust, of low cost and affordable. Anaerobic technologies should be one of options systems since they have proved to be a success in tropical climates, which Kigali enjoys.

Public awareness on solid waste management (sorting and recycling) should be increased. The big improvements needs government initiative to take the whole responsibility starting from waste container, collection, sorting and management of transfer stations to contain only one kind of waste with different colors. Since 98% of the waste produced can be recyclable, the incentives to the investors should be done in this sector so that the quantified waste is adequately valorized.

8.4 Planning and financing

Sanitation should receive its due recognition and prioritization when planning development projects at National and district level, bearing in mind that they internationally recognized as indicators of sustainable development

Ways should be looked at on how to create markets in sanitation service

provision so that PPP can be attracted in the sector.

Districts self financing mechanism should be improved to raise enough finances to disburse planned projects.

8.5 Suggested further studies

- Impacts of poor sanitation and urbanization on wetlands in Rwanda
- Impact of poor sanitation services on the public health
- Impact of Solid waste management on Climate Change
- Role of Solid Waste Management in Poverty Reduction.
- Cost effectiveness of solid waste valorization options

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10.Appendix

List of Annexes

I. ANNEX 1: QUESTIONNAIRE FOR SOLID WASTE MANAGEMENT IN KIGALI CITY

SURVEY ON SOLID WASTE MANAGEMENT IN THE KIGALI CITY HOUSEHOLD SURVEY QUESTIONNAIRE

Date: / / Sector:

File number: _____ Surveyor's name:

PART 1. SOCIO-ECONOMIC ASPECTS

100 Type of habitat: 1. Traditional □ 2. Low standing□ 3 Middle standing □

4. High standing □

Name of the household head:

Gender of household head: 1. Male □ 2. Female □

102 Level of education of the household head: 1. Literate □ 2. Primary□ 3. Secondary □

4. High □ 5. Maternal □ 6. Illiterate □

103 Members of the household (number):

Type of the household home: 1. Owner □ 2. Lenter □ 3. Family house □

4. Other □

Household members grouping: 1. [0-5years]------ 2. [5-10years]----------

3. [10-15 years] □--------- 4. Adults' □ ----------

107 Main activity income of the household head: 1. Farmer □ 2. Breeder □

3. Fisher □ 4. Artisan □ 5. Shopkeeper □ 6. Public servant □ 7. Private

8. Other □

108. Do you have a second activity?

1. Yes □. No □

If yes, state it : ----------

109. Number of household members who have an activity generating income:

Do you save money? Yes 2. No

110. If yes, how much money he saves by month? (Optional)

111. Do you receive external finances aid? 1. Yes □ 2. No □

if yes, specify the amount:

PART 2. SANITATION ASPECT: SOLID WASTE AT THE HOUSEHOLD LEVEL

201. How do you collect the solid waste you produce? 1. Classic dustbin D (volume)

2. Old container (volume) 3.Plastic bag (volume) 3. Pit □ 4 directly on the ground□

5. Other □

If dustbin, Where do you put it? 1. Home □ 2. Court □ 4.Other

Is the dustbin covered? 1. Yes □ 2.Non □

202. Can you tell us the average of the solid waste do you produce by day?

203. Who is responsible for emptying the dustbin? 1. Child □ 2. Adult □ 3.Third person paid.

4. Others □

203.1 If third person paid:

Which? 1. Association □ 2. City □ 3. Cooperative □ 4. Other □

How much money do you pay by month?

203.1.3 Are you satisfied with the services and the cost of waste collection? 1. Yes □ 2. No □

203.1.4 Why?

203.2 In other way (If not):

203.2.1 How do you disposal your waste? 1. Cart □ 2 Wheelbarrow □ 3. Man4. Other □

203.2.2 Where do you dispose your solid waste? 1. Court □

2. Roads and channels 3. Wild discharge □ 4. Fields □

5. Landfill □ 6. Collection bins □ 7.Other □

204. What is the frequency of the collection of the solid waste? 1. by day □ 2.After 2 days □

3. after 3 days □ 4. Once by week □ 5.Other □

Is there any structure of solid waste collection? 1. Yes □ 2. No □

Do you know the final destination of the solid waste collected? 1. Wild discharge □ 2 Landfill □ 3. Treatment center □ 4.Other □

207.1 If treatment center, which kind of treatment? 1. Composting □ 2. Recycling D 3.Other □

208. Are you experiencing particular problems in waste management?

1. Yes □ 2.No □

208.1 Why?

209. Do you have some suggestions on how the solid waste management can be improved in Kigali City?

209.1 Collection:

209.2. Transit centers: ----------

209.3. Treatment centers: ----------

210. For collection:

210.1 Do you need a solid waste collection association? Yes □ No □

If yes: Are you ready for contribution? 1. Yes □ 2. No □

210.2 If yes, what will be your contribution? 1. Financial (How much) 2. Material contribution □ (nature) 3.Other □

210.3 If not, Why? : .

211. Do you support the construction of waste transit center? : Yes □ 2. No □

211. 1. No □

211.2. If yes what will be your contribution?

1. Financial (How much): 2. Materiel contribution (nature):

3. Other □

211.3 If not why? :

212. What kind of approach would you like to use for collecting the solid waste? 1. Voluntary collection □ 2. Door to door approach □

