

IMPROVING INFORMAL AND FORMAL SOLID WASTE MANAGEMENT SYSTEMS IN KAMPALA

GARIKAI MARTIN MEMBELE
February, 2014

SUPERVISORS:
Dr. R.V. Sliuzas
Ir. M.J.G. Brussel



IMPROVING INFORMAL AND FORMAL SOLID WASTE MANAGEMENT SYSTEMS IN KAMPALA

GARIKAI MARTIN MEMBELE

Enschede, The Netherlands, February, 2014

Thesis submitted to the Faculty of Geo-Information Science and Earth Observation of the University of Twente in partial fulfilment of the requirements for the degree of Master of Science in Geo-information Science and Earth Observation.

Specialization: Urban Planning and Management

SUPERVISORS:

Dr. R.V. Sliuzas

Ir. M.J.G. Brussel

THESIS ASSESSMENT BOARD:

Pro. Dr. ir, M.F.A.M, van Maarseven : Chair

Drs. M. Huijsman : External Examiner, IHS

Dr. R.V. Sliuzas : 1st Supervisor

Ir. M.J.G. Brussel : 2nd Supervisor

DISCLAIMER

This document describes work undertaken as part of a programme of study at the Faculty of Geo-Information Science and Earth Observation of the University of Twente. All views and opinions expressed therein remain the sole responsibility of the author, and do not necessarily represent those of the Faculty.

ABSTRACT

Like many cities of developing countries, Kampala also faces challenges in the management of solid waste. Apart from the high population growth which has led to the mushrooming of informal neighbourhoods, changing consumption patterns of the people coupled with poor collection, limited recycling activities as well as inadequate involvement of the community, the civil society and the media have exacerbated the problem.

This study focuses on evaluating ways of improving informal and formal solid waste management systems in Kampala. In doing this, a mixed approach was used to understand the operations of the informal sector as well as the formal sector namely Kampala Capital City Authority (KCCA) and private companies. These methods include household questionnaires, interviews with key informants, observation as well as mapping of illegal dump sites in the selected informal and planned neighbourhoods.

The research findings show that the waste generation rate in Kampala is higher than other cities in low income countries and that more than 70 percent of the waste is organic and of high moisture content. Sorting of waste at source is hardly done and indiscriminate disposal of waste is prevalent. The findings also show that informal waste collectors service all income groups and their service is rated as that of KCCA. However, in spite of the informal waste collectors playing an important role the collection and recycling of waste as well as in providing income to the youth and women, their operations are without any policy or regulatory support. This study shows that the people in Kampala receive inadequate information on solid waste management and KCCA has problems in enforcing laws. Hence some private companies operate illegally and conflicts among service providers are rampant.

Therefore, to improve the management of solid waste in Kampala, there is an urgent need to adopt an Integrated Solid Waste Management approach. Governance elements have been identified to be paramount in any endeavours to improve solid waste management in Kampala. Moreover the use of Waste Transfer Stations operated by informal waste collector organisations and the establishment of waste collection zones are key structural and control mechanisms. GIS and remote sensing techniques can help to delineate homogenous waste collection zones and identify the optimal locations of the transfer stations to promote efficiency in solid waste management. Besides, adequate involvement of the community, CBOs and NGOs in solid waste management will increase ownership of the new initiatives to fostering their success.

Key words: Informal waste collectors, integration, recycling, governance, awareness, GIS, remote sensing

ACKNOWLEDGEMENTS

‘For the weapons of our welfare are not carnal but mighty in God to even bring down strongholds’.

My special gratitude goes to my supervisors Dr. R.V. Sliuzas and Ir. M.J.G. Brussel for their very satisfactory supervision and constructive ideas during my thesis writing period. I also thank them for taking a keen interest in my welfare when crucibles of life came my way. I am indebted to Drs. E.J.M. Dopheide for his special administrative qualities and social support.

I would also like to thank Dr Lwasa, the Town Clerk for Nakawa division and Kampala Capital City Authority (KCCA) for their support during my data collection period in Kampala.

To my course mates (UPM 2012-2014), you were such a good family and I felt at home away from home.

My deepest thanks go to my parents, brothers and sisters for their prayers and for filling the gap I left while I was pursuing my studies. To Tamara I say you are just the best. I can not forget to acknowledge the role played by my former boss Brian Chitoshi and my good friend Benny Kabwela.

I also want to show my appreciating to Sylvia Donk for her motherly care and spiritual support, ‘*Dank u*’.

Lastly I acknowledge my grandmother who died during hard times of the last phase of my studies by dedicating this thesis to her.

Garikai M. Membele

March, 2014, Enschede, The Netherlands.

TABLE OF CONTENTS

1.	BACKGROUND.....	9
1.1.	Introduction	9
1.2.	Justification of the study	9
1.3.	Research problem	10
1.4.	Research objectives and questions	11
1.5.	Thesis outline	12
2.	LITERATURE REVIEW.....	13
2.1.	Definition of solid waste management.....	13
2.2.	Key elements for improving SWM in developing countries.....	13
2.3.	Conceptual framework for improving SWM.....	13
2.4.	Structural-operational elements	15
2.5.	Governance elements	16
2.6.	Integrated solid waste management (ISWM).....	16
2.7.	A systems view to solid waste management systems in Kampala	18
3.	RESEARCH METHODOLOGY	19
3.1.	Data collection sources.....	19
3.2.	Sampling techniques	24
3.3.	Quality control mechanism.....	24
3.4.	Limitation of data collection	24
3.5.	Data analysis	25
4.	FUNCTIONAL COMPONENTS OF SOLID WASTE MANAGEMENT IN KAMPALA	26
4.1.	Waste generation	26
4.2.	Composition of waste	26
4.3.	Storage and sorting of waste.....	27
4.4.	Sorting of waste	27
4.5.	Waste collection and transportation.....	28
4.6.	Ways for arriving at waste collection fees	31
4.7.	Conflicts among waste service providers	31
4.8.	Income strata of service recipients	32
4.9.	Waste disposal.....	36
4.10.	Waste composting, reusing and recycling	39
4.11.	The role of NGOs in recycling.....	40
4.12.	Problems encountered in the neighbourhood.....	41
4.13.	Solid waste management awareness	41
4.14.	Community participation	41
4.15.	Willingness to participate in better solid waste management	43
4.16.	Integration of informal and formal solid waste systems	43
4.17.	Respondents's views for improving collection and indiscriminate dumping of waste	43
4.18.	Aspects to be considered for improvement of SWM in Kampala	43
4.19.	Solid waste management indicators	46
4.20.	Summary	48
5.	STRATEGIES FOR IMPROVEMENT	49
5.1.	Key research findings to be addressed	49
5.2.	Reducing waste generation	49
5.3.	Waste storage facilities.....	50
5.4.	Improving waste collection, transportation and disposal.....	51
5.5.	Community involment and financial sustainability	51
5.6.	Composting and Recycling	53
5.7.	Dealing with service provider conflicts	54
5.8.	Recognition of informal sector comtribution	54
5.9.	Formation of organisations	55
5.10.	Challenges and the future of UWMA.....	56
5.11.	Integration of informal and formal solid waste management systems	56
5.12.	Barriers to the integration of formal and formal SWM systems	57
5.13.	Legal or regulatory reform.....	58

5.14.	Enforcement	58
5.15.	Kiteezi landfill	59
5.16.	Solid waste management indicators	59
5.17.	Operalization of the proposed SWM system in Kampala.....	61
5.18.	Summary	62
6.	CONCLUSION AND RECOMMENDATIONS	63
6.1.	Conclusion	63
6.2.	Recommendations.....	64
	LIST OF REFERENCES	65
	APPENDICES.....	69

LIST OF FIGURES

Figure 1. Conceptual framework for improving solid waste in developing countries	14
Figure 2. Solid waste management hierarchy	17
Figure 3a. Study area shown in bold underlined.....	21
Figure 4. Research design.....	25
Figure 5. Composition of waste in Kampala (Source: KCCA 2013)	26
Figure 6. Percentage of households sorting waste	27
Figure 7. Waste service providers and the percentage of households they serve.....	27
Figure 8. Waste disposed in open space (wetland).....	29
Figure 9. Fees paid to service providers per household.....	30
Figure 10. Frequency of amounts paid to service providers for waste collection.....	30
Figure 11. Rating of fees charged by service providers to households for waste collection	30
Figure 12. Household satisfaction to waste management services.....	33
Figure 13. Respondents' view to adding waste collection fee to house rentals	35
Figure 14. House occupant's status and their response to adding waste collection fee to house rental	35
Figure 15. Disposal practices of household who do not pay for waste collection.....	37
Figure 16. Open truck without a cover transporting waste	37
Figure 17. Backyard dumping of waste with indications of waste burning.....	37
Figure 18. Burning of waste in open spaces.....	38
Figure 19. Burning of waste in open spaces.....	38
Figure 21. A few products made by KIWI.....	38
Figure 20. Stuck truck being pushed by a dozer.....	38
Figure 22. Illegal dump sites in Bukoto 1	38
Figure 23. Illegal dump sites in Ntinda parish	38
Figure 24. Type of SWM information received by respondents in the last 12 months	42
Figure 25. Ways respondents receive SWM information.....	42
Figure 26. Respondents view for improving waste collection in their neighbourhood	44
Figure 27. Respondents' views to solving problems experienced in their neighbourhood	45
Figure 28. Percentage priority aspects for improving SWM in Kampala	45
Figure 29. Modified conceptual framework for addressing SWM in Kampala	45
Figure 30. Functional components of solid waste management in Kampala	48
Figure 31. Indicators index for measuring SWM performance in Kampala	61
Figure 32. Proposed SWM structure in Kampala.....	62

LIST OF TABLES

Table 1. Research specific objectives and questions.....	11
Table 2. Key informants interviewed both at a city and case study level.....	20
Table 3. Usable and reformulated questions from pilot survey.....	22
Table 4. Monthly average amount paid for waste collection in UGS.....	33
Table 5. Usable and reformulated or recommended indicators	46
Table 6. Indicators for measuring SWM performance in Kampala	47
Table 7 Indicators and policy objectives for improving SWM as recommended by Key informants in Kampala.	60

LIST OF ACRONYMS

CBOs	Community Based Organisations
EPR	Extended Producer Responsibility
GIS	Geographic Information Systems
ISWM	Integrated Solid Waste Management
KCCA	Kampala Capital City Authority
KIWI	Kinawataka Women's Initiative
MDGs	Millennium Development Goals
NGOs	None Governmental Organisations
SWM	Solid Waste Management
UGS	Ugandan Shilling
UNEP	United Nations Environment Programme
UWMA	Urban Waste Management Association

1. BACKGROUND

This chapter introduces the solid waste management problem in developing countries. It then highlights the justification of this research and then outlines the problem, research objectives and questions. It ends by outlining the chapters for this thesis.

1.1. Introduction

Target 7c of the Millennium Development Goals (MDGs) focuses on how to improve waste management. However, many developing countries' local and national governments are persistently troubled with solid waste management. This can be attributed to a number of factors. The rapid increase in population for instance has led to the expansion of urban areas and subsequent mushrooming of informal neighbourhoods (Okot-Okumu, 2012). Poor waste management is also associated with limited financing, poor governance, low level public awareness and changing consumption patterns which put pressure on resources and increase waste production (Couth & Trois, 2010). Moreover, targets set by many developing countries for waste management are too high or do not have a clear vision or objectives. This has made them impossible to achieve thus having destructive consequences which jeopardize the system. There is also a tendency to duplicate approaches from developed countries without considering the socio-economic and political differences as well as priorities of developing countries (Agamuthu, 2003). It is therefore a common trend to witness that 30 to 40 per cent of solid waste in cities of developing countries is uncollected (Cointreau, 1982). This situation has contributed to adverse social, health and environmental impacts (Practical Action, 2007) and lessens the willingness to invest in urban and economic development (Scheinberg, 2007).

1.2. Justification of the study

Like most developing countries Uganda and particularly the city of Kampala has challenges dealing with solid waste management. The Republic of Uganda (2010) reports that Kampala has witnessed an increase in the volume of solid waste generated due to increased population growth, poor behaviour, changing consumption habits of the people, concentration of industries in the city and inappropriate waste management practices.

Most of the uncollected waste in the city is found in the informal settlements where the majority of occupants are poor and cannot afford to pay for waste collection fees. This segment of the population also have a tendency of taking the waste no farther than the nearest unofficial collection point (Katusiimeh, Burger, & Mol, 2013). According to Okot-Okumu and Nyenje (2011), the urban poor receive very low to no waste collection services owing to inaccessible roads, unplanned facilities and negligence on the part of the local authority. On the other hand only 40 percent of the waste is collected and disposed of at the landfill from the formal Kampala administrative area (UN-Habitat, 2009). One of the reasons for this is that the private companies engaged by the local authority do not have the capacity to adequately collect and transport waste to the landfill. The local authority has also failed to manage or regulate the operations of the private companies (Republic of Uganda, 2010).

According to Okot-Okumu (2012), the removal of skips in many parts of Kampala in 2002 due to the involvement of the private sector in solid waste management and their link to unsanitary conditions led to an increase in indiscriminate dumping of waste, burning and burying of waste. Therefore, this

indiscriminately dumped waste eventually finds its way in road verges and drains thereby contributing to floods, poor aesthetics, health and environmental problems.

Tukahirwa (2012), asserts that Kampala lacks a solid waste management system that is robust. As a result the city is not able to properly monitor, coordinate, finance, plan and let alone control the entire flow of waste from the point of generation to collection, transportation, disposal, treatment as well as re-use or recycling. Community participation and awareness in solid waste management is also absent. Further, the centralized Kiteezi landfill is not only old but has a limited working area with limited room for expansion. The landfill is also nearing its optimal capacity. There are also inadequate sustainable technological options for recycling or re-use, energy recovery and on-site waste treatment (Kampala Capital City Authority, 2012).

The municipality also lacks accurate and reliable data on solid waste generated in the city, its composition and how much is collected. This has led to having plans and budgets that do not adequately address actual challenges of waste collection, transportation and disposal. Additionally, the local authority does not have the capacity to implement or enforce legal measures which relate to waste management. This is in spite the local authority having a fully-fledged enforcement department (Kampala Capital City Authority, 2012; Niringiye & Omotor, 2010). Workers under waste management operate under harsh conditions such as in the absence of protective clothing and late payment of wages. This situation adversely affects their morale and their performance at work is consequently poor. (Republic of Uganda, 2010). Therefore improving solid waste management (SWM) in Kampala is paramount.