212.1 If door to door approach, are you read to pay the service? 1. Yes □ 2. No □

212.2 If yes, how much?

213. Do you support the waste transit centers construction? Yes □ No n

213.1 If yes, are you ready to contribute? Yesn No □

213.2 If yes, what will be your contribution? _____1.Financial (how much) □

2. Material contribution (nature) □ 3.0ther □

213.3 If not why? :

214. Do you support the Solid waste valorization association? Yes □ No □

214.1 if yes, are you ready for the contribution? 1. Yes □ 2. No □

214.2 If yes, which kind of contribution? 1. Financial (How much) □ 2 Material contribution (nature) □ 3.Other □

212.3 If not, why? :

ANNEX 1: PRODUCTION OF BIODEGRADABLE WASTE

Sector	Household	Standing	Production of Biodegradable waste during 7 days	Members	Production by HH by day	Production by person by Day
Kimihurura	Kim 01	HS	13.4	16.0	1.9	0.8
Kimihurura	Kim 02	HS	28.0	8.0	4.0	3.5
Kimihurura	Kim 03	Low standing	16.0	5.0	2.3	3.2
Kimihurura	Kim 04	Low standing	10.2	2.0	1.5	5.1
Kimihurura	Kim 05	Low standing	28.0	4.0	4.0	7.0
Kimihurura	Kim 06	HS	26.3	5.0	3.8	5.3
Kimihurura	Kim 07	Low standing	24.5	5.0	3.5	4.9
Kimihurura	Kim 08	Trad	19.5	5.0	2.8	0.6
Kimihurura	Kim 09	Low standing	21.8	4.0	3.1	0.8
Kimihurura	Kim 10	Low standing	15.0	4.0	2.1	0.5
Kimihurura	Kim 11	HS	20.2	4.0	2.9	0.7
Kimihurura	Kim 12	Trad	19.2	10.0	2.7	0.3
Kimihurura	Kim 13	Trad	28.0	6.0	4.0	0.7
Kimihurura	Kim 14	Low standing	10.0	3.0	1.4	0.5
Kimihurura	Kim 15	Low standing	12.0	5.0	1.7	0.3

Kimihurura	Kim 16	MS	15.0	6.0	2.1	0.4
Kimihurura	Kim 17	MS	17.2	11.0	2.5	0.2
Kimihurura	Kim 18	MS	14.5	3.0	2.1	0.7
Kimihurura	Kim 19	Low standing	14.6	7.0	2.1	0.3
Kimihurura	Kim 20	Low standing	21.8	6.0	3.1	0.5
Kimihurura	Kim 21	MS	10.0	5.0	1.4	0.3
Kimihurura	Kim 22	Trad	28.8	4.0	4.1	1.0
Kimihurura	Kim 23	MS	5.5	3.0	0.8	0.3
Kimihurura	Kim 24	Trad	30.1	6.0	4.3	0.7
Kimihurura	Kim 25	MS	24.2	6.0	3.5	0.6
Kimihurura	Kim 26	MS	17.5	6.0	2.5	0.4
Kimihurura	Kim 27	MS	21.0	5.0	3.0	0.6
Kimihurura	Kim 28	Low standing	14.5	4.0	2.1	0.5
Kimihurura	Kim 29	HS	32.0	4.0	4.6	1.1
Kimihurura	Kim 30	Trad	19.6	10.0	2.8	0.3
Kimihurura	Kim 31	Trad	12.5	6.0	1.8	0.3
Kimihurura	Kim 32	Low standing	15.6	3.0	2.2	0.7
Kimihurura	Kim 33	Low standing	10.4	5.0	1.5	0.3
Kimihurura	Kim 34	MS	21.0	6.0	3.0	0.5

Kimihurura	Kim 35	MS	10.5	11.0	1.5	0.1
Kimihurura	Kim 36	MS	21.0	3.0	3.0	1.0
Kimihurura	Kim 37	HS	10.5	3.0	1.5	0.5
Kimihurura	Kim 38	MS	16.0	6.0	2.3	0.4
Kimihurura	Kim 39	MS	10.2	4.0	1.5	0.4
Kimihurura	Kim 40	MS	28.0	5.0	4.0	0.8
Nyarugenge	Nya 01	HS	26.3	6.0	3.8	0.6
Nyarugenge	Nya 02	Trad	11.0	6.0	1.6	0.3
Nyarugenge	Nya 03	HS	24.5	7.0	3.5	0.5
Nyarugenge	Nya 04	Trad		4.0	0.0	0.0
Nyarugenge	Nya 05	MS	19.6	3.0	2.8	0.9
Nyarugenge	Nya 06	Trad	12.5	6.0	1.8	0.3
Nyarugenge	Nya 07	MS	15.6	6.0	2.2	0.4
Nyarugenge	Nya 08	MS	10.4	6.0	1.5	0.2
Nyarugenge	Nya 09	MS	21.0	5.0	3.0	0.6
Nyarugenge	Nya 10	HS	10.5	16.0	1.5	0.1
Nyarugenge	Nya 11	HS	16.0	8.0	2.3	0.3
Nyarugenge	Nya 12	Low standing	10.2	5.0	1.5	0.3
Nyarugenge	Nya 13	Low standing	28.0	2.0	4.0	2.0

Nyarugenge	Nya 14	Low standing	26.3	4.0	3.8	0.9
Nyarugenge	Nya 15	HS	24.5	5.0	3.5	0.7
Nyarugenge	Nya 16	Low standing	19.5	5.0	2.8	0.6
Nyarugenge	Nya 17	Trad	11.8	5.0	1.7	0.3
Nyarugenge	Nya 18	Low standing	15.0	4.0	2.1	0.5
Nyarugenge	Nya 19	Low standing	20.2	4.0	2.9	0.7
Nyarugenge	Nya 20	HS	19.2	4.0	2.7	0.7
Nyarugenge	Nya 21	Trad	8.0	10.0	1.1	0.1
Nyarugenge	Nya 22	Trad	18.8	6.0	2.7	0.4
Nyarugenge	Nya 23	Low standing	5.5	3.0	0.8	0.3
Nyarugenge	Nya 24	Low standing	30.1	5.0	4.3	0.9
Nyarugenge	Nya 25	MS	24.2	6.0	3.5	0.6
Nyarugenge	Nya 26	MS	15.0	11.0	2.1	0.2
Nyarugenge	Nya 27	MS	17.2	3.0	2.5	0.8
Nyarugenge	Nya 28	HS	14.5	3.0	2.1	0.7
Nyarugenge	Nya 29	MS	14.6	6.0	2.1	0.3
Nyarugenge	Nya 30	MS	21.8	4.0	3.1	0.8
Nyarugenge	Nya 31	MS	10.0	5.0	1.4	0.3
Nyarugenge	Nya 32	HS	28.8	6.0	4.1	0.7

Nyarugenge	Nya 33	Trad	5.5	6.0	0.8	0.1
Nyarugenge	Nya 34	HS	30.1	7.0	4.3	0.6
Nyarugenge	Nya 35	MS	19.6	5.0	2.8	0.6
Nyarugenge	Nya 36	HS	12.5	6.0	1.8	0.3
Nyarugenge	Nya 37	Trad	15.6	6.0	2.2	0.4
Nyarugenge	Nya 38	HS	10.4	7.0	1.5	0.2
Nyarugenge	Nya 39	MS	21.0	7.0	3.0	0.4
Nyarugenge	Nya 40	MS	10.5	4.0	1.5	0.4
Niboye	Nib 01	HS	14.5	3.0	2.1	0.7
Niboye	Nib02	MS	14.6	6.0	2.1	0.3
Niboye	Nib 03	MS	21.8	4.0	3.1	0.8
Niboye	Nib 04	MS	10.0	5.0	1.4	0.3
Niboye	Nib 05	HS	28.8	6.0	4.1	0.7
Niboye	Nib 06	Trad	5.5	6.0	0.8	0.1
Niboye	Nib 07	HS	30.1	7.0	4.3	0.6
Niboye	Nib 08	MS	24.2	7.0	3.5	0.5
Niboye	Nib 09	Low standing	15.0	7.0	2.1	0.3
Niboye	Nib 10	Low standing	17.2	6.0	2.5	0.4
Niboye	Nib 11	MS	14.5	5.0	2.1	0.4

Niboye	Nib 12	Trad	14.6	4.0	2.1	0.5
Niboye	Nib 13	MS	21.8	3.0	3.1	1.0
Niboye	Nib 14	Trad	10.0	6.0	1.4	0.2
Niboye	Nib 15	MS	28.8	6.0	4.1	0.7
Niboye	Nib 16	MS	5.5	6.0	0.8	0.1
Niboye	Nib 17	MS	30.1	5.0	4.3	0.9
Niboye	Nib 18	HS	24.2	3.0	3.5	1.2
Niboye	Nib 19	MS	17.5	6.0	2.5	0.4
Niboye	Nib 20	MS	21.0	4.0	3.0	0.8
Niboye	Nib 21	MS	24.5	5.0	3.5	0.7
Niboye	Nib 22	HS	19.6	6.0	2.8	0.5
Niboye	Nib 23	Trad	12.5	6.0	1.8	0.3
Niboye	Nib 24	HS	15.6	7.0	2.2	0.3
Niboye	Nib 25	Low standing	10.4	5.0	1.5	0.3
Niboye	Nib 26	Low standing	21.0	2.0	3.0	1.5
Niboye	Nib 27	Low standing	10.5	4.0	1.5	0.4
Niboye	Nib 28	HS	13.4	5.0	1.9	0.4
Niboye	Nib 29	Low standing	28.0	5.0	4.0	0.8
Niboye	Nib 30	Trad	16.0	5.0	2.3	0.5

Niboye	Nib 31	Low standing	10.2	4.0	1.5	0.4
Niboye	Nib 32	Low standing	28.0	4.0	4.0	1.0
Niboye	Nib 33	HS	26.3	4.0	3.8	0.9
Niboye	Nib 34	Trad	24.5	10.0	3.5	0.4
Niboye	Nib 35	Trad	19.5	6.0	2.8	0.5
Niboye	Nib 36	Low standing	21.8	3.0	3.1	1.0
Niboye	Nib 37	Low standing	15.0	5.0	2.1	0.4
Niboye	Nib 38	MS	20.2	6.0	2.9	0.5
Niboye	Nib 39	MS	19.2	11.0	2.7	0.2
Niboye	Nib 40	MS	28.0	3.0	4.0	1.3

ANNEX 2: PRODUCTION OF CARTONS AND PAPERS

Sector	**Household**	**Standing**	**Production of Cartons and Papers waste during 7 days**	**Members**	**Production by HH per day**	**Production per person by Day**
Kimihurura	Kim 01	HS	2	16.0	0.285714286	0.017857143
Kimihurura	Kim 02	HS	2.4	8.0	0.342857143	0.021428571
Kimihurura	Kim 03	Low standing	2.5	5.0	0.357142857	0.022321429
Kimihurura	Kim 04	Low standing	0.7	2.0	0.1	0.00625

Sector	**Household**	**Standing**	**Production of Cartons and Papers waste during 7 days**	**Members**	**Production by HH per day**	**Production per person by Day**
Kimihurura	Kim 05	Low standing	0.1	4.0	0.014285714	0.000892857
Kimihurura	Kim 06	HS	2.5	5.0	0.357142857	0.022321429
Kimihurura	Kim 07	Low standing	0.15	5.0	0.021428571	0.001339286
Kimihurura	Kim 08	Trad	2	5.0	0.285714286	0.017857143
Kimihurura	Kim 09	Low standing	1	4.0	0.142857143	0.008928571
Kimihurura	Kim 10	Low standing	0.8	4.0	0.114285714	0.007142857
Kimihurura	Kim 11	HS	0.35	4.0	0.05	0.003125
Kimihurura	Kim 12	Trad	1	10.0	0.142857143	0.008928571
Kimihurura	Kim 13	Trad	0.9	6.0	0.128571429	0.008035714
Kimihurura	Kim 14	Low standing	0.5	3.0	0.071428571	0.004464286
Kimihurura	Kim 15	Low standing	0.6	5.0	0.085714286	0.005357143
Kimihurura	Kim 16	MS	0.9	6.0	0.128571429	0.008035714
Kimihurura	Kim 17	MS	3	11.0	0.428571429	0.026785714
Kimihurura	Kim 18	MS	0.6	3.0	0.085714286	0.005357143
Kimihurura	Kim 19	Low standing	1	7.0	0.142857143	0.008928571
Kimihurura	Kim 20	Low standing	0.7	6.0	0.1	0.00625
Kimihurura	Kim 21	MS	1	5.0	0.142857143	0.008928571