1.3. Research problem

Kampala needs a robust solid waste management system that is effective and sustainable in the long term. A number of authors (Okot-Okumu, 2012; Okot-Okumu & Nyenje, 2011; Republic of Uganda, 2010; Tukahirwa, 2012) are of the view that in spite of privatisation in 2002 having improved service provision in Kampala, it has not been very successful as solid waste management still faces a number of challenges. For instance up to now only 40 per cent of the waste is collected and disposed at a landfill (UN-Habitat, 2009). Furthermore, private sector involvement in solid waste management led to the removal of skips in many parts of the city which in turn contributed to more unacceptable ways of managing waste such as open disposal, burning and burying of waste because of poor access roads (Kulabako, 2010) and that most of the people in informal settlements are poor and cannot manage to pay for waste collection services (UN-Habitat, 2007). One of the major reasons for this outcome is that the private companies only manage waste in formal or planned neighbourhoods while the informal settlements where over 60 per cent of the population lives (UN-Habitat, 2007) is not served by the private sector. The informal sector players who largely manage waste in these informal settlements have the tendency of dumping waste indiscriminately which contributes to floods by blocking drains (UN-Habitat, 2010). Others effects are poor aesthetics, health and environmental problems (Gunsilius, Sandra, & García-Cortés, 2011; Katusiimeh et al., 2013). Little is known about how the informal and the formal solid waste management systems can be improved in Kampala. Possibilities to integrate the informal and formal systems are often ignored by most governments in the developing countries (Scheinberg, 2007). Wilson, Velis, and Cheeseman (2006), state that the attitude of those involved in the formal solid waste management system to the informal one is in many times undesirable as they consider the informal system as illegal, backward, unsanitary and generally incompatible with the formal waste management system. It is probably for this reason that there is no interdependence or cooperation between the informal and the formal solid waste sectors in Kampala (Katusiimeh et al., 2013).

1.4. Research objectives and questions

The main objective of this research is to evaluate ways of improving the informal and formal solid waste management systems in Kampala. Based on this main objective, specific objectives and questions that this research will address were developed as shown in table 1.

Table 1. Research specific objectives and questions

Specific objectives	Research questions
1. To estimate the amount and composition of waste generated in both informal and formal settlements	<ul style="list-style-type: none"> i. What is the composition of waste generated in both informal and formal neighbourhoods? ii. What is the amount of waste generated per capita?
2. To describe the current informal and formal solid waste management practices and their performance.	<ul style="list-style-type: none"> i. How is the solid waste collected, transported, recycled or reused and disposed to the landfill in both systems? ii. How much solid waste is recycled and where does this recycling take place? iii. What are the constraints and strengths in both systems?
3. To develop a conceptual model for improving the informal and formal solid waste management systems in Kampala	<ul style="list-style-type: none"> i. What concepts do stakeholders consider important for improving the two systems? ii. What structures and control measures do stakeholders recommend for improving the two systems?
4. To assess the willingness and extent to which improving the informal and formal improves the overall solid waste management in Kampala.	<ul style="list-style-type: none"> i. How can collection, transportation, recycling and disposal be improved in both systems? ii. Is integration of the informal and formal solid waste management systems a possible solution of improving solid waste management in Kampala? iii. Are the stakeholders willing to integrate the two systems? iv. What indicators can be used to measure the possible performance of the improved systems? v. What actions can be taken at the system level to enhance improved solid waste management outcomes?

1.5. Thesis outline

Chapter 1: Presents the introduction of this research, the background as well as the justification of this study. It further highlights the research problem, objectives and questions. The conceptual framework is also presented in this chapter.

Chapter 2: A review of literature relating to the key elements or aspects for improving SWM in developing countries is given and a conceptual framework for improving SWM in developing countries deduced. The concept of achieving sustainable development in solid waste management is also given.

Chapter 3: The methodologies used in this research are presented in this chapter, particularly highlighting the data collection sources, sampling techniques, quality control measures and limitations in data collection. Moreover, the way the data collected was analysed is also presented in this chapter.

Chapter 4: This chapter discusses the functional components of solid waste management in Kampala from generation, composition, collection and transportation to recycling and disposal. Moreover results of respondents' view on different aspects of solid waste will also be discussed.

Chapter 5: This chapter discusses some interventions or strategies that can be undertaken in Kampala to help address the challenges discussed in the foregoing chapter. Others are best practices from other developing countries.

Chapter 6: Gives a conclusion and recommendations for the research.

2. LITERATURE REVIEW

This chapter first defines SWM and then presents a review of literature for key elements for improving SWM in developing countries thereby deriving a conceptual framework. It further gives a brief review of the Integrated Solid Waste Management approach and defines the systems view of looking at the operations of the informal and formal solid management in Kampala.

2.1. Definition of solid waste management

Solid waste is generally the responsibility of local authorities; it is for this reason that it is also known as municipal waste. Solid waste includes refuse generated from households, commercial and institutional areas. It also includes non-hazardous waste from industries. It is usually composed of organic waste such as food leftovers and inorganic materials such as glass or plastic. SWM on the other hand relates to all measures and activities such as planning, storage, collection, transportation, treatment, reuse, recycling and disposal. All these activities are done to minimize inconvenience, nuisance, pollution and environmental problems (Cointreau-Levine, 1994; Gerold, 2009; Medina, 2002; Schubeler, 1996).

2.2. Key elements for improving SWM in developing countries

A review of literature highlights a number of key elements for improving SWM in developing countries. Local authorities do not have to provide solid waste service alone, private sectors involvement is important in the provision of solid waste services in developing countries (Cointreau-Levine, 1994). Schubeler (1996), adds that there is need to establish a SWM system that meets the need of all citizens including the poor and presents a conceptual framework for improving SWM in developing countries and states that political, institutional, social, financial, economic and technical elements are important. Moreover, Medina (2002), proposes a decentralised approach which promotes community participation, incorporates informal waste collectors, public-private partnerships and informal waste collectors organisations. Wilson et al. (2006), asserts that local authorities should recognise the contribution of informal waste collectors hence guarantee their access to waste resources. Raising awareness and stakeholder communication are important in developing countries. Gutberlet (2008) asserts that the integration of informal waste collectors into the city solid waste management system provides a significant initiative for improving SWM. Cardenas (2009) contends that there is need for solid waste service providers to form partnerships and provide financial incentives for waste collector organisations. Scheinberg (2012) further agrees that there is need to encourage waste collectors to diversify their activities in order to improve waste collection, their livelihoods and protect the environment. Informal waste collectors recycle more waste than the formal sector and integrating them into the formal SWM systems significantly contributes to development goals (Gunsilius, 2010; Gunsilius et al., 2011). To have a well functioning SWM system governance strategies are required (Wilson, Rodic, Scheinberg, Velis, & Alabaster, 2012).

2.3. Conceptual framework for improving SWM

Therefore based on the review of literature as discussed above, a conceptual framework for improving solid waste in developing countries was developed (figure 1). This conceptual framework considers what can be called the structural-operational elements and governance elements. It also shows that the

structural-operational and governance elements are inter-related. For instance access to information and education is related to legal reform in that the former makes the people understand the SWM laws and regulations which enhances adherence (Atienza, 2011). Moreover, partners such as non-governmental organizations and the media can help in documenting and advertising the contributions of the informal sector within the broader city solid waste management system which can be used for strategic planning. At the same time the partnership is also related to access to information and education in that more partners can for instance make awareness campaigns more visible to the public thereby helping to bring about change in attitude and behaviour towards waste. Moreover a lack of legal recognition of the informal sector may be a barrier in forming partnerships (Van de Klundert & Lardinois, 1995). At the same time the formation of organisations by the informal sector can lead to networking and partnerships with NGOs, international organisations including public and private sector partners.

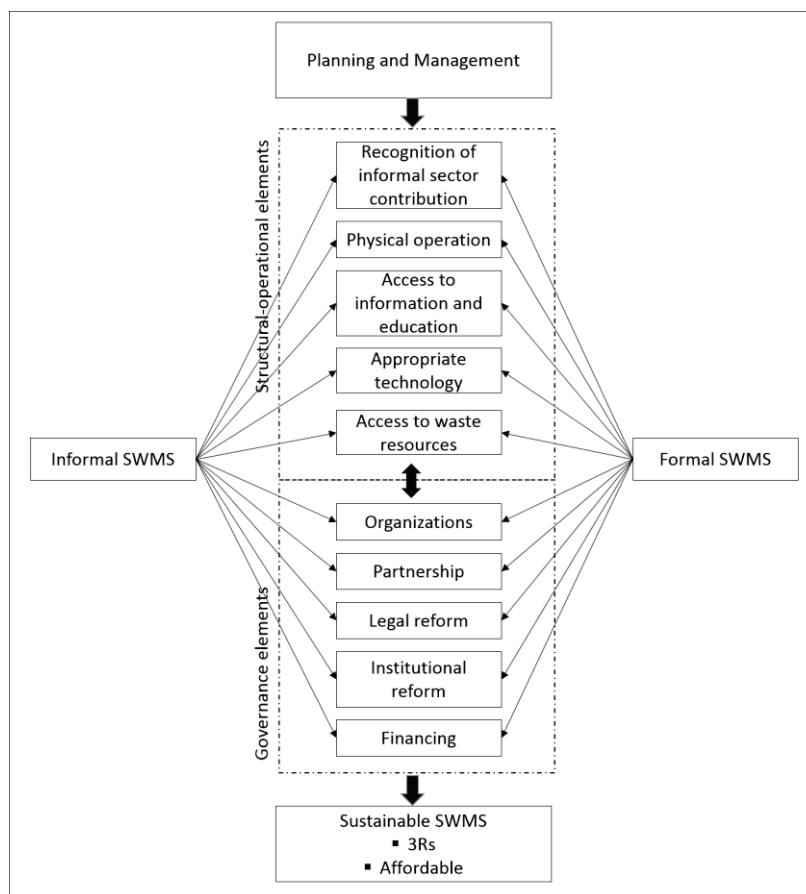


Figure 1. Conceptual framework for improving solid waste in developing countries

2.3.1. Planning and management

This is very important as it allows the analysis and documentation of the whole solid waste management system in order to formulate achievable goals, visions, objectives and strategies through consultation of multiple stakeholders (Gunsilius et al., 2011). Analysis of the city's solid waste management system is important as it gives a complete picture of the flow of materials in the city. This further enhances strategic planning and monitoring of the whole system (Van de Klundert & Arnschutz, 2001). Another important aspect of planning and management is spatial planning. It is important because it affects urban form and

the nature of urban developments in the city. Collaborative spatial planning can for instance be used to reduce informal developments in the city.

2.4. Structural-operational elements

The structural-operational elements consider the flow of waste material from generation to disposal as well as other day to day physical operational activities of the SWM system.

2.4.1. Recognition of informal sector contribution

Recognising the contribution of the informal sector in SWM can provide a win-win of opportunities. These include protecting and developing people's livelihoods; addressing negative health and environmental impacts; and reducing cost of managing waste in the city (Paul, Arce-Jaque, Ravena, & Villamor, 2012; Scheinberg et al., 2010; Velis et al., 2012; Wilson et al., 2006). Therefore recognising the role that the informal sector plays is paramount in fostering improvement of solid waste management.

2.4.2. Physical operation

Physical operation ensures that waste management is done with the right infrastructure in place for collection, transportation and disposal of waste. It also into prevention, reuse and recycling activities and ensures that the system is economically viable and socially acceptable while addressing health and environmental concerns. It basically ensures that responsible people go beyond the mere importation of European models and systems (Van de Klundert & Arnschutz, 2001).

2.4.3. Access to information and education

Changing people's attitude and behaviour is also crucial in Kampala (Sliuzas et al., 2013). This is because it will help in reducing indiscriminate dumping of waste in the city which eventually finds its way in road verges and drains thereby causing blockages and contributes to floods. Attitudes to waste are generally a function of people's social and cultural settings. "Attitudes may be positively influenced through awareness-building campaigns and educational measures on the negative impacts of inadequate waste collection with regard to public health and environmental conditions and the value of effective disposal. Such campaigns also inform people of their responsibilities as waste generators and their rights as citizens to waste management services" (Schubeler, 1996, p. 35).

2.4.4. Appropriate technology

Technology applied in waste collection, storage, transport, treatment and disposal should be well suited for the operational requirements and the physical and socio-economic conditions of the city for improvement to be successful (Medina, 2002). Having appropriate technology also fosters maintenance and efficiency (Schubeler, 1996).

2.4.5. Access to waste resources

A successfully improved management system should also guarantee access to waste resources to both informal and formal actors to protect people's livelihoods in the long term (Gunsilius, 2010; Katusiimeh et al., 2013; Velis et al., 2012).

2.5. Governance elements

Governance here refers to the processes and mechanism such as policies or regulatory or institutional measures, roles and mandates which facilitate planning, design and procedures of solid was management in the city (Atienza, 2011; Deininger, Selod, & Burns, 2011). Transparency is highly considered as the fundamental principle of good governance. Transparency refers to acting visibly, acting predictably and understandably and sharing of information in an open and clear manner. (UN-Habitat, 2004).

2.5.1. Organisations

Forming of organisations such as solid waste cooperatives or associations is very important as it provides a platform for those involved to present their interest and influence public as well as political opinion. It also promotes partnerships and networking (Gunsilius et al., 2011). The organizations are also important in empowering those involved.

2.5.2. Financing

This refers to the provision of solid waste management budget allocations, stability or reliability and the cost of operation and financial sustainability in general (Troschinetz & Mihelcic, 2009). It also considers the provision of affordable solid waste service provision to all society groups.

2.5.3. Legal reform

This refers to adjustments in the solid waste management policies or laws, ordinances and regulations by the federal or local government (Dias, 2011). It also includes the presence of incentives and control mechanisms (Cardenas, 2009; Troschinetz & Mihelcic, 2009).

2.5.4. Institutional reform

This refers to adjustments in the institutional structure, organisational procedures and capacity of responsible institutions which control and implement solid waste management policies and operate the system as a whole (Schubeler, 1996).

2.5.5. Partnership

Partnership on the other hand involves the consultative and cooperative processes of actors such as the public, private, NGOs, media and the community in order to create optimal solid waste management through dialogue and networking (Van de Klundert & Lardinois, 1995).

2.5.6. Sustainable solid waste management

This refers to solid waste reduction reuse, recycling as well as resource recovery to ensure better social, health and environmental wellbeing (United Nations, 1992). It also refers a solid waste management system that is affordable for the people in the city.

2.6. Integrated solid waste management (ISWM)

Integrated solid waste management (ISWM) is an approach which considers all facets of a solid waste management system all together, both technical and non-technical. It is a concept not only used for designing a new waste management system but it is also used to rationalize an existing one. ISWM further empathises tailoring of the solid waste management system to the local conditions and ensuring that

environmental, social and economic realities are secured (UNEP, 2005). This is because there is no ‘one size fits all’ when it comes to solid waste management. This is because every society or community has its own unique composition or profile of solid waste. Additionally people’s attitude and behaviour towards waste management practices differ. The ISWM concept also underscores economic independence or cost recovery to ensure financial sustainability. To minimise air and water pollution and to protect public health and safety the waste hierarchy is considered. The waste hierarchy is an internationally accepted concept in ISWM frameworks and it is very important to consider when devising a solid waste management plan and its overall objectives. Hence solid waste management legislation plays a very cardinal role at this point.