Sector	**Household**	**Standing**	**Production of Cartons and Papers waste during 7 days**	**Members**	**Production by HH per day**	**Production per person by Day**
Kimihurura	Kim 22	Trad	0.8	4.0	0.114285714	0.007142857
Kimihurura	Kim 23	MS		3.0	0	0
Kimihurura	Kim 24	Trad	3	6.0	0.428571429	0.026785714
Kimihurura	Kim 25	MS	0.6	6.0	0.085714286	0.005357143
Kimihurura	Kim 26	MS	1	6.0	0.142857143	0.008928571
Kimihurura	Kim 27	MS	0.7	5.0	0.1	0.00625
Kimihurura	Kim 28	Low standing	1	4.0	0.142857143	0.008928571
Kimihurura	Kim 29	HS	0.8	4.0	0.114285714	0.007142857
Kimihurura	Kim 30	Trad		10.0	0	0
Kimihurura	Kim 31	Trad	3	6.0	0.428571429	0.026785714
Kimihurura	Kim 32	Low standing	0.9	3.0	0.128571429	0.008035714
Kimihurura	Kim 33	Low standing	3	5.0	0.428571429	0.026785714
Kimihurura	Kim 34	MS	0.6	6.0	0.085714286	0.005357143
Kimihurura	Kim 35	MS	1	11.0	0.142857143	0.008928571
Kimihurura	Kim 36	MS	0.7	3.0	0.1	0.00625
Kimihurura	Kim 37	HS	1	3.0	0.142857143	0.008928571
Kimihurura	Kim 38	MS	0.8	6.0	0.114285714	0.007142857

Sector	**Household**	**Standing**	**Production of Cartons and Papers waste during 7 days**	**Members**	**Production by HH per day**	**Production per person by Day**
Kimihurura	Kim 39	MS	3	4.0	0.428571429	0.026785714
Kimihurura	Kim 40	MS	0.6	5.0	0.085714286	0.005357143
Nyarugenge	Nya 01	HS	1	6.0	0.142857143	0.008928571
Nyarugenge	Nya 02	Trad	0.7	6.0	0.1	0.00625
Nyarugenge	Nya 03	HS	1	7.0	0.142857143	0.008928571
Nyarugenge	Nya 04	Trad	0.8	4.0	0.114285714	0.007142857
Nyarugenge	Nya 05	MS		3.0	0	0
Nyarugenge	Nya 06	Trad	3	6.0	0.428571429	0.026785714
Nyarugenge	Nya 07	MS	0.5	6.0	0.071428571	0.004464286
Nyarugenge	Nya 08	MS		6.0	0	0
Nyarugenge	Nya 09	MS	1	5.0	0.142857143	0.008928571
Nyarugenge	Nya 10	HS	1	16.0	0.142857143	0.008928571
Nyarugenge	Nya 11	HS	2	8.0	0.285714286	0.017857143
Nyarugenge	Nya 12	Low standing	1.56	5.0	0.222857143	0.013928571
Nyarugenge	Nya 13	Low standing	0.1	2.0	0.014285714	0.000892857
Nyarugenge	Nya 14	Low standing	2.5	4.0	0.357142857	0.022321429
Nyarugenge	Nya 15	HS	0.15	5.0	0.021428571	0.001339286

Sector	**Household**	**Standing**	**Production of Cartons and Papers waste during 7 days**	**Members**	**Production by HH per day**	**Production per person by Day**
Nyarugenge	Nya 16	Low standing	2	5.0	0.285714286	0.017857143
Nyarugenge	Nya 17	Trad	1	5.0	0.142857143	0.008928571
Nyarugenge	Nya 18	Low standing	0.8	4.0	0.114285714	0.007142857
Nyarugenge	Nya 19	Low standing	0.35	4.0	0.05	0.003125
Nyarugenge	Nya 20	HS	1	4.0	0.142857143	0.008928571
Nyarugenge	Nya 21	Trad	0.7	10.0	0.1	0.00625
Nyarugenge	Nya 22	Trad	1	6.0	0.142857143	0.008928571
Nyarugenge	Nya 23	Low standing	0.8	3.0	0.114285714	0.007142857
Nyarugenge	Nya 24	Low standing	0.5	5.0	0.071428571	0.004464286
Nyarugenge	Nya 25	MS	3	6.0	0.428571429	0.026785714
Nyarugenge	Nya 26	MS	0.9	11.0	0.128571429	0.008035714
Nyarugenge	Nya 27	MS	3	3.0	0.428571429	0.026785714
Nyarugenge	Nya 28	HS	0.6	3.0	0.085714286	0.005357143
Nyarugenge	Nya 29	MS	1	6.0	0.142857143	0.008928571
Nyarugenge	Nya 30	MS	0.7	4.0	0.1	0.00625
Nyarugenge	Nya 31	MS	1	5.0	0.142857143	0.008928571
Nyarugenge	Nya 32	HS	0.8	6.0	0.114285714	0.007142857

Sector	**Household**	**Standing**	**Production of Cartons and Papers waste during 7 days**	**Members**	**Production by HH per day**	**Production per person by Day**
Nyarugenge	Nya 33	Trad	3	6.0	0.428571429	0.026785714
Nyarugenge	Nya 34	HS	0.6	7.0	0.085714286	0.005357143
Nyarugenge	Nya 35	MS	1	5.0	0.142857143	0.008928571
Nyarugenge	Nya 36	HS	0.7	6.0	0.1	0.00625
Nyarugenge	Nya 37	Trad	1	6.0	0.142857143	0.008928571
Nyarugenge	Nya 38	HS	0.8	7.0	0.114285714	0.007142857
Nyarugenge	Nya 39	MS		7.0	0	0
Nyarugenge	Nya 40	MS	3	4.0	0.428571429	0.026785714
Niboye	Nib 01	HS	0.5	3.0	0.071428571	0.004464286
Niboye	Nib02	MS		6.0	0	0
Niboye	Nib 03	MS	1	4.0	0.142857143	0.008928571
Niboye	Nib 04	MS	1	5.0	0.142857143	0.008928571
Niboye	Nib 05	HS	2	6.0	0.285714286	0.017857143
Niboye	Nib 06	Trad	1.56	6.0	0.222857143	0.013928571
Niboye	Nib 07	HS	3	7.0	0.428571429	0.026785714
Niboye	Nib 08	MS	0.9	7.0	0.128571429	0.008035714
Niboye	Nib 09	Low standing	3	7.0	0.428571429	0.026785714