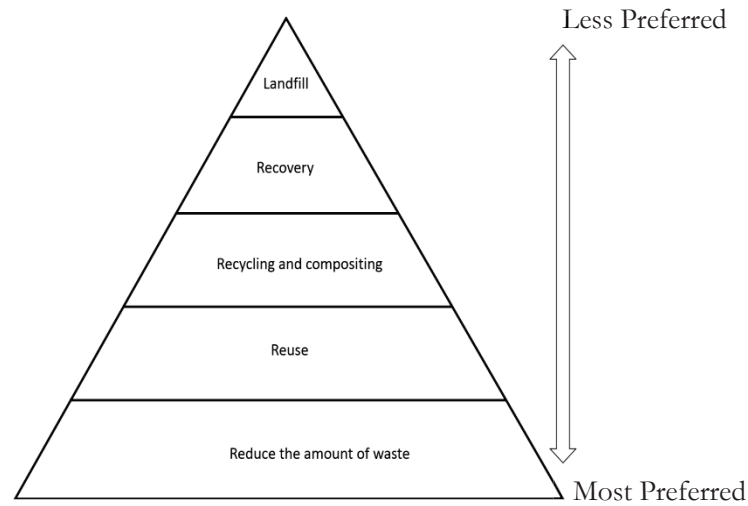


Figure 2. Solid waste management hierarchy

From figure 2 it can be seen that reduction, reuse and recycle also known as the 3Rs are the most preferred waste treatment options. By adding recovery to the 3Rs the waste diversion option is formed. This underlines using less and reusing more in order to save the use of materials through production, resource cost and energy. The landfill is the last disposal option and the least preferred. However, after the landfill has been capped, the land can be reclaimed by the creation of recreation sites such as golf courses or parks (UNEP, 2005).

In developing countries failed solid waste management systems are countless, and most of them have been unsuccessful not because of having technical difficulties but because of poor governance. Wilson et al. (2012), are of the view that good governance in waste management reduces the risk and increases likelihood of a successful solid waste management system.

2.6.1. Public private partnership

Due to weaknesses in the public sector which include poor service delivery, inefficiency, wastefulness and carelessness, most developing countries have embraced Public Private Partnership (PPP) as an alternative solution to the management of waste. PPP has been identified as one of the governance tools in waste management. PPP is defined as the “transfer and control of a good or a service currently provided by the public sector, either in whole or in part, to the private sector” (Massoud & El-Fadel, 2002, p. 621). Moreover, the increased practice of PPP in solid waste management includes the desire to relieve the local authority’s waste management budget and due to the desire to create jobs, increase social responsibility

and environmental awareness. Others include the private sector's entrepreneurial spirit, managerial efficiency and access to finance.

However, for PPP to be successful each partnership should be mutually benefiting and there should have a common goal. Cointreau-Levine (1994), asserts that PPP can be problematic due to different commitments to the common goals. For instance for the public sector, saving money is of interest but the private sector interest is to make money.

Moreover, developing countries tend to face challenges in implementing PPP because of weak regulatory frameworks. Ahmed and Ali (2004), are of the view that the implementation of PPP without transparency, fairness and accountability usually breeds corruption and inefficiency. This is even worsened if the public sector does not have proper contract control over the private sector.

2.6.2. Integration of informal and formal solid waste management systems

Research on the integration of the informal sector into the solid waste management system has received much attention since the mid-1990s because it is seen as a possible solution to deal with the complexity of solid waste management in most cities of the developing countries. However this concept of integration is a tricky one and it is still under debate as there is not yet a generic definition for it (Scheinberg, 2012; Velis et al., 2012).

Van de Klundert and Arnschutz (2001), see integration as cooperation or relations between the informal and formal as well as other stakeholders in solid waste management. It also includes various aspects of technical or financing as well as various collection and treatment options. They further broaden their definition by stating that this relationship extends to other urban systems such as drainage, energy and urban agriculture. Scheinberg (2012), on the other hand defines it as the willingness of public authorities to make real changes in solid waste management which incorporate the activities of the informal sector. However, this definition does not consider the meaning of the modifications whether there are beneficial to the informal sector or not. Oguntoyinbo (2012), uses the term inclusive to mean integration and defines it as having activities of the informal and formal solid waste management system complementing each other in a mutually beneficial relationship. This definition however does not specify the initiator of the integration.

Therefore, this research defines integration as adjustments in the city solid waste management system facilitated by the local authority which allows for beneficial interdependence or cooperation of both informal and formal systems to promote sustainable solid waste management.

2.7. A systems view to solid waste management systems in Kampala

According to Hall and Day (1977), a system can be defined as a phenomena that has two or more components that have some interaction. Moreover (Voinov, 2008, p. 6) asserts that "a system is a combination of parts that interact and produce a new quality in their interaction". Hence a system is made up of parts and these parts interact such that something new is produced as a result of their interactions. Therefore in order to understand solid waste management in Kampala and propose ways of improvement, two systems operating in the city cannot be ignored. These include the informal and the formal solid waste management systems.

The informal sector is here referred to the informal solid waste management systems. This system is operated by individuals, and families collecting and taking it to the nearest unofficial dump site (Katusiimeh et al., 2013). They also involved in reusing and recycling of waste as a means of livelihood. These activities are not organized, financed, contracted nor recognized, taxed or reported upon by the

local authority. This informal system largely operates in informal neighbourhoods with low technology, low income and labour intensive. The formal system on the other hand refers to operations of KCCA and the licensed private companies in Kampala. These operators are regulated by laws within a local authority and they use high cost and advanced technology. The private companies mainly collect waste from planned settlements including civic and commercial institutions. It is worth to note that there are registered or unlicensed private companies operating in the formal solid waste management system in Kampala (Katusiimeh, Mol, & Burger, 2012).

3. RESEARCH METHODOLOGY

Data collection methods used to undertake this research is presented in this chapter. A mixed approach was used that includes qualitative and quantitative methods to collect data for purposes of adequately addressing all the research questions.

The use of qualitative and quantitative methods in the same study provide the possibility to ask both confirmatory and exploratory research questions thereby helping to verify and generate theory. Moreover the use of both of these methods provides stronger inferences and greater collection of divergent views (Teddie & Tashakkori, 2009).

3.1. Data collection sources

Primary and secondary data sources were used to get a deeper understanding on issues regarding solid waste management in Kampala. Primary data sources involved household questionnaires, interviews with key informants, observations and mapping. A documentary review of academic publications, government reports and newspaper articles was also done. Data was collected on two levels namely the city level and the case study areas.

3.1.1. City level

City level methods included documentary reviews and semi-structured interviews with key informants.

3.1.1.1. Documentary reviews

Government documents and reports such as the Ugandan laws and policies were reviewed to understand the legal framework under which solid waste management was operating. Moreover, academic publications, consultancy reports and newspapers articles were used to supplement primary data collection. Information collected from these documents helped to identify the key informants. It also provided information on the composition of waste in Kampala and amount of generation per capita as well as health and environmental effects of poor waste management.

3.1.1.2. Interview with key informants

Key informants were interviewed to have an in-depth understanding of solid waste management from planning, collection, recycling and disposal. These key informants were also interviewed on the priority aspects they considered important for improving the informal and formal solid waste management systems in Kampala. A semi-structured interview with open and closed ended questions was used (Appendix 1). Their views on the integration of informal and formal solid waste management systems were also sought. Notes were taken down during these interviews. Key informants interviewed from a city level were from KCCA (figure 2). This is because the KCCA formerly known as Kampala City Council (KCC) has the mandate to collect, transport and dispose garbage as outlined in the Solid Waste Management Ordinance of 2000 and the Solid Waste Management Strategy of 2002 which was revised in 2006. KCCA was established recently by the central government of Uganda through the KCCA Act of 2010.

Table 2. Key informants interviewed both at a city and case study level

Role	Number of interviews
Nakawa division Health inspector	1
Nakawa division Waste and sanitation supervisor	1
Nakawa division garbage supervisor	1
KCCA, PPP waste project coordinator	1
KCCA, Waste and sanitation supervisor	1
KCCA, Landfill supervisor	1
Urban waste management association chairman	1
NGO, Kinawataka women initiative executive director	1
Faith based organization, Christians in conservation	1
Informal waste collectors	2
Private waste collection company, operations manager	1
Recycling industry, operations manager	1
Local leaders	2

3.1.2. Case level

To understanding how waste is managed from both informal and formal neighbourhoods at household level, two case study areas were selected. Yin (1994), defined a case study method as an inquiry into contemporary real life issues where the context is not clearly marked, which therefore allows for the use of multiple sources of information. Considering the large size of Kampala which is around 195 square

kilometres (Katusiimeh, 2012), case were selected to provided inferences or generalizations to the entire city of Kampala. This is based on Kumer (2005), who argues that selected cases can be used as a proxy for sections of a wider study area by deducing generalizations from the case study findings Yin (1994).

The two case studies were selected from Nakawa division. This division has clearly marked informal and planned neighbourhoods (Katusiimeh et al., 2013). This is in line with the main objective of this research. Ordinarily, most of the neighbourhoods in Kampala have a mixture of planned and unplanned neighbourhoods. Therefore Bukoto 1 (informal neighbourhood) and Ntinda (planned neighbourhoods) parishes were selected (figure 2a).

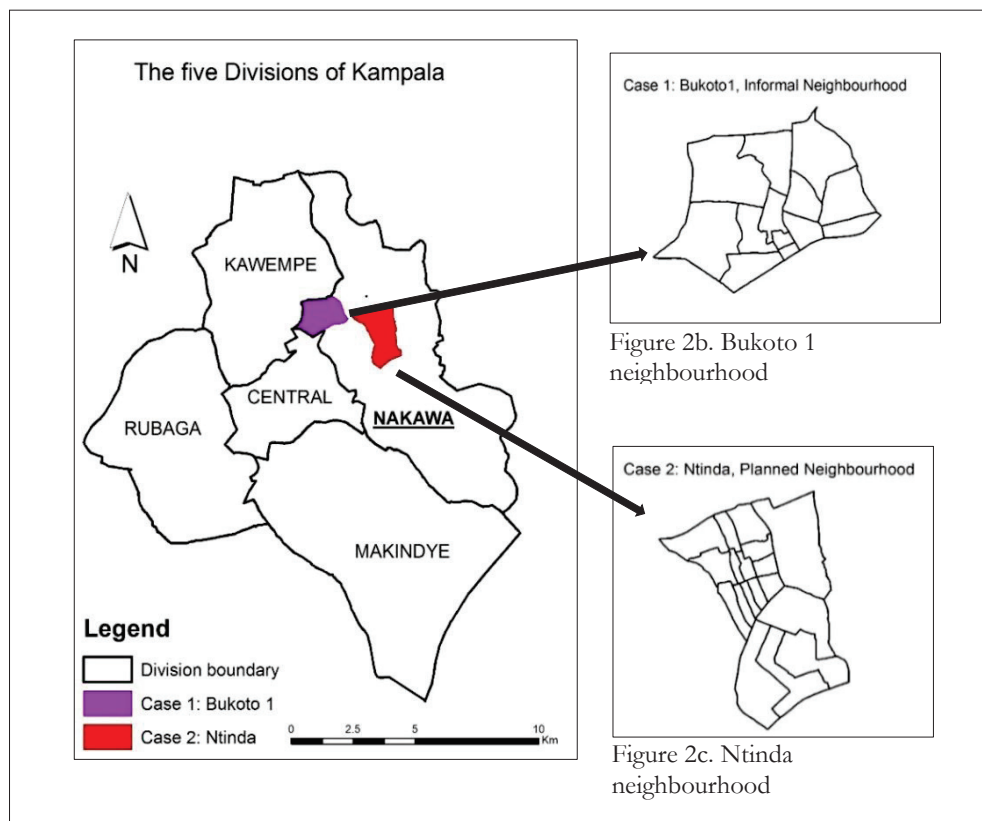


Figure 3a. Study area shown in bold underlined

3.1.2.1. Case 1: Bukoto 1 parish

Bukoto 1 parish is approximately 6.5 kilometres north of the central business district of Kampala (figure 2b). The parish borders with Kasaasi, Kyabando, Mulago, Bukoto 2, Nagulu 2 and Kamwokya 2. The northern by-pass road passes through this parish on its northern end. Bukoto 1 was generally a bush 15 years ago and was a hid out for criminals and drug dealers then. The parish has the size of approximately 210 hectares with 13 zones and has an estimated population of over 1,500 people. A local leader further indicated that the population in Bukoto 1 has been growing in leaps and bounds. In the past ten years the population has more than doubled.

This increase in population however, has not been increasing at the same pace as infrastructure and other social services. Houses for instance are built haphazardly in low laying areas without proper planning.

Moreover, the parish has a number of narrow and poor access roads which have made the provision of services such as solid waste collection a challenge.

The way solid waste is managed in Bukoto 1 is of great concern not only to residents but to KCCA and other environmental activists because the neighbourhood is located in the Lubigi catchment which has largest wetland in Kampala. It is for this reason that Banda which was earlier proposed to be one of the case study areas was dropped during the field work phase. This is to say that reality in the field revealed that solid waste management was much more problematic in Bukoto 1 than Banda.

3.1.2.2. Ntinda parish

Ntinda a well-planned neighbourhood with 18 zones and having a size of approximately 263 hectares lies 8 kilometres north east of Kampala's central business district (figure 2c). It has a population of 9,094 people (Uganda Bureau of Statistics, 2002). The parish is boarded by Bukoto 2, Nguru 1 and 2, Kiswa, Mbuya 1, Kyambango, U.P.K, Nakawa, Upper Estates and Kiwatule. Ntinda was well planned since the colonial days. After independence the parish evolved as an estate constructed by the government to house staff of the East African Railways and Harbours (Muinde, 2013). Therefore the neighbourhood of Ntinda is an upper class area also inhabits people of high income. It also has a high occupancy rate per plot of available land (Nyakaana, Sengendo, & Lwasa, 2000).

At the case study level interviews were also conducted as discussed in sub section 3.1.1.2 (page 20) and the key informants interviewed are shown in table 2. Other methods included household questionnaires, observation and mapping.

3.1.2.3. Household questionnaires

To ensure that the questions in the questionnaire were formulated to suit the local context and avoid ambiguity, a pilot survey was conducted using twenty household. Ten questionnaires in both the informal and formal or planned neighbourhoods were administered during the pilot. After the pilot survey some questions were removed while others were reformulated. Table 3 below shows the actual questions which were discarded and those which were reformulated with a comment on each. The actual household questionnaire which was administered to is shown in appendix 2.

Table 3. Usable and reformulated questions from pilot survey

Question number	Pilot result and comment
2. Age	A lot of respondents did not indicate their age in spite of emphasizing that the responses would remain anonymous. Hence this question was discarded in the actual questionnaire.
6. Income	All the piloted respondents indicated more than 20,000 UGS. The income categories were adjusted upwards with a minimum of less 300,000 UGS.
15. Reason for sorting waste	This question proved irrelevant because it was not answered at all. It was thus adjusted to "what kind of waste do you sort"

28. Waste disposal	It was reformulated to be answered only by those who did not pay for waste collection. A response options “on the road side” was included.
29. Distance to communal container	Proved irrelevant as communal containers were removed by KCCA due to privatisation in waste management and generator pays principle.
30. Perception of distance to communal container	It was also irrelevant since communal containers are no longer in existence in the neighbourhoods.
38. Making use of recycling facilities	Was removed as it was not answered. It was seen not to add value to the research in the end.
42. Effects of waste problems experienced in the neighbourhood	Reformulated to just problems they were experiencing, as respondents could hardly state the effects.
46. Way information on waste was received	Mega phone was added a response option while dram, posters and music where removed as they were not relevant.
49. Integration of ways of managing waste in informal and planned neighbourhoods	The question was not properly understood. It reformulated by using the word cooperation instead of integration.