Sector	**Household**	**Standing**	**Production of Cartons and Papers waste during 7 days**	**Members**	**Production by HH per day**	**Production per person by Day**
Niboye	Nib 10	Low standing	0.6	6.0	0.085714286	0.005357143
Niboye	Nib 11	MS	1	5.0	0.142857143	0.008928571
Niboye	Nib 12	Trad	0.7	4.0	0.1	0.00625
Niboye	Nib 13	MS	1	3.0	0.142857143	0.008928571
Niboye	Nib 14	Trad	0.8	6.0	0.114285714	0.007142857
Niboye	Nib 15	MS		6.0	0	0
Niboye	Nib 16	MS	3	6.0	0.428571429	0.026785714
Niboye	Nib 17	MS	0.5	5.0	0.071428571	0.004464286
Niboye	Nib 18	HS	3	3.0	0.428571429	0.026785714
Niboye	Nib 19	MS	1	6.0	0.142857143	0.008928571
Niboye	Nib 20	MS	1	4.0	0.142857143	0.008928571
Niboye	Nib 21	MS	2	5.0	0.285714286	0.017857143
Niboye	Nib 22	HS	1.56	6.0	0.222857143	0.013928571
Niboye	Nib 23	Trad	2.5	6.0	0.357142857	0.022321429
Niboye	Nib 24	HS	0.7	7.0	0.1	0.00625
Niboye	Nib 25	Low standing	0.1	5.0	0.014285714	0.000892857
Niboye	Nib 26	Low standing	2.5	2.0	0.357142857	0.022321429

Sector	**Household**	**Standing**	**Production of Cartons and Papers waste during 7 days**	**Members**	**Production by HH per day**	**Production per person by Day**
Niboye	Nib 27	Low standing	0.15	4.0	0.021428571	0.001339286
Niboye	Nib 28	HS	0.6	5.0	0.085714286	0.005357143
Niboye	Nib 29	Low standing	0.5	5.0	0.071428571	0.004464286
Niboye	Nib 30	Trad	2.5	5.0	0.357142857	0.022321429
Niboye	Nib 31	Low standing	0.7	4.0	0.1	0.00625
Niboye	Nib 32	Low standing	0.1	4.0	0.014285714	0.000892857
Niboye	Nib 33	HS	2.5	4.0	0.357142857	0.022321429
Niboye	Nib 34	Trad	0.15	10.0	0.021428571	0.001339286
Niboye	Nib 35	Trad	2	6.0	0.285714286	0.017857143
Niboye	Nib 36	Low standing	1	3.0	0.142857143	0.008928571
Niboye	Nib 37	Low standing	0.8	5.0	0.114285714	0.007142857
Niboye	Nib 38	MS	0.35	6.0	0.05	0.003125
Niboye	Nib 39	MS	1	11.0	0.142857143	0.008928571
Niboye	Nib 40	MS	1	3.0	0.142857143	0.008928571
TOTAL			140.03		20.00428571	1.250267857

ANNEX 3: PRODUCTION OF PLASTICS

Sector	Household	Standing	Production of Plastics waste during 7 days	Members	Production per HH per day	Production per person per Day
Kimihurura	Kim 01	HS	0.7	16.0	0.1	0.00625
Kimihurura	Kim 02	HS	0.5	8.0	0.071428571	0.008928571
Kimihurura	Kim 03	Low standing	2.5	5.0	0.357142857	0.071428571
Kimihurura	Kim 04	Low standing	0.3	2.0	0.042857143	0.021428571
Kimihurura	Kim 05	Low standing	0.1	4.0	0.014285714	0.003571429
Kimihurura	Kim 06	HS	2.5	5.0	0.357142857	0.071428571
Kimihurura	Kim 07	Low standing	0.1	5.0	0.014285714	0.002857143
Kimihurura	Kim 08	Trad	1	5.0	0.142857143	0.028571429
Kimihurura	Kim 09	Low standing	2	4.0	0.285714286	0.071428571
Kimihurura	Kim 10	Low standing	1	4.0	0.142857143	0.035714286
Kimihurura	Kim 11	HS	0.45	4.0	0.064285714	0.016071429
Kimihurura	Kim 12	Trad	0.9	10.0	0.128571429	0.012857143
Kimihurura	Kim 13	Trad	0.5	6.0	0.071428571	0.011904762
Kimihurura	Kim 14	Low standing	0.8	3.0	0.114285714	0.038095238
Kimihurura	Kim 15	Low standing	0.6	5.0	0.085714286	0.017142857

Sector	Household	Standing	Production of Plastics waste during 7 days	Members	Production per HH per day	Production per person per Day
Kimihurura	Kim 16	MS	0.7	6.0	0.1	0.016666667
Kimihurura	Kim 17	MS	1	11.0	0.142857143	0.012987013
Kimihurura	Kim 18	MS	0.7	3.0	0.1	0.033333333
Kimihurura	Kim 19	Low standing	0.5	7.0	0.071428571	0.010204082
Kimihurura	Kim 20	Low standing	2.5	6.0	0.357142857	0.05952381
Kimihurura	Kim 21	MS	0.3	5.0	0.042857143	0.008571429
Kimihurura	Kim 22	Trad	0.1	4.0	0.014285714	0.003571429
Kimihurura	Kim 23	MS	2.5	3.0	0.357142857	0.119047619
Kimihurura	Kim 24	Trad	0.1	6.0	0.014285714	0.002380952
Kimihurura	Kim 25	MS	1	6.0	0.142857143	0.023809524
Kimihurura	Kim 26	MS	2	6.0	0.285714286	0.047619048
Kimihurura	Kim 27	MS	1	5.0	0.142857143	0.028571429
Kimihurura	Kim 28	Low standing	0.45	4.0	0.064285714	0.016071429
Kimihurura	Kim 29	HS	0.9	4.0	0.128571429	0.032142857
Kimihurura	Kim 30	Trad	1	10.0	0.142857143	0.014285714
Kimihurura	Kim 31	Trad	0.3	6.0	0.042857143	0.007142857
Kimihurura	Kim 32	Low standing	0.1	3.0	0.014285714	0.004761905