The revised questionnaires were then administered to the respondents in informal and formal neighbourhoods in both case study areas (appendix 2). To ensure that there was 100 per cent response rate the questionnaires were administered door to door to the randomly sampled households and were retrieved immediately they were completed. Household heads were targeted to ensure that the information the information was reliable. Formal neighbourhood were administered with questionnaires during the weekends and public holiday because that was when there were higher chances of having at least one household head (male or female) at home.

The questionnaires captured a wide range of issues ranging from the socio-economic characteristics of the respondents, waste collectors, payment dynamics, perceptions, level of satisfaction, the kind of solid waste management information they received in the past twelve months to the problems they were experiencing in their neighbourhood with regard to solid waste. Others issues addressed included whether they sorted or recycled their waste. The household questionnaires also sought to find out whether or not the integration of informal and formal solid waste management systems was a good thing to do.

3.1.2.4. Observation

Field observation complemented other research methods. It was at the same time used to validate other methods. During the field observations pictures or photographs were also taken as shown in the subsequent discussions. Particularly observations were done on solid waste storage, collection, transportation, recycling and reuse as well as disposal.

3.1.2.5. Mapping

Moreover, mapping complemented observation. The locations of open dump sites which were observed to be used by more than seven households were marked. The mapping was done by passing through streets in both neighbourhoods which are accessible by car. A hand held Global Positioning System (GPS) was used for this task. Others areas mapped included sorting or collection centres for informal waste collectors and recycling industries in the study area. This was to have an understanding of the location and spatial differences of illegal and open dump sites in the two case study areas. Maps produced out of this method are shown in sub section 4.2 below (figure 34 and 35).

3.2. Sampling techniques

In this research, systematic non-random and stratified random sampling methods were used. A systematic non-probabilistic method was used on key informants. This is because key informants are known for their role and contribution to solid waste management. Fifteen key informants were interviewed from different groups as discussed in sub section 3.1.12 and shown in table 2 respectively. Moreover, 300 household questionnaires were administered. With the stratified random sampling method 180 households were administered with questionnaires from the informal neighbourhood of Bukoto 1 and Ntinda a planned neighbourhood had 120 questionnaires. This was based on the information that 40 and 60 percent of the population live in informal neighbourhoods and formal neighbourhoods respectively (UN-Habitat, 2007). Hence a sampling ratio of 1:1.5 from a total sample of 300 was used. The 300 sample was sufficient because of the homogeneity of solid waste management practices in Kampala.

3.3. Quality control mechanism

To increase the validity and reliability of the research findings, multiple sources of information were used. These included interviews with key informants and households, observation (photographs), mapping and documentary reviews. Moreover, household heads were also targeted in administering the research. Hence households which did not have heads of the household or indeed a responsible and knowledgeable adult were left for the next household. Research assistants were trained to have a higher level of interpreting of the questions. A pilot survey was conducted with 20 households, ten for each neighbourhood to ensure that the questionnaires contained relevant and realistic questions to answer the research questions. After the pilot survey further training was given to the research assistants to fill the gaps in interpretation. Some questions were improved and irrelevant ones were removed. The questionnaires was also designed and worded in a brief, easy to read and understand manner (appendix 2). On top of that, a stratified random sampling method was used to reduce the sampling error and improve the representativeness of the sampling population (Ezeah & Roberts, 2012).

3.4. Limitation of data collection

One of the major challenges faced in the field was that some potential key informants who were identified before field work were not interviewed. One of the reasons is due to the structural changes which were made at Kampala Capital City Authority (KCCA). For instance the divisions no longer have environmental officers. These officers are now at the central level and it was a challenge to secure appointments with them. In spite of training the research assistants it was noted that they still had problems comprehending certain questions in the questionnaire. The other limitation is that some of the questions in the questionnaires were not answered by the respondents. Besides, not all illegal dump sites could have been mapped in the case study areas since only those (illegal dump sites) along the streets accessible by car were marked.

3.5. Data analysis

Responses from interviews with key informants were jotted down in a note book. They were then descriptively analysed, synthesised and interpreted. Microsoft excel was used to produce results of the three priority aspects for improving solid waste management in informal and planned neighbourhoods in Kampala. It was also used to make pie charts. Furthermore, generated data from household questionnaires was analysed using descriptive and inferential statistics using version 21 of the Statistical Package for the Social Sciences (SPSS) software. Tables, graphs and charts were produced to analyse these research results. Chapter 4 below discusses the research results

The summary of the approach for the research is diagrammatically summarized in figure 4 below.

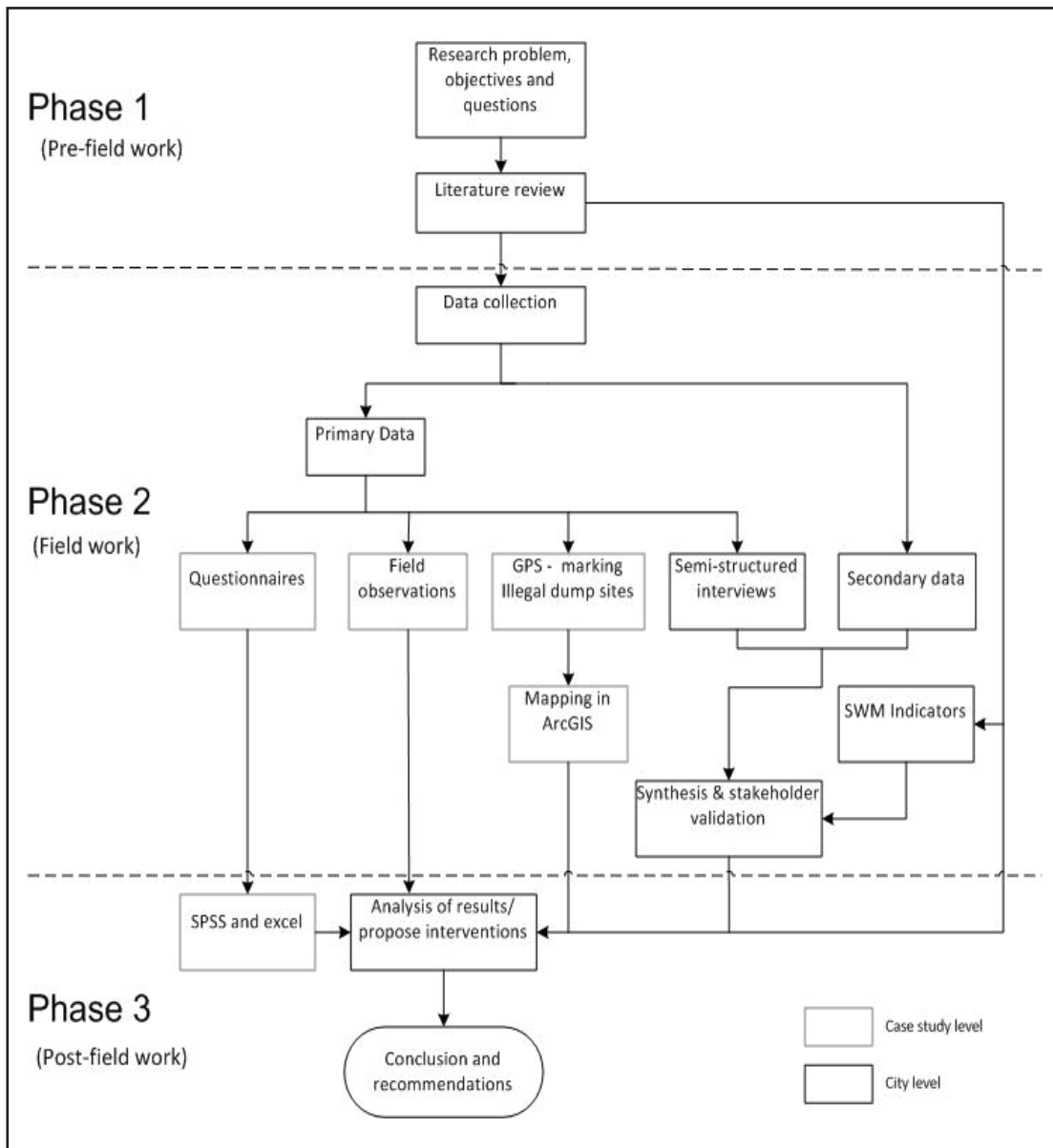


Figure 4. Research design

4. FUNCTIONAL COMPONENTS OF SOLID WASTE MANAGEMENT IN KAMPALA

This chapter discusses the functional components of solid waste management in Kampala from generation, composition, collection and transportation to recycling and disposal. Moreover results of respondents' view on different aspects of solid waste will also be discussed. These include willingness to pay, combination of waste collection fee to house rent and problems experienced in their neighbourhoods as well as the integration of informal and formal solid waste management systems.

4.1. Waste generation

The average waste generation rate in Kampala is 0.89 kg per person per capita (Lwasa, Koojo, Mabiriizi, Mukwaya, & Sekimpi, 2011). Including the transient population, Kampala approximately has a population of 2 million people. This implies a waste generation of approximately 1,780 tonnes of waste per day. This rate is higher than the national average rate which stands at 0.34 kg per capita per day (Hoorweg & Bhada-Tata, 2012). It is also higher than other cities in low income countries whose rate ranges between 0.4 - 0.6 kg/person/day (Chandrappa & Das, 2012). This high waste generation rate is attributed to high population growth, high average household size of 5.7, rural-urban migration and economic growth. Observation also the staple food (posho and matoke) consumed by the inhabitants of the city results in a lot of waste during preparation and after. Further field observation also showed that informal neighbourhoods generate lower waste than planned neighbourhoods. This could be attributed to high disposal income associated with the latter.

4.2. Composition of waste

"Over 70 percent of the waste generated in Kampala is organic" stated one of the key informants from KCCA (figure 5). This waste stream is largely comprised of banana, potato and cassava peels including food and garden waste. It was observed that the waste is dense and of high moisture content. Plastic waste was also observed to be generated more in planned than informal neighbourhoods. This is probably because planned neighbourhoods generally have higher disposal income which allows them to purchase pre-packed and non-consumable products than informal neighbourhoods.

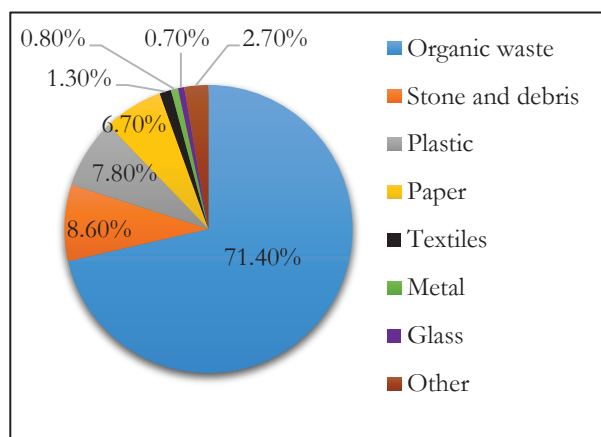


Figure 5. Composition of waste in Kampala (Source: KCCA 2013)

4.3. Storage and sorting of waste

Household survey results indicate that 50 percent of the respondents use sacks (maize meal bags) to store their household waste and about 30 percent use polythene bags. Moreover, 20 per cent use dust bins. Sacks are readily available in almost every household because many household largely consumes maize meal (posho) which is sold in sacks. It was interesting to observe that even private sector clients also use sacks in addition to the containers they receive from their service providers. This further confirms that planned neighbourhood generate more waste. It further suggests containers given by private companies are not adequate enough to store all their waste. The survey result also indicates that the majority (55 percent) and 49.2 percent of respondents who use polythene bags and dust bins respectively are serviced by private companies. Households not serviced by private companies do not receive containers from their service providers.

4.4. Sorting of waste

The Kampala City Council Solid Waste Management Ordinance (2000), revised in 2002 and the national environment waste management regulation (section 4) directs that a generator of waste should sort or separate their waste. Findings from the household survey indicate that only a small proportion (16 percent) of respondents sorts their waste (figure 6).

A two proportional z test was conducted to find out if both informal and planned neighbourhoods do not equally sort their waste (appendix 3 for description of the two proportions z test). The results ($z=-2.975$, $p<0.05$) indicate that the sorting practice is significantly different in the two neighbourhoods. Sorting of waste is not done in informal neighbourhoods where as planned neighbourhoods are involved in sorting. This can be attributed to the provision of at least two waste containers in planned neighbourhoods by their service providers (mainly private companies). Informal neighbourhoods on the other hand are not provided with containers by KCCA or informal waste collectors. Moreover, when KCCA trucks collect the waste in these neighbourhoods all the waste is thrown in the truck, whether sorted or not. Hence households do not see the need of sorting their waste. It was however observed that banana and cassava peelings are sorted albeit at a small scale for purposes of feeding domestic animals.

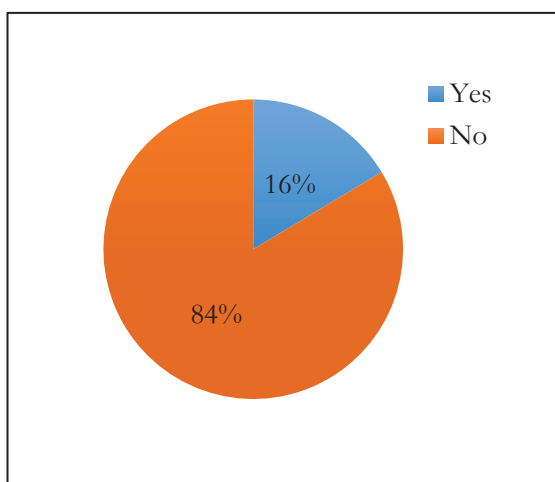


Figure 6. Percentage of households sorting waste

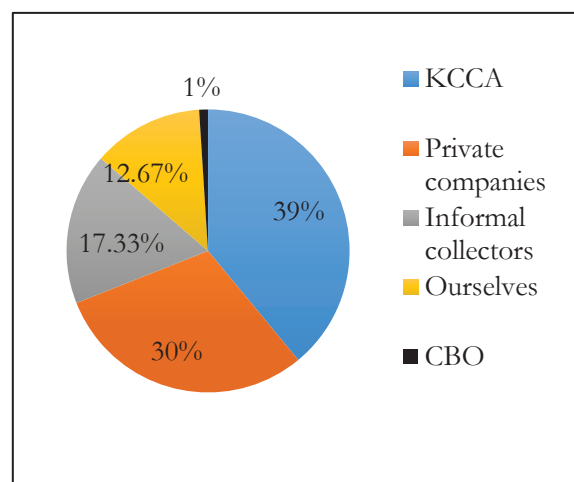


Figure 7. Waste service providers and the percentage of households they serve

4.5. Waste collection and transportation

Waste collection in Kampala is currently implemented through three modes. The first one is self-loading also known as “bring to the truck”. This is where less affluent neighbourhoods take their waste to the KCCA truck on specified days and waste is collected for free. The door to door method is second. This strategy is used in affluent neighbourhoods at a fee. The last one is using collection points. This method is used at public markets.

The Public Health Act cap 281 section 5 empowers local authorities to take lawful, necessary and practical measures to safeguard and promote public health as well as prevent nuisance such as uncollected waste. Moreover, section 4 (2) of the solid waste management ordinance gives KCCA the mandate to collect solid waste by either using its agents, servants or licensed collectors to make sure that solid waste is collected and transported to treatment installations or approved disposal sites. This should be done in ways that fulfil both public health and environment conservation requirements.

Based on the survey, collection of household waste in Kampala is mainly done by KCCA followed by private companies (figure 7). The result also indicates that CBOs are not playing a big role in waste collection. This could be attributed to KCCA’s preference of private companies and the inability of CBOs to compete with private companies. This is however to the detriment of informal neighbourhoods and the poor. CBOs previously played an important role in waste collection. They also provided affordable services to the public (Tukahirwa, Mol, & Oosterveer, 2013).

Moreover, the solid waste management ordinance section 4 (7) stipulates that collection of waste should be done on a regular basis at least once a week in order to avoid a public health nuisance. Private companies have been very successful in following this direction, but KCCA has most often failed. KCCA sometimes takes longer than two weeks to collect waste in certain areas of informal neighbourhoods. Moreover, observation showed that KCCA collects waste along particular main roads hence people in some areas with inaccessible roads are not serviced. A few households interviewed also complained that sometimes they have to pay (bribe) KCCA officials for a truck to pass through their area. Moreover, KCCA trucks often times come almost full such that residents struggle to load their waste in the truck. In the process fights have often ensued. Therefore “*the self-loading strategy is not effective*” remarked a key informant from KCCA.

“*At least 10 trucks each making 3 trips are needed in Nakawa division to completely collect the waste*”, stated another key informant from KCCA. But it was found that only half of the targeted waste was collected in the division during the field visit period. Of the 6 trucks with a tonnage capacity of 7, only 4 trucks were in operation. Additionally, 1 truck of the 4 trucks was shared with Rubaga division. The 4 trucks only made 2 trips which resulted in a collection of 84 tonnes of solid waste per day instead of the targeted 168 tonnes per day. This has resulted into infrequent and inadequate waste collection especially in informal neighbourhoods. This suggests why most households have resorted to engaging informal waste collectors locally known as “abakasilo” to collect their waste. In spite of informal waste collectors collecting money for their service, they have no capacity to transport the waste to Kiteezi landfill. They therefore tend to dump the waste in open areas which are mainly wetlands (figure 8). Moreover, these activities are in violation of section 4 (1) of the solid waste management ordinance which prohibits the disposal of waste on private property, public street, river or anywhere the waste can become a public nuisance.



Figure 8. Waste disposed in open space (wetland)

4.5.1. Cost of solid waste collection services

Section 4 (4) of the solid waste management ordinance also empowers KCCA to prescribe fees for collection and final disposal of waste. The Kolmogorov test which was conducted on the amounts sampled households pay for waste collection reveals that there is no normality in the amounts paid for waste collection in both informal ($D(86) = 0.365, p < 0.05$) and planned ($D(83) = 0.190, p = 0.05$) neighbourhoods respectively. A Levine's test on the sample also showed a heterogeneity of variances on the amount paid for waste collection by households in both informal and planned neighbourhoods $F(1,167) = 14.745, p = 0.05$. There is therefore a significant difference in the amounts paid to service providers in both informal and planned neighbourhoods. This suggests a lack of standard price prescribed by KCCA for waste collection.

All service providers charge lower fees (<5,000), the lower fees however, are mainly paid to informal waste collectors while medium (5,000 - 20,000) and high fees (>20,000) are mainly paid to private companies (figure 9). Besides, households mainly pay the lower fees weekly to informal waste collectors while medium and high fees are paid to private companies monthly (figure 10). The fees charged by private companies are considered to be high to be paid by the poor. *"The fees charged by private companies are too high for our people"*, remarked a local leader from one of the informal neighbourhoods

4.5.2. Rating of waste collection fee

Results from a household survey show that there is a significant yet low relationship between waste service providers and the rating of the fees households pay for waste collection (Chi-square 14.157, $df=6, p < 0.05$) and (Cramer's $V=0.207$). This implies that service providers who charge lower fees ordinarily have low ratings probably because of their lower level of service. There is a common belief that private companies in Kampala charge higher fees, but the ratings by sampled households who pay to these companies reveals that private companies charge moderate fees (figure 11). This could be because households serviced by the companies are mainly high income earners.

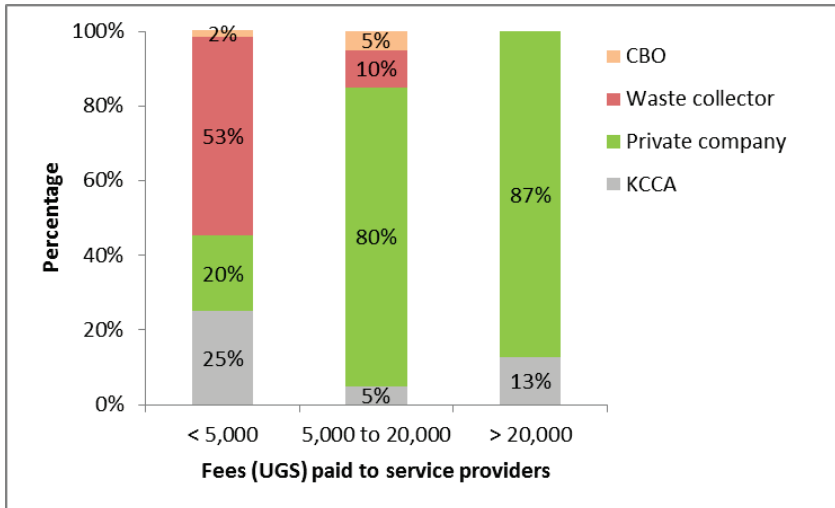


Figure 9. Fees paid to service providers per household

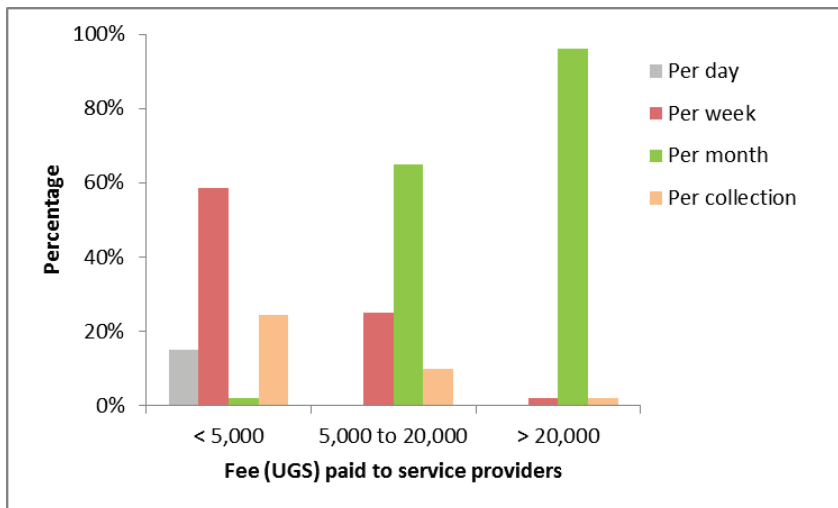


Figure 10. Frequency of amounts paid to service providers for waste collection

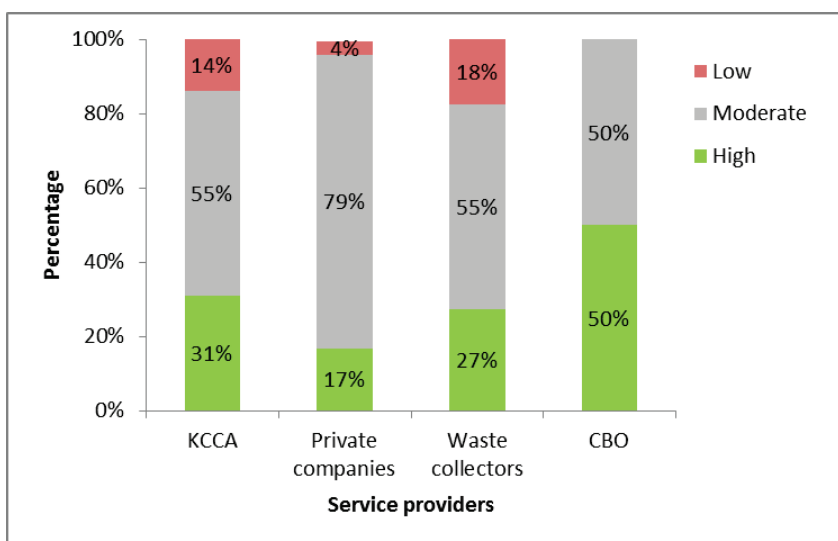


Figure 11. Rating of fees charged by service providers to households for waste collection

4.6. Ways for arriving at waste collection fees

Respondents were asked to state how the amounts they are paying their service providers are arrived at. The majority respondents (53 percent) indicated that the amount is fixed and 47 percent indicated that they bargained. To find if there is no significance difference in the way informal collectors and other waste service providers (KCCA and private companies) arrive at their fees a two proportion z-tests were conducted. The results ($z=-2.670$, $p<0.05$) reveal that there is a significant difference in the way the waste collection fees paid to informal collectors and KCCA are arrived at. This evidence implies that waste collectors bargain with their clients more than KCCA. Informal waste collectors also bargain with their clients than private companies ($z=-6.237$, $p<0.05$). Therefore KCCA and private companies mainly have fixed fees for waste collection. This bargaining process done by informal waste collectors depends on both the negotiation skills of the client and on the informal waste collector. It also depends on the time and amount of waste to be collected. This flexibility by informal waste collectors to allow bargaining could explain why they are increasingly attractive to people.

4.7. Conflicts among waste service providers

Section 20 (e) of the Solid Waste Management Ordinance stipulates that it is an offence to collect, remove or dispose refuse for a fee or other considerations without a valid permit. Interviews with key informants from KCCA and private service provider revealed that apart from informal waste collectors operating without licenses, a few private companies also operate illegally. To acquire the permit one is required to pay a fee of up to 400,000 UGS to KCCA and to be able to transport the waste to the landfill a National Environment Management Authority (NEMA) license is also required. This license however cost 5 million UGS. *“It is a problem to acquire the NEMA license because the money they require is too much”* stated a key informant from one of the private companies. This could explain why there are illegal private companies operating in Kampala. This situation is further exacerbated by the lack of specific operating areas for service providers. This situation has contributed to conflicts among service provider in Kampala.

The illegal companies are said to be taking away clients that belong to service providers with valid permits because they charges lower fees. KCCA has tried to encourage these illegal operators to acquire valid permits but their efforts have had little success. Private companies have also clashed with informal waste collectors. This is because when informal waste pickers are collecting recyclable materials they sometimes destroy the waste containers (polythene bags). This has resulted littering and scattering of waste on the road side. It has also contributed to the increase in loading time as well as general efficiency for private companies.

Moreover, private companies have also being in conflict with KCCA. A key informant from one of the private companies stated that *“there have been instances where we have charged a client a certain fee, only to realize later that we lost the client because KCCA offered a much cheaper fee”*. This could also explain why KCCA has failed to set a standard fee waste collection fees despite having a regulation that allows it to do so. Therefore KCCA is being said to be exhibiting double standard because on one hand it is claiming to encourage more operators in waste collection while on the other hand it has interests in the business to the detriment of the former.

Most key informants in Kampala share the same view that waste collection zones for service providers be established as control mechanism to reduce illegal operators as well as reduce conflicts among service providers in the city. *“KCCA should pull out of the waste collection business so that it concentrates on its regulatory mandate”* according to a key informant for the new formed Urban Waste Management Association”. This is seen to helpful to KCCA’s conflict of interest.

4.8. Income strata of service recipients

It is KCCA policy to collect waste for free in poor neighbourhoods. However, results from the sampled households reveal that of the 19 households that pay KCCA for waste collection 89 percent of these household have a monthly income of less than 300,000 UGS (low income). Therefore using low income as a proxy for poor households it can be said that there is evidence that KCCA also charges in poor neighbourhoods. This is contrary their policy of providing free waste collection services in poor neighbourhoods (Kampala Capital City Authority, 2013).

Moreover, a two proportional z test conducted to find out whether there is no difference in the income strata serviced by informal waste collectors and other service providers. The results ($z=1.52$, $p<0.05$) and ($z=1.167$, $p<0.05$) show that there is no significant difference in low and high income strata serviced by informal waste collectors and KCCA respectively. There is however a significance difference in the medium income strata ($z=-2.038$, $p<0.05$) serviced by these two providers. The same test conducted on informal and private companies also shows that there is a significant difference in two income strata, low ($z=-2.814$, $p<0.05$) and high income ($z=4.292$, $p>0.05$) serviced by the two providers. There is conversely, no significant difference in the medium income strata ($z=-1.620$, $p>0.05$).

These results first of all show that informal waste collectors provide waste service in all income strata. The results further show that informal waste collectors service low income households as much as KCCA. The reason why KCCA serves medium income earners more than informal waste collectors could be that most of them are either in planned neighbourhoods or they are staying alone accessible main roads where KCCA services are better.

As expected the results show that informal waste collectors serve more households with low income than private waste collectors. Private companies on the other hand service more high income households than informal waste collectors. This is because high income earners have more money to pay private companies as well as more waste that they want to quickly and frequently get rid. The results additionally show that there is sufficient evidence that indicates that informal waste collectors serve middle income waste collectors as much as private companies. This could be because some middle income households do not want to spend a lot of money on waste collection hence they also engage informal waste collectors. Besides, income waste collectors tend to develop a personal relationship with their clients such that payment is at times not done immediately the waste is collected.

Table 4 shows that informal waste collectors by far charge the lowest average amount for waste collection than other service providers. Whereas private companies by far higher charge higher fees than other service provider. The competitiveness of the informal waste collectors could also be because they know the income levels of their clients since they stay in the same neighbourhood hence they charge what people can afford. The monthly average amount charged by KCCA is high because of the high fees they charged households in high income neighbourhoods.

4.8.1. Satisfaction levels to the quality of service

Using a Likert scale of 1 not satisfactory, 2 satisfactory and 3 very satisfactory respondents were asked to state the level of satisfaction with the way their waste was managed in their household. The survey results show that households serviced by informal waste collectors receive unsatisfactory service than those households service by other service providers (figure 12).