Sector	**Household**	**Standing**	**Production of Plastics waste during 7 days**	**Members**	**Production per HH per day**	**Production per person per Day**
Kimihurura	Kim 33	Low standing	2.5	5.0	0.357142857	0.071428571
Kimihurura	Kim 34	MS	0.1	6.0	0.014285714	0.002380952
Kimihurura	Kim 35	MS	1	11.0	0.142857143	0.012987013
Kimihurura	Kim 36	MS	2	3.0	0.285714286	0.095238095
Kimihurura	Kim 37	HS	1	3.0	0.142857143	0.047619048
Kimihurura	Kim 38	MS	0.45	6.0	0.064285714	0.010714286
Kimihurura	Kim 39	MS	0.9	4.0	0.128571429	0.032142857
Kimihurura	Kim 40	MS	0.8	5.0	0.114285714	0.022857143
Nyarugenge	Nya 01	HS	0.9	6.0	0.128571429	0.021428571
Nyarugenge	Nya 02	Trad	0.7	6.0	0.1	0.016666667
Nyarugenge	Nya 03	HS	2	7.0	0.285714286	0.040816327
Nyarugenge	Nya 04	Trad	0	4.0	0	0
Nyarugenge	Nya 05	MS	0.8	3.0	0.114285714	0.038095238
Nyarugenge	Nya 06	Trad	0.2	6.0	0.028571429	0.004761905
Nyarugenge	Nya 07	MS	0.5	6.0	0.071428571	0.011904762
Nyarugenge	Nya 08	MS	1	6.0	0.142857143	0.023809524
Nyarugenge	Nya 09	MS	2	5.0	0.285714286	0.057142857

Sector	**Household**	**Standing**	**Production of Plastics waste during 7 days**	**Members**	**Production per HH per day**	**Production per person per Day**
Nyarugenge	Nya 10	HS	0.5	16.0	0.071428571	0.004464286
Nyarugenge	Nya 11	HS	0.45	8.0	0.064285714	0.008035714
Nyarugenge	Nya 12	Low standing	0.9	5.0	0.128571429	0.025714286
Nyarugenge	Nya 13	Low standing	1	2.0	0.142857143	0.071428571
Nyarugenge	Nya 14	Low standing	0.3	4.0	0.042857143	0.010714286
Nyarugenge	Nya 15	HS	0.1	5.0	0.014285714	0.002857143
Nyarugenge	Nya 16	Low standing	2.5	5.0	0.357142857	0.071428571
Nyarugenge	Nya 17	Trad	0.1	5.0	0.014285714	0.002857143
Nyarugenge	Nya 18	Low standing	1	4.0	0.142857143	0.035714286
Nyarugenge	Nya 19	Low standing	2	4.0	0.285714286	0.071428571
Nyarugenge	Nya 20	HS	1	4.0	0.142857143	0.035714286
Nyarugenge	Nya 21	Trad	0.45	10.0	0.064285714	0.006428571
Nyarugenge	Nya 22	Trad	0.9	6.0	0.128571429	0.021428571
Nyarugenge	Nya 23	Low standing	0.5	3.0	0.071428571	0.023809524
Nyarugenge	Nya 24	Low standing	0	5.0	0	0
Nyarugenge	Nya 25	MS	0.1	6.0	0.014285714	0.002380952
Nyarugenge	Nya 26	MS	0.3	11.0	0.042857143	0.003896104

Sector	**Household**	**Standing**	**Production of Plastics waste during 7 days**	**Members**	**Production per HH per day**	**Production per person per Day**
Nyarugenge	Nya 27	MS	0.4	3.0	0.057142857	0.019047619
Nyarugenge	Nya 28	HS	0.7	3.0	0.1	0.033333333
Nyarugenge	Nya 29	MS	1	6.0	0.142857143	0.023809524
Nyarugenge	Nya 30	MS	0.7	4.0	0.1	0.025
Nyarugenge	Nya 31	MS	0.5	5.0	0.071428571	0.014285714
Nyarugenge	Nya 32	HS	2.5	6.0	0.357142857	0.05952381
Nyarugenge	Nya 33	Trad	0.3	6.0	0.042857143	0.007142857
Nyarugenge	Nya 34	HS	0.1	7.0	0.014285714	0.002040816
Nyarugenge	Nya 35	MS	2.5	5.0	0.357142857	0.071428571
Nyarugenge	Nya 36	HS	0.1	6.0	0.014285714	0.002380952
Nyarugenge	Nya 37	Trad	1	6.0	0.142857143	0.023809524
Nyarugenge	Nya 38	HS	2	7.0	0.285714286	0.040816327
Nyarugenge	Nya 39	MS	1	7.0	0.142857143	0.020408163
Nyarugenge	Nya 40	MS	0.45	4.0	0.064285714	0.016071429
Niboye	Nib 01	HS	0.9	3.0	0.128571429	0.042857143
Niboye	Nib02	MS	1	6.0	0.142857143	0.023809524
Niboye	Nib 03	MS	1.3	4.0	0.185714286	0.046428571

Sector	Household	Standing	Production of Plastics waste during 7 days	Members	Production per HH per day	Production per person per Day
Niboye	Nib 04	MS	0.5	5.0	0.071428571	0.014285714
Niboye	Nib 05	HS	1	6.0	0.171428571	0.028571429
Niboye	Nib 06	Trad	0.3	6.0	0.042857143	0.007142857
Niboye	Nib 07	HS	3.5	7.0	0.5	0.071428571
Niboye	Nib 08	MS	2.5	7.0	0.357142857	0.051020408
Niboye	Nib 09	Low standing	0.7	7.0	0.1	0.014285714
Niboye	Nib 10	Low standing	0.5	6.0	0.071428571	0.011904762
Niboye	Nib 11	MS	2.5	5.0	0.357142857	0.071428571
Niboye	Nib 12	Trad	0.3	4.0	0.042857143	0.010714286
Niboye	Nib 13	MS	0.1	3.0	0.014285714	0.004761905
Niboye	Nib 14	Trad	2.5	6.0	0.357142857	0.05952381
Niboye	Nib 15	MS	0.1	6.0	0.014285714	0.002380952
Niboye	Nib 16	MS	1	6.0	0.142857143	0.023809524
Niboye	Nib 17	MS	2	5.0	0.285714286	0.057142857
Niboye	Nib 18	HS	1	3.0	0.142857143	0.047619048
Niboye	Nib 19	MS	0.45	6.0	0.064285714	0.010714286
Niboye	Nib 20	MS	0.9	4.0	0.128571429	0.032142857