Table 4. Monthly average amount paid for waste collection in UGS

Income category	KCCA	Private Companies	Informal collector	CBOs
Low income	1,300	10,167	1,423	1,000
Middle income	13,559	19,688	2,579	2,000
High income	43,000	31,964	3,000	20,000
Overall	13,403	22,964	2,298	7,667

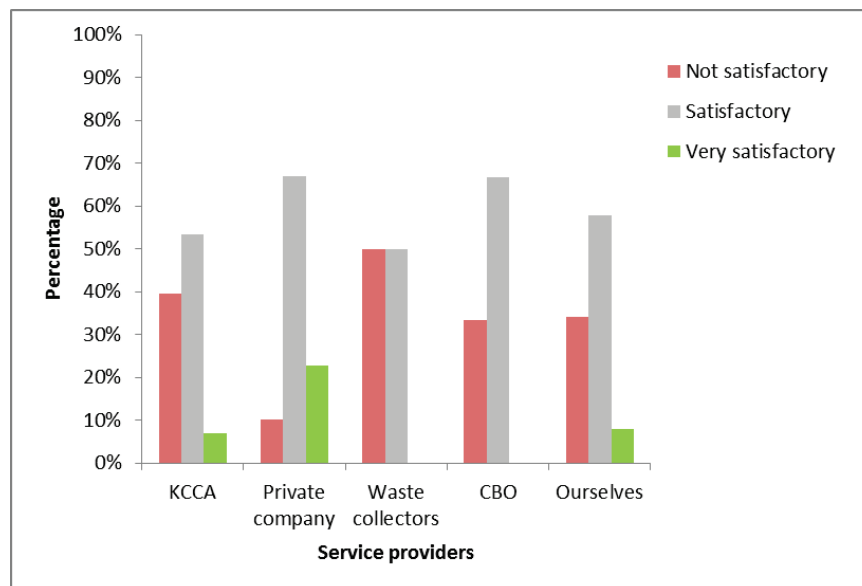


Figure 12. Household satisfaction to waste management services

To ascertain whether there was no significant difference in the levels of satisfaction of households served by informal waste collectors and KCCA as well as private companies, a two proportion z-test was conducted (CBO is not considered in this test because it does not meet the assumption of having at least 10 successes and 10 failures).

The test results show that there is no significant difference in the levels of satisfaction between informal waste collectors and KCCA, not satisfactory ($z=-1.253$, $p>0.05$), satisfactory ($z=0.424$, $p<0.05$) and very satisfactory ($z=1.940$, $p<0.05$). There is however a significant difference in the levels of satisfaction between informal waste collectors and private companies, not satisfactory ($z=-5.251$, $p<0.05$), satisfactory ($z=2.073$, $p>0.05$) and very satisfactory ($z=3.713$, $p>0.05$).

The similarity of results in the satisfaction levels between KCCA and the informal sector reveals a contrary perspective from dualist theories which state that there are differences between services provided by the informal and formal sectors (Moser, 1978). This difference could be because KCCA does not collect the waste as frequent as they should hence their clients are not very satisfied. Besides, KCCA does not collect waste in all parts of the neighbourhood partly due to poor access roads in informal neighbourhoods. The dualist theory however applies when comparing the satisfaction level of private companies and informal

waste collectors because the results reveal that private companies provide a very satisfactory level of service to their clients than informal waste collectors.

4.8.2. Modes of transportation

Compactor and open tipping trucks were observed to be commonly used in transporting waste from households to the landfill in Kampala. The informal waste collectors on the other hand manually carry the waste on their heads or backs using sacks. They also use wheel barrows, bicycles and motor bikes to transport waste to the nearest illegal dump site. It was also observed that during collection and transportation, waste spillage is prevalent due to improper handling, overloading and inadequate covering of the waste (figure 16).

“Compactor trucks are not the right vehicles to collect waste in Kampala at the moment because of the high organic stream and density of the waste. About 850,000 to 1,000,000 UGS is spent on average to service one compactor truck after a period of three months. This is not ideal because ordinarily waste collection trucks are supposed to be maintained based on their mileage. But we do this because of financial constraints, as you may know that compactor trucks have a high maintenance costs. The ‘bring to the truck’ self-loading strategy results in frequenting starting and stopping of the engine. Hence we experience a lot of truck break downs because the truck’s charging system because 98 per cent of the compactor truck is automated. The other challenge is under staffing of drivers for waste collection; hence most of the drivers who drive the trucks have no training in solid waste management”, stated a key informant from KCCA.

This could explain why 15 trucks were found not be operational at the KCCA main office during the field work period. Besides, the lack of training of key people like drivers contributes to mishandling of waste during collection and transportation there explaining the waste spillage that take place during the collection and transportation of waste.

4.8.3. Adding waste collection fee to house rentals

The survey results indicate that the majority of the respondents are of the view that a waste collection fee should be added to fees paid for house rent (figure 13). Furthermore the majority of renters and non-renters support the idea of adding a waste collection fee to house rentals (figure 14). The reason for this could be that most people renting houses want their landlords to be responsible for waste management.

To ascertain whether there was no sufficient evidence of a relationship between house occupant status (renters or non-renters) and their view of adding a waste collection fees to house rent, a chi-square test was conducted. The results indicate that there is no sufficient evidence of a relationship between the house occupant status and their view to adding a waste collection fee to house rentals (Chi-square =0.445, df =1, $p > 0.05$) and (Cramer’s $V = 0.04$) i.e. very weak. This result suggest that even though the household survey showed that the majority of households indicated that waste collection fees should be added to house rentals, these findings could be out of chance. This further indicates that the view of adding a waste collection fee to house rent cannot be generalised to the entire population of Kampala.

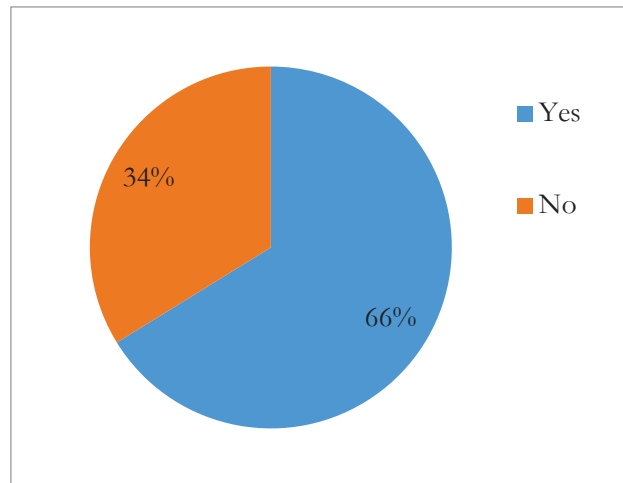


Figure 13. Respondents' view to adding waste collection fee to house rentals

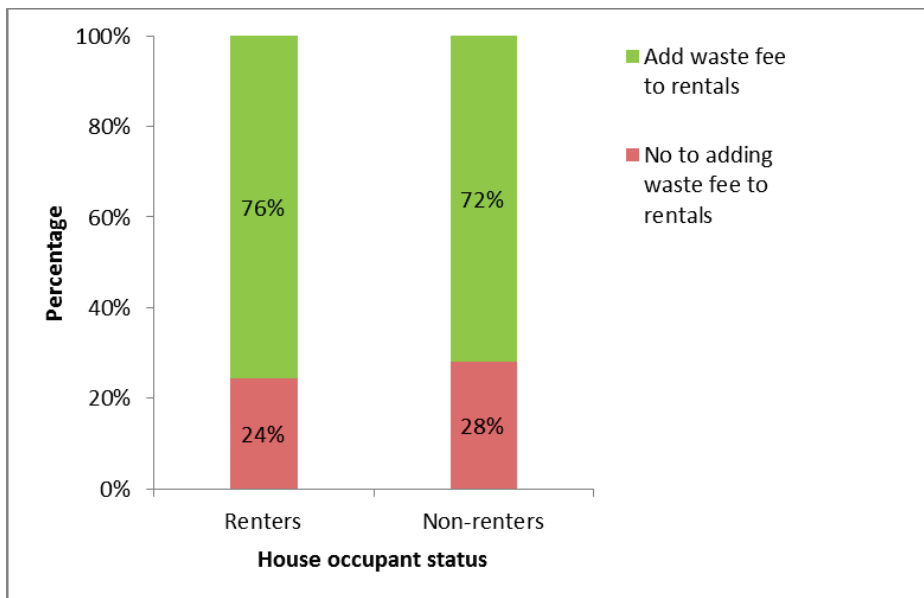


Figure 14. House occupant's status and their response to adding waste collection fee to house rental

4.8.4. Willingness to pay for waste collection

The current solid waste management system in Kampala was established on the principle that the waste generator pays. This is stipulated in the solid waste management ordinance. The result of a household survey indicates that 52 percent who did not pay for waste collection are not willing to pay. Only 48 per cent of the respondents are willing to start paying. This is could because the majority of these people who do not pay for waste collection still have the traditional idea that it is KCCA's responsibility to manage waste in the city. This further reflects the people's lack of adequate awareness on SWM regulations. Section 4(1) of the solid waste management ordinance states that every owner or occupant of a commercial or dwelling premise is responsible for their generated waste until it is collected by KCCA, its appointed agents or licenced operators.

To find out if there was any correlation between willingness to pay and the type of neighbourhood (informal or planned), household size, education level, income and gender, a chi-square was carried out. The results of the chi-square test indicate that the type of neighbourhood does not influence willingness to pay for waste collection (chi-square =0.772, df =1, $p>0.05$). The results also show that household size (chi-square=3.601, df=1, $p>0.05$) and income (chi-square=3.603, df=3, $p>0.05$) do not influence willingness to pay. Besides, house occupant status (chi-square=1.154, df=1, $p>0.05$) and education level (chi-square=5.316, df=3, $p>0.05$) according to the survey results do not correlate with willingness to pay. These results could also be attributed to a lack of awareness of better solid waste management practices and laws.

There is however, a significant correlation albeit weak between households willingness to pay and the gender of the household head (chi-square=4.481, df =1, $p<0.05$), (Cramer's $V=0.189$). It is expected for female respondents are more willing to pay for waste management than men. This is because traditionally women in most part of Africa have the role of taking care of cleaning and subsequent disposal of waste. To the contrary, results in this survey found that more males (65 per cent) are willing to pay for waste collection than females (35 per cent). The reason for this could be that there were more male household heads than females in the survey. The second reason could be that in the presence of male household heads, women would rather ask male heads to talk to strangers. The final reason could be that female household heads have challenges in making decisions which relate to payment for something at a household level.

The survey further showed that household who are not paying for waste collection are willing to start paying an average amount of 7,050 UGS per month. But only 36 percent of households were willing to pay this amount.

4.9. Waste disposal

According to the survey, disposal of waste in open areas is the most dominant disposal practice among households who do not pay for waste collection (figure 15). The household survey further shows that this practice is only in informal neighbourhoods. Observation and subsequent mapping of open waste disposal sites in both informal and planned neighbourhoods however, shows that open space disposal is also practiced in informal and planned neighbourhoods (figures 22 and 23). Apart from informal waste collectors, household and industries also have a tendency of dumping waste in open spaces. *"All that waste you see there, does not only come from these houses but also from those industries. They dump their waste at night"*, remarked one of the local leaders. Disposal in open spaces is however more wide spread in informal neighbourhoods. It is remarkable to also note that the tendency of disposing waste in open space in informal neighbourhoods is because it is a way of reclaiming a wetland (Kulabako, Nalubega, & Thunvik, 2007) where as the high occupancy rate per plot of available land in the planned neighbourhood of Ntinda could explain where are fewer open disposal points or illegal dump sites (Nyakaana et al., 2000).

It was also observed that burning of waste in the backyard (figure 17) and open spaces (figure 19) is also very common practices in Kampala. This can also be attributed to a lack of awareness of better ways of managing waste. This practice adversely affects the air quality and causes respiratory problems, headaches, nausea and rashes. It also increases the risk of people developing heart and lung diseases (Government of Canada, 2013).

In addition, both neighbourhoods have a tendency of dumping their waste on the road side (figure 18). It was also observed that most plots in planned neighbourhoods have a small piece of land between the drainage and the wall fence. It is therefore on this piece of land (on the roadside) that some households who do not pay for waste collection dispose their waste. In informal neighbourhoods, when KCCA

announces that it will collect waste in the neighbourhood people usually put their waste on the road side. However it sometimes happens that KCCA does not come, the waste is also left there and heaps continue to accumulate with time and scatters everywhere. Just like dumping of waste in open space, discussions with residents in Ntinda revealed that people have a tendency of dumping waste on the road sides at night when no one can see them. Road side disposal is problematic not only because of being a nuisance to people, their health and the environment but because it also contributes to floods (Okot-Okumu, 2012) especially in low lying areas. Respondents who dispose waste in the communal collection points are households that are near public markets where communal collection points are still in use. This is because the use of communal collection points in neighbourhoods was abolished with the coming of privatization in waste management in Kampala. *“Communal collection containers were abolished in the neighbourhoods because they were associated with unsanitary conditions?”*, stated a key informant from KCCA.

The disposal of waste in open space, road side and backyards is not only against the solid waste management ordinance but it is also against Article 39 of the Ugandan Constitution which stipulates that every individual has the right to a clean and health environment (Republic of Uganda, 1995).

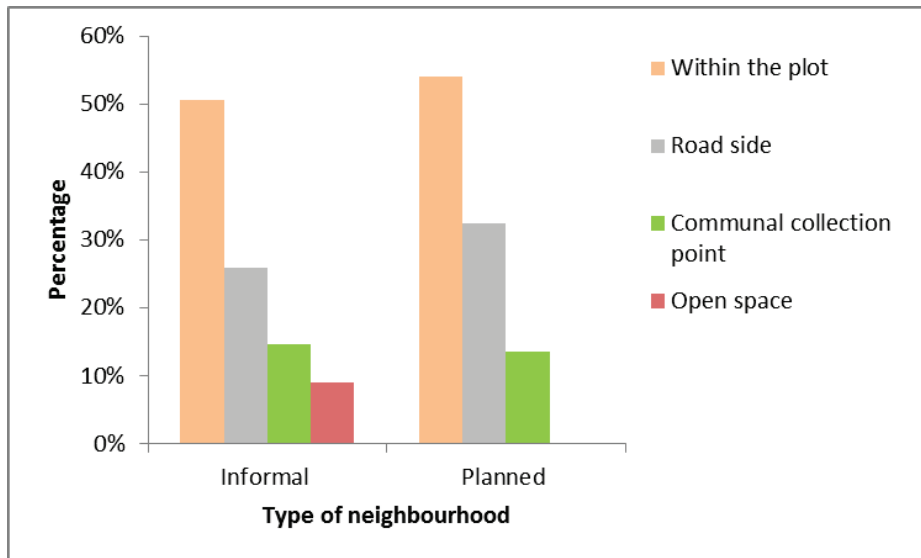


Figure 15. Disposal practices of household who do not pay for waste collection



Figure 16. Open truck without a cover transporting waste



Figure 17. Backyard dumping of waste with indications of waste burning



Figure 18. Burning of waste in open spaces



Figure 19. Burning of waste in open spaces



Figure 21. Stuck truck being pushed by a dozer



Figure 20. A few products made by KIWI

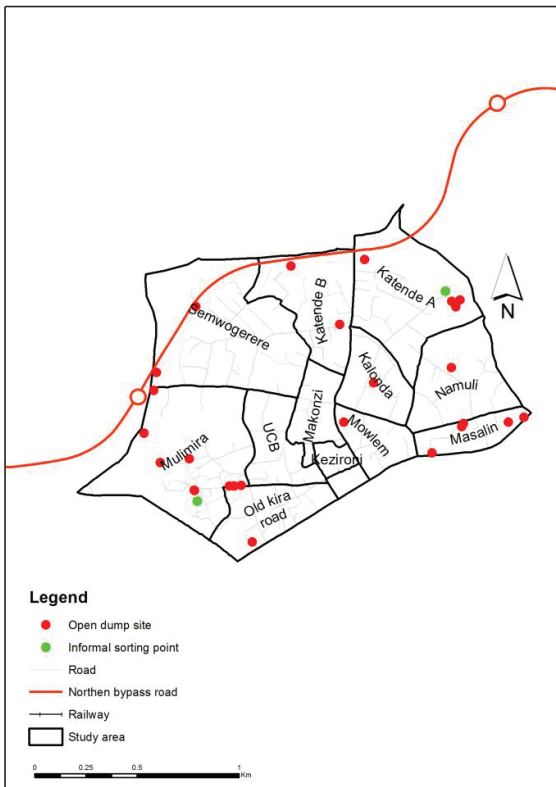


Figure 22. Illegal dump sites in Bukoto 1

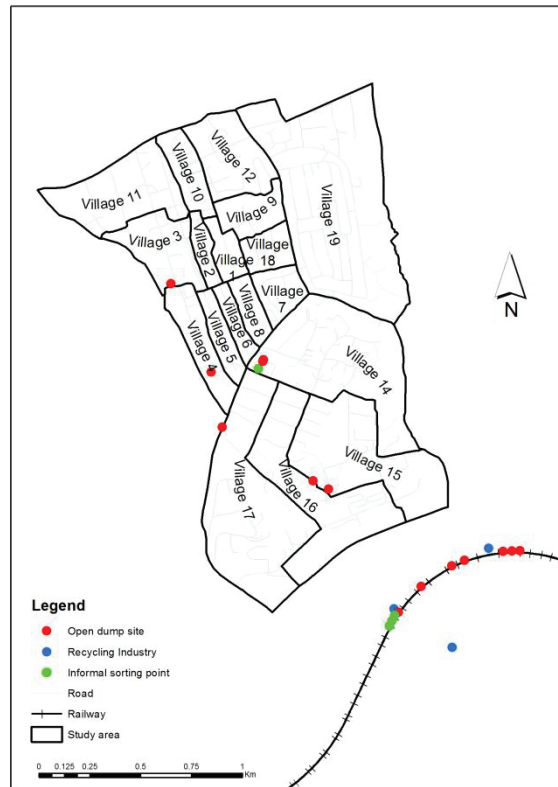


Figure 23. Illegal dump sites in Ntinda parish

4.9.1. Waste disposal at Kiteezi landfill

“An average amount of 950 tonnes of waste is received per day at the Kiteezi landfill”, according to a key informant from KCCA. This implies that over 800 tonnes of waste is uncollected in the city considering that 1,780 tonnes of waste is generated per day in the city. The uncollected waste is mainly in informal neighbourhoods where KCCA largely provides the service.

Mugagga (2006), indicated that waste pickers at the landfill were sometimes harassed and chased from the landfill in accordance to section 10 (e) of the solid waste management ordinance which prohibits someone to collect, transport, remove or dispose refuse without a valid permit. However, an interview with a KCCA key informant at the landfill revealed the informal waste pickers are no longer chased at all in spite of the their activities being an offence. This is because they are considered helpful in reducing the amount of waste at the landfill considering that the landfill is almost full. *“About 500 informal waste collectors operate at this landfill everyday sorting waste unlike 12 years ago when we were only 7 of us. The challenge we face at the moment is that the people who buy our waste coming from Kampala usually exploit us through changes in the prices they offer us for our waste”*, indicated an informal waste collector interviewed at the landfill. This was in reference intermediaries who buy recyclable waste material and sell to recycling industries. It was also observed that the sorting of waste is done under unhygienic and unsafe conditions. A few of them were seen coughing. This key informant also stated that they have never undergone any health check-up. KCCA key informant interviewed at the landfill estimate that about 11 tonnes of waste is recycled per day at the landfill.

Further observation at the landfill revealed inadequate management of the landfill. For instance leachate was seen flowing indiscriminately. Moreover, scavenger birds were also observed. These birds are also responsible for scattering of waste. These activities therefore pose environmental and health threats. The weighbridge was not in operation reportedly for a couple of months hence the amount of waste brought by each truck was approximated hence one of the key informants from a private company remarked, *“how can you control waste if you can not properly measure it?”* The landfill is also not completely fenced hence open to any person any time. The landfill is also surrounded by private houses, many of which belong to the waste collectors according to the KCCA key informant. *“Four (4) recycling factories are operating around the landfill. These factories complain of lack of proper access roads to the landfill due to informal development around the landfill”* added a key informant from KCCA. This suggests that informal waste collectors are earning enough money from their operations such that they are able to build their own houses. However, their houses have hampered the expansion of the landfill which is almost full. The developments around the landfill have further created a challenge for sourcing soil for burying the waste; hence the layer of soil that is put is small. This has resulted in increased smell and trucks getting stuck at the landfill (figure 20) and worse when it rains

In spite Uganda having ratified the Basel Convention on the control of trans-boundary movements of hazardous waste and their disposal as well as has having set local regulations regarding waste toxic and hazardous waste (Mugagga, 2006), there is a tendency to dump hazardous waste from industries at the landfill. Besides, there is no gas collection and treatment of waste at the landfill.

4.10. Waste composting, reusing and recycling

Composting, reusing and recycling activities are generally not organized and done at a local and small scale. The survey reveals that 86 per cent of recycling activities are taking place at the industrial area located in Nakawa division where none biodegradable waste is recycled.

4.10.1. Composting

Composting of waste in Kampala is low and mainly done at a small scale; this was observed to be undertaken in people’s farms and gardens. Individuals and CBOs are in the fore front composting organic

waste. The CBOs charge a fee to non-members and members access composite manure for free. Composting of waste is not wide spread in Kampala due to land inadequacy and lack of support from KCCA (Mugagga, 2006). In most cases the people who are involved in composting use low technology and tend not to follow the composting steps correctly. Composting is important as it can reduce the amount of waste for landfilling. Correctly done composting can also be used as organic fertilizer which increases soil stability and nutrients thereby improving plant growth.

4.10.2. Recycling of waste materials

Water bottles, polythene bags, paper, charcoal (in the form of briquettes), drinking water straws as well as metal are generally reused and recycled in Kampala. There is also recycling of organic waste for making charcoal briquettes and for feeding animals. Scrap metal business is one of the lucrative recycling business activities in Kampala. According to Jaramogi (2013), in spite of the imposed ban on nonferrous scrap metal by government four years ago due to suspected harbouring of criminals and vandalism coupled with unsound environmental practices (burning waste to remove metals), scrap dealing is still prominent in Kampala. Scrap metal is used locally in informal workshops and exported. Like in many developing countries the urban poor are the major players in collecting valuable waste materials from people's houses, dump sites as well as the landfill. The collected waste materials are sold to recycling industries directly and sometimes through intermediaries.

Waste recycling albeit unorganized and inadequately supported by KCCA plays an important role in providing household income to those involved. *"I am able to pay my house rent and my children school fees from this business"*, stated one of the informal waste collectors interviewed.

At least 8 plastic waste recycling industries exist in Kampala from a single plastic waste management plant in 2010. A key informant from one of the recycling industries stated that *"80 percent of recycling materials brought to this industry comes from informal waste collectors"*. He continued by stating that *"It is not easy to establish a recycling industry in Kampala due to high operational costs coupled with high cost of recycling equipment and the unorganized nature of our suppliers"*. Hence, on average most of the recycling companies process 8 to 11 tonnes of waste per day. Polyethylene terephthalate (PET) is one of the waste materials on high demand in Kampala because of the available market of flakes (shredded waste) in China. Observations at one of the recycling companies visited however showed that workers do their work without protective clothing. Leakages of untreated water from waste washing machines were also observed. This therefore poses health and environmental threats. This could suggest why a few workers at the industry were noticed coughing.

4.11. The role of NGOs in recycling

In Kampala women groups play an important role in reducing, reusing and recycling waste. One such organization is the Kinawataka Women's Initiative (KIWI). This organization is comprised of single mothers, widows, disabled and people living with HIV/AIDS. Others are women from war ravaged areas. KIWI was formed in 1998 to help raise the standards of living in the community. One strategy used in improving the living standards of its members is through training in waste recycling activities. Purse handbags, shopping bags, baskets, ropes and mats are made from waste materials such as polythene bags and water drinking straws (figure 21). The key informant from the organisation stated that *"waste recycling is not just a way of improving the livelihoods of the women but it was also environmentally friendly"*.

KIWI however, faces some challenges which include lack of transport to carry their waste materials and products. Moreover, they manually press the straws because the pressing machine broke down just after barely working for only months. There are also challenges in repairing the pressing machine because of alleged corruption that was involved in the procurement process. Hence it is difficult to contact the

supplier again. As a result some women ran away because the manure pressing of straws is very tedious. The other challenge is that local people find their products rather expensive. A good market for their products however exists in Europe and neighbouring countries like Sudan, Kenya and Rwanda.

Moreover, faith based organizations are also active in recycling waste. A Rocha Uganda is for instance involved in making of charcoal briquettes and training of the youth and women in income generating activities such as making and selling of charcoal briquettes. A Charcoal briquette is smokeless solid fuel used for cooking and boiling. They also buy water bottles from informal waste collectors which they sell to recycling industries.

4.12. Problems encountered in the neighbourhood

Respondents were asked to indicate solid waste management related problems they were experiencing in their neighbourhood. The majority (68 percent) of the respondents indicated that indiscriminate waste disposal was rampant and 17.2 percent indicated that they were experiencing health and environmental problems. 7.6 percent mentioned that they did not experience anything while 2 percent of the respondents indicated other reasons.

To find out whether there is no significant difference indiscriminate waste disposal in both informal and planned neighbourhoods, a two proportion z test was carried out. The results ($z=2.270$, $p>0.05$) show that there is a significant difference in the problems experienced in the two neighbourhoods.

These results indicate that indiscriminate disposal of waste is more problematic in informal than planned neighbourhoods. This could be due to inadequate collection of waste by KCCA and the tendency of informal collectors dumping the waste not far from where they get the waste. This problem contributes to poor aesthetics, health and environmental threats.

4.13. Solid waste management awareness

The Kampala City Council Solid Waste Management Strategy (2002), revised in 2006 emphasizes the need to educate members of the public on solid waste management. The household survey conducted shows that 55 percent of respondents received information on SWM in the last twelve months. The information received is largely on proper waste disposal (figure 24). This further confirms that indiscriminate disposal of waste is the most problematic SWM issue in Kampala. The survey also shows that mega phones are widely used to disseminate SWM information to the public (figure 25). Interviews with a few people in the neighbourhoods showed that mega phones are used by local leaders in unplanned neighbourhoods to when announcing the time the KCCA truck would collect waste in the neighbourhood. “...*encourage the people to burn the waste*”, was the response of one of the local leaders when asked to state how waste management could be improved in the neighbourhood. The response suggests that local leaders which KCCA uses to raise awareness on solid waste management are not very knowledgeable on better solid management practices. This further suggests that the public who rely on local leaders for SWM information to do not receive adequate information which can enhance proper SWM in their neighbourhoods. Additionally figure 25 also shows that there is limited use radio and television therefore also suggesting there inadequate involvement of the civil society and the media in raising awareness.

4.14. Community participation

One of the objectives stipulated in the solid waste management strategy is to work in active partnership with the community. To achieve this objective the KCCA introduced the monthly clean ups campaigns in all neighbourhoods. The business community, NGOs, CBOs, youth groups and government department like prisons have come on board to support KCCA by providing cleaning utensils as well as the actual

cleaning. However, observation in two neighbourhoods in Nakawa division showed that the monthly cleaning activities are hardly carried out. One of the local leaders interviewed said that “the monthly clean ups are not done anymore because the community showed resistance, so I have stopped organising them”. Moreover, the activities of supporting groups in most neighbourhoods have been faced with poor community turn out. “The poor community turn out for clean ups is due to people’s poor attitude to waste and their traditional belief that waste management is a responsibility of KCCA alone” stated a key informant from KCCA. Poor community participation in Kampala is also as a result of the high transient nature of the population (Kampala Capital City Authority, 2013). Therefore this lack of community participation in solid waste management is one of the contributing factors to KCCA’s failure to attain an 80 percent waste collection target (Republic of Uganda, 2010).

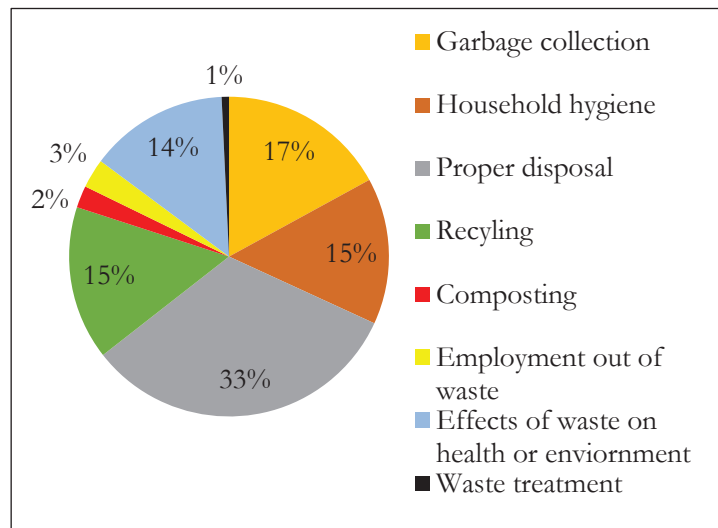


Figure 24. Type of SWM information received by respondents in the last 12 months

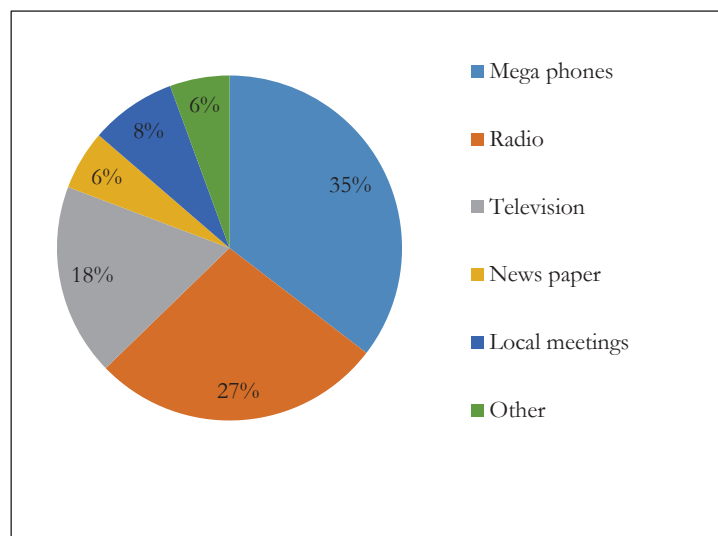


Figure 25. Ways respondents receive SWM information

4.15. Willingness to participate in better solid waste management

The survey indicated that 94 percent of the respondents are willing to participate in better solid waste management. Only 6 percent indicated that they are not willing because they have no time. This result indicates that people are willing to participate in solid waste management but there seems to be inadequate motivating, mechanisms and information for the public.