Sector	Household	Standing	Production of Plastics waste during 7 days	Members	Production per HH per day	Production per person per Day
Niboye	Nib 21	MS	0.3	5.0	0.042857143	0.008571429
Niboye	Nib 22	HS	0.1	6.0	0.014285714	0.002380952
Niboye	Nib 23	Trad	2.5	6.0	0.357142857	0.05952381
Niboye	Nib 24	HS	0.1	7.0	0.014285714	0.002040816
Niboye	Nib 25	Low standing	1	5.0	0.142857143	0.028571429
Niboye	Nib 26	Low standing	2	2.0	0.285714286	0.142857143
Niboye	Nib 27	Low standing	1	4.0	0.142857143	0.035714286
Niboye	Nib 28	HS	0.7	5.0	0.1	0.02
Niboye	Nib 29	Low standing	0.5	5.0	0.071428571	0.014285714
Niboye	Nib 30	Trad	2.5	5.0	0.357142857	0.071428571
Niboye	Nib 31	Low standing	0.3	4.0	0.042857143	0.010714286
Niboye	Nib 32	Low standing	0.1	4.0	0.014285714	0.003571429
Niboye	Nib 33	HS	2.5	4.0	0.357142857	0.089285714
Niboye	Nib 34	Trad	0.1	10.0	0.014285714	0.001428571
Niboye	Nib 35	Trad	1	6.0	0.142857143	0.023809524
Niboye	Nib 36	Low standing	2	3.0	0.285714286	0.095238095
Niboye	Nib 37	Low standing	1	5.0	0.142857143	0.028571429

Sector	Household	Standing	Production of Plastics waste during 7 days	Members	Production per HH per day	Production per person per Day
Niboye	Nib 38	MS	0.45	6.0	0.064285714	0.010714286
Niboye	Nib 39	MS	0.9	11.0	0.128571429	0.011688312
Niboye	Nib 40	MS	1	3.0	0.142857143	0.047619048

ANNEX 3: LAND AND SAND

Sector	Household	Standing	Production of Plastics waste during 7 days (Kgs)	Members	Production by HH by day	Production by person by Day
Kimihurura	Kim 01	HS	0	16.0	0	0
Kimihurura	Kim 02	HS	0	8.0	0	0
Kimihurura	Kim 03	Low standing	26	5.0	3.714285714	0.742857143
Kimihurura	Kim 04	Low standing	22	2.0	3.142857143	1.571428571
Kimihurura	Kim 05	Low standing	7.6	4.0	1.085714286	0.271428571
Kimihurura	Kim 06	HS	15	5.0	2.142857143	0.428571429
Kimihurura	Kim 07	Low standing	2.5	5.0	0.357142857	0.071428571
Kimihurura	Kim 08	Trad	5.5	5.0	0.785714286	0.157142857
Kimihurura	Kim 09	Low standing	11.2	4.0	1.6	0.4
Kimihurura	Kim 10	Low standing	11.2	4.0	1.6	0.4
Kimihurura	Kim 11	HS	14.7	4.0	2.1	0.525
Kimihurura	Kim 12	Trad	5	10.0	0.714285714	0.071428571
Kimihurura	Kim 13	Trad	12	6.0	1.714285714	0.285714286
Kimihurura	Kim 14	Low standing	2	3.0	0.285714286	0.095238095

Sector	Household	Standing	Production of Plastics waste during 7 days (Kgs)	Members	Production by HH by day	Production by person by Day
Kimihurura	Kim 15	Low standing	6	5.0	0.857142857	0.171428571
Kimihurura	Kim 16	MS	12	6.0	1.714285714	0.285714286
Kimihurura	Kim 17	MS	12	11.0	1.714285714	0.155844156
Kimihurura	Kim 18	MS	14	3.0	2	0.666666667
Kimihurura	Kim 19	Low standing	4	7.0	0.571428571	0.081632653
Kimihurura	Kim 20	Low standing	5.5	6.0	0.785714286	0.130952381
Kimihurura	Kim 21	MS	16	5.0	2.285714286	0.457142857
Kimihurura	Kim 22	Trad	10.5	4.0	1.5	0.375
Kimihurura	Kim 23	MS	21	3.0	3	1
Kimihurura	Kim 24	Trad	21.2	6.0	3.028571429	0.504761905
Kimihurura	Kim 25	MS	8	6.0	1.142857143	0.19047619
Kimihurura	Kim 26	MS	2.5	6.0	0.357142857	0.05952381
Kimihurura	Kim 27	MS	5.5	5.0	0.785714286	0.157142857
Kimihurura	Kim 28	Low standing	11.2	4.0	1.6	0.4
Kimihurura	Kim 29	HS	11.2	4.0	1.6	0.4
Kimihurura	Kim 30	Trad	14.7	10.0	2.1	0.21
Kimihurura	Kim 31	Trad	5	6.0	0.714285714	0.119047619
Kimihurura	Kim 32	Low standing	12	3.0	1.714285714	0.571428571
Kimihurura	Kim 33	Low standing	2	5.0	0.285714286	0.057142857
Kimihurura	Kim 34	MS	6	6.0	0.857142857	0.142857143
Kimihurura	Kim 35	MS	12	11.0	1.714285714	0.155844156
Kimihurura	Kim 36	MS	12	3.0	1.714285714	0.571428571
Kimihurura	Kim 37	HS	14	3.0	2	0.666666667

Sector	Household	Standing	Production of Plastics waste during 7 days (Kgs)	Members	Production by HH by day	Production by person by Day
Kimihurura	Kim 38	MS	4	6.0	0.571428571	0.095238095
Kimihurura	Kim 39	MS	5.5	4.0	0.785714286	0.196428571
Kimihurura	Kim 40	MS	16	5.0	2.285714286	0.457142857
Nyarugenge	Nya 01	HS	10.5	6.0	1.5	0.25
Nyarugenge	Nya 02	Trad	21	6.0	3	0.5
Nyarugenge	Nya 03	HS	21.2	7.0	3.028571429	0.432653061
Nyarugenge	Nya 04	Trad	8	4.0	1.142857143	0.285714286
Nyarugenge	Nya 05	MS	15	3.0	2.142857143	0.714285714
Nyarugenge	Nya 06	Trad	18	6.0	2.571428571	0.428571429
Nyarugenge	Nya 07	MS	16	6.0	2.285714286	0.380952381
Nyarugenge	Nya 08	MS	6	6.0	0.857142857	0.142857143
Nyarugenge	Nya 09	MS	0	5.0	0	0
Nyarugenge	Nya 10	HS	13.8	16.0	1.971428571	0.123214286
Nyarugenge	Nya 11	HS	2.5	8.0	0.357142857	0.044642857
Nyarugenge	Nya 12	Low standing	5.5	5.0	0.785714286	0.157142857
Nyarugenge	Nya 13	Low standing	11.2	2.0	1.6	0.8
Nyarugenge	Nya 14	Low standing	11.2	4.0	1.6	0.4
Nyarugenge	Nya 15	HS	14.7	5.0	2.1	0.42
Nyarugenge	Nya 16	Low standing	5	5.0	0.714285714	0.142857143
Nyarugenge	Nya 17	Trad	12	5.0	1.714285714	0.342857143
Nyarugenge	Nya 18	Low standing	0	4.0	0	0
Nyarugenge	Nya 19	Low standing	0	4.0	0	0
Nyarugenge	Nya 20	HS	26	4.0	3.714285714	0.928571429

Sector	Household	Standing	Production of Plastics waste during 7 days (Kgs)	Members	Production by HH by day	Production by person by Day
Nyarugenge	Nya 21	Trad	22	10.0	3.142857143	0.314285714
Nyarugenge	Nya 22	Trad	7.6	6.0	1.085714286	0.180952381
Nyarugenge	Nya 23	Low standing	15	3.0	2.142857143	0.714285714
Nyarugenge	Nya 24	Low standing	2.5	5.0	0.357142857	0.071428571
Nyarugenge	Nya 25	MS	5.5	6.0	0.785714286	0.130952381
Nyarugenge	Nya 26	MS	11.2	11.0	1.6	0.145454545
Nyarugenge	Nya 27	MS	11.2	3.0	1.6	0.533333333
Nyarugenge	Nya 28	HS	14.7	3.0	2.1	0.7
Nyarugenge	Nya 29	MS	5	6.0	0.714285714	0.119047619
Nyarugenge	Nya 30	MS	6	4.0	0.857142857	0.214285714
Nyarugenge	Nya 31	MS	12	5.0	1.714285714	0.342857143
Nyarugenge	Nya 32	HS	12	6.0	1.714285714	0.285714286
Nyarugenge	Nya 33	Trad	14	6.0	2	0.333333333
Nyarugenge	Nya 34	HS	4	7.0	0.571428571	0.081632653
Nyarugenge	Nya 35	MS	5.5	5.0	0.785714286	0.157142857
Nyarugenge	Nya 36	HS	16	6.0	2.285714286	0.380952381
Nyarugenge	Nya 37	Trad	10.5	6.0	1.5	0.25
Nyarugenge	Nya 38	HS	21	7.0	3	0.428571429
Nyarugenge	Nya 39	MS	21.2	7.0	3.028571429	0.432653061
Nyarugenge	Nya 40	MS	8	4.0	1.142857143	0.285714286
Niboye	Nib 01	HS		3.0	0	0
Niboye	Nib02	MS	4	6.0	0.571428571	0.095238095
Niboye	Nib 03	MS	5.5	4.0	0.785714286	0.196428571

Sector	Household	Standing	Production of Plastics waste during 7 days (Kgs)	Members	Production by HH by day	Production by person by Day
Niboye	Nib 04	MS	16	5.0	2.285714286	0.457142857
Niboye	Nib 05	HS	10.5	6.0	1.5	0.25
Niboye	Nib 06	Trad	21	6.0	3	0.5
Niboye	Nib 07	HS	21.2	7.0	3.028571429	0.432653061
Niboye	Nib 08	MS	8	7.0	1.142857143	0.163265306
Niboye	Nib 09	Low standing	2.5	7.0	0.357142857	0.051020408
Niboye	Nib 10	Low standing	5.5	6.0	0.785714286	0.130952381
Niboye	Nib 11	MS	11.2	5.0	1.6	0.32
Niboye	Nib 12	Trad	11.2	4.0	1.6	0.4
Niboye	Nib 13	MS	14.7	3.0	2.1	0.7
Niboye	Nib 14	Trad	5	6.0	0.714285714	0.119047619
Niboye	Nib 15	MS	12	6.0	1.714285714	0.285714286
Niboye	Nib 16	MS	2	6.0	0.285714286	0.047619048
Niboye	Nib 17	MS	6	5.0	0.857142857	0.171428571
Niboye	Nib 18	HS	12	3.0	1.714285714	0.571428571
Niboye	Nib 19	MS	12	6.0	1.714285714	0.285714286
Niboye	Nib 20	MS	14	4.0	2	0.5
Niboye	Nib 21	MS	4	5.0	0.571428571	0.114285714
Niboye	Nib 22	HS	5.5	6.0	0.785714286	0.130952381
Niboye	Nib 23	Trad	16	6.0	2.285714286	0.380952381
Niboye	Nib 24	HS	10.5	7.0	1.5	0.214285714
Niboye	Nib 25	Low standing	21	5.0	3	0.6
Niboye	Nib 26	Low standing	21.2	2.0	3.028571429	1.514285714

Sector	Household	Standing	Production of Plastics waste during 7 days (Kgs)	Members	Production by HH by day	Production by person by Day
Niboye	Nib 27	Low standing	8	4.0	1.142857143	0.285714286
Niboye	Nib 28	HS	4	5.0	0.571428571	0.114285714
Niboye	Nib 29	Low standing	0	5.0	0	0
Niboye	Nib 30	Trad	0	5.0	0	0
Niboye	Nib 31	Low standing	26	4.0	3.714285714	0.928571429
Niboye	Nib 32	Low standing	22	4.0	3.142857143	0.785714286
Niboye	Nib 33	HS	7.6	4.0	1.085714286	0.271428571
Niboye	Nib 34	Trad	15	10.0	2.142857143	0.214285714
Niboye	Nib 35	Trad	2.5	6.0	0.357142857	0.05952381
Niboye	Nib 36	Low standing	5.5	3.0	0.785714286	0.261904762
Niboye	Nib 37	Low standing	11.2	5.0	1.6	0.32
Niboye	Nib 38	MS	11.2	6.0	1.6	0.266666667
Niboye	Nib 39	MS	14.7	11.0	2.1	0.190909091
Niboye	Nib 40	MS	5	3.0	0.714285714	0.238095238