4.16. Integration of informal and formal solid waste systems

“The attitude towards waste pickers in Kampala is very bad. Those involved in the collection of waste are usually considered cursed or insane” according to key informant from KCCA. This is in spite of them providing affordable waste collection services to many households. During the survey respondents were asked to indicate whether it is a good idea to integrate informal and formal solid waste management system. 85 percent of the respondents indicated that integrating the two systems is a good idea while 15 percent were of the contrary view. To test the weather this response is the same in both informal and formal neighbourhoods a two proportion z test was conducted. The test result ($z=-0.489$, $p>0.05$) indicates there is no significant difference in the proportions of respondents who are in favour of integrating the two systems in both informal and planned neighbourhoods. This means that both informal and planned neighbourhoods equally favour the idea of integrating the informal and the formal solid waste management systems. Besides, all the key informants interviewed were also of the view that integration is important. This is because informal waste collectors serve all income groups in Kampala. *“When they are integrated, areas where the truck does not reach will be serviced”*, stated one of the key informants. Integration is also seen as a way of improving the social perception, working conditions and capacity of those involved in the informal solid waste management system. *“Once they are integrated it can be easier to train them to do their work in a better way. They can also be protected”*, stated one of local leaders interviewed.

4.17. Respondents’s views for improving collection and indiscriminate dumping of waste

Respondents were asked to state how waste collection could be improved in their neighbourhoods. The results indicate that 40 percent of the respondents consider that the provision of communal disposal containers in their neighbourhood would help to improve waste collection (figure 26). This shows the respondents desire to get rid of the waste at any time without having to wait for a particular day. Moreover, to deal with the problem of indiscriminate waste disposal, a number of responses were given. But the provision of more trucks and frequent waste collection is seen to be more important in their neighbourhoods (figure 27).

4.18. Aspects to be considered for improvement of SWM in Kampala

Key informants were asked to indicate by ticking and eventually prioritize 3 aspects or elements (number 1 being highest priority) that should be taken into account to in any effort to improve SWM in Kampala’s informal and planned neighbourhoods. First of all, access to information and education; recognition of informal sector contribution and physical operations are three aspects with the highest frequency considered by key informants in both informal and planned neighbourhoods (appendix 4). Unlike the frequency, the prioritization of 3 aspects shows different aspects being selected to be priority in both neighbourhoods (figure 28). However, what is coming out more prominently from the analysis of both the frequency and the prioritized aspects is that governance elements are very significant in any endeavour to improve SWM in Kampala.

Therefore based on the analysis of the household survey results and the prioritization of 3 aspects by key informants in Kampala, the initial conceptual framework shown in figure 1 (page 14) was modified. The modified conceptual framework differs from the first one in that two aspects, access to waste and

institutional reform were removed because the key informants in Kampala seem not to consider them very important at the moment. For instance both waste collectors and private companies have access to waste resources in the streets, households and landfill. Besides, KCCA is a relatively new institution still undergoing a number of institutional changes. Moreover, discussions with key informants revealed that the recognition of informal sector contribution and access to information and education are actually governance elements or aspects and not structural-operational elements as shown in figure 1. Figure 29 therefore shows the modified conceptual framework.

Just like the household survey shows, access to information and education is a priority in informal neighbourhoods. It will help people to develop a positive attitude towards waste and for them to act responsibly. *“They should be given certificates to show that they are recognized by KCCA”*, stated one of the key informants in reference to the aspect of the recognition of informal waste collector contribution. This aspect is seen as important to officially bring the informal waste collectors on board as important waste service providers to help in increasing the coverage of waste collection especially in informal neighbourhoods where access by trucks is a challenge. Finances on the other hand are needed to upscale the reusing and recycling activities of informal waste collectors, youth and women groups. Figure 28 also shows key informants prioritised separate aspects in planned neighbourhoods. *“The law has to be changed. The licenses that we have do not allow us to take the waste for recycling. It only allows us to collect and transport the waste to the landfill”*, according to a key informant from a private company. Partnership with the community, informal waste collectors, private companies as well as CBO and NGOs is also considered important because KCCA alone can not solve the problem of waste in the city. *“The informal waste collectors also have to be organised for KCCA and NGOs to easily reach out to them to improve their capacity”*, stated another key informant emphasizing the need to form informal waste collector organisations.

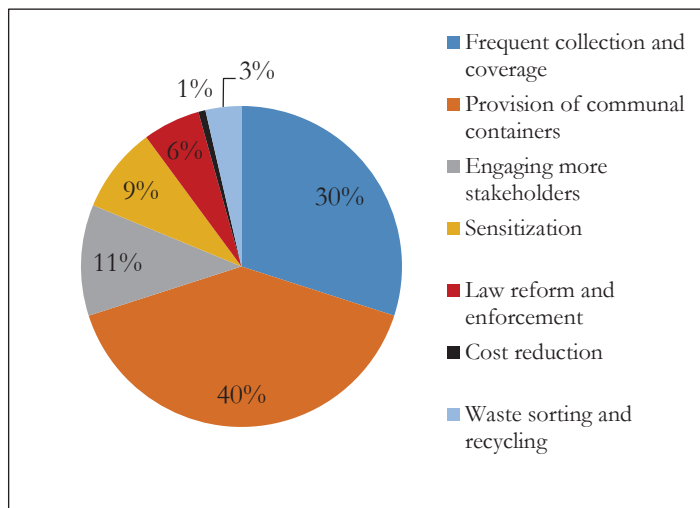


Figure 26. Respondents view for improving waste collection in their neighbourhood

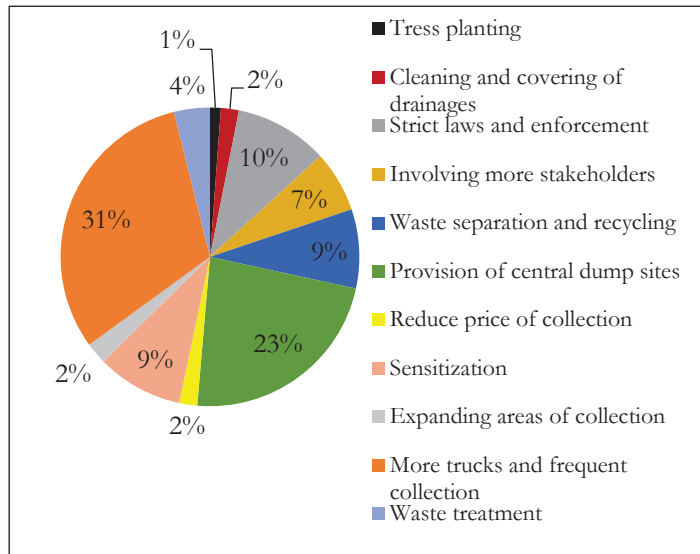


Figure 27. Respondents' views to solving problems experienced in their neighbourhood

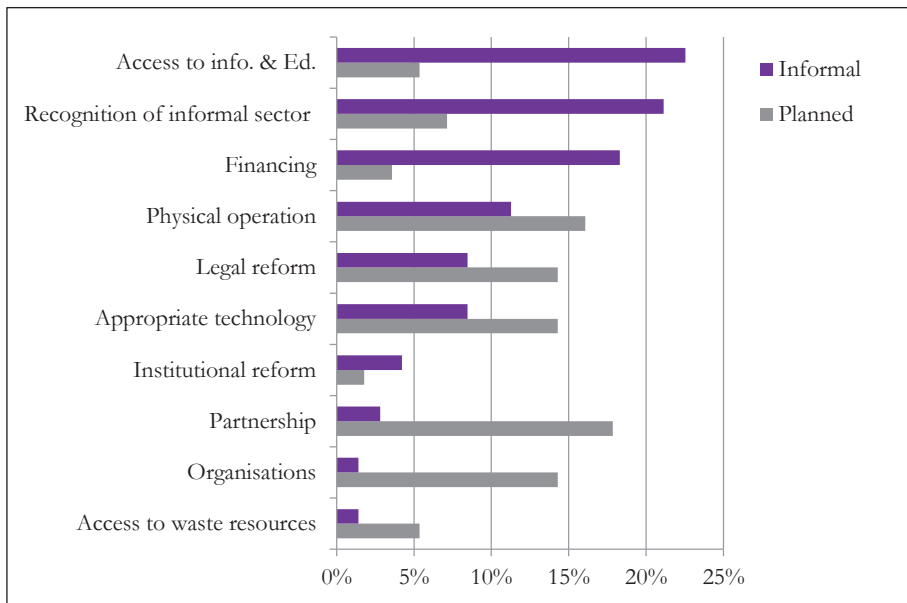


Figure 28. Percentage priority aspects for improving SWM in Kampala

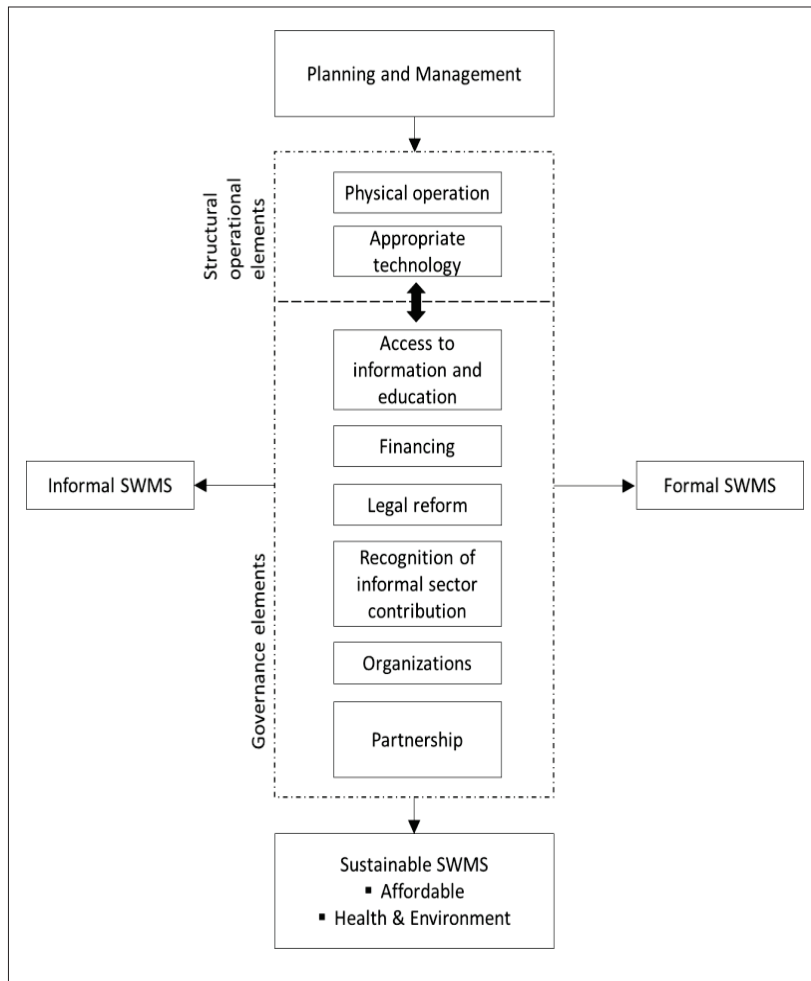


Figure 29. Modified conceptual framework for addressing SWM in Kampala

4.19. Solid waste management indicators

Furthermore key informants were presented with a list of variables derived from literature (appendix 1, table 2) for them selecting appropriate one and recommending new ones were necessary to derive indicators for measuring SWM performance in Kampala. Table 5 shows the indicators which were considered not important in Kampala and those recommended. Table 6 on the other hand shows a complete list of indicators and the units of measure as recommended and validated by key informants.

Table 5. Usable and reformulated or recommended indicators

Variable	Explanation
Generation	Reformulated into specific waste generation
Waste composting	Included to deal with the high organic waste
Sorting of waste	Included to promote sorting of waste at source
Handling	Improved to include generation of waste from different neighbourhoods
Collection	Reformulated into access to service
Carbon footprint	Removed because it considered not important since more collection

	vehicles are needed.
Financing	Reformulated to include budgets on community initiatives and recycling activities.
Inspection	Removed because its enforcement was covering this aspect
Inclusivity	Reformulated into stakeholder participation
Sound institutions	Reformulated into Inter-sectoral collaboration
Transparency	Reformulated to include publicizing of SWM regulations and procedures for participation
Enforcement	Number of successful enforcement actions against waste management offenders
Waste composition	Added to help in planning for targeting the reduction of particular waste stream
Illegal dump sites	Included to handle illegal dumping of waste which is a of health and environmental concern
Awareness and behaviour change	Included to emphasise the need for awareness to help change peoples attitude to waste
Accountability	Added to make service provider answerable
Service provider conflicts	Included to reduce conflicts among service providers

Table 6. Indicators for measuring SWM performance in Kampala

Variable	Definition	Unit of measure
Specific waste generation	Percentage of specific waste streams produced from households	Percentage
Waste compositing	Percentage of organic waste stream composited	Percentage
Recycling	Percentage of waste recycled or recovered before disposal	
Handling	Percentage of waste collected compared to generated waste from different neighbourhoods	Percentage
Disposal	Percentage reduction of waste disposed at the landfill	Percentage
Access to service	Percentage of inhabitants provided with regular waste collection per week	Percentage
Social perception	Degree of inhabitants satisfaction	Level
Operational cost	Average cost per tonne of waste	Average
Illegal dump sites	Percentage reduction in illegal dumping incidents	Percentage
Financing	Percentage of municipal budget on waste community initiatives and recycling activities	Percentage
Employment	Number of workers employed in SWM	Average
Stakeholder participation	Degree of stakeholder involvement in planning and service delivery	Level
Inter-sectoral collaboration	Degree of institutional collaboration in solid waste management	Average
Awareness and behaviour change	Proportion of people informed on better solid waste management practices	Percentage
Transparency	Degree of publicizing SWM regulation and procedures for participation	Level
Accountability	Degree of holding service providers answerable for the service they provide to the community	Percentage
Enforcement	Number of offenders successfully reported and prosecuted	Average
Service provider conflicts	Number of conflicts resolved in service areas	Average

4.20. Summary

Figure 30 below shows a diagrammatic summary of the functional components of solid waste management discussed in this chapter. Sorting of waste at the household level is barely existent in Kampala and composting of waste together with recycling are done at a small scale and without support from KCCA. Collection of recyclable materials is mainly done by informal waste collectors to fill the gap of unemployment. In spite of privatisation of solid waste management KCCA is still a major collector of waste. Its collection pattern is however erratic and done only accessible in informal neighbourhoods. Waste service provision is also adversely affected by conflicts among service providers. Moreover, there is also inadequate attention given to recent health and environmental concerns in the policies as well as other alternative ways of dealing with waste apart from collection and disposal. Waste scattering occurs during waste collection where some waste is not properly handled and finds its waste in drainages while waste spillage occurs due to inadequate covering of waste during the transportation of waste to the landfill. Awareness and community participation in solid waste management is poor and the involvement NGOs and CBO. The constitution, the public health act, the solid waste management ordinance and the solid waste management strategy are important policy and legal frameworks that guide solid waste management in Kampala. The major challenge is a lack of implementation and enforcement of these policies, laws and regulations. Hence people in Kampala experience poor aesthetics, health and environmental problems.

The next chapter will discuss the possible strategies that can be considered to help improve solid waste management in Kampala based on the issues raised in this chapter.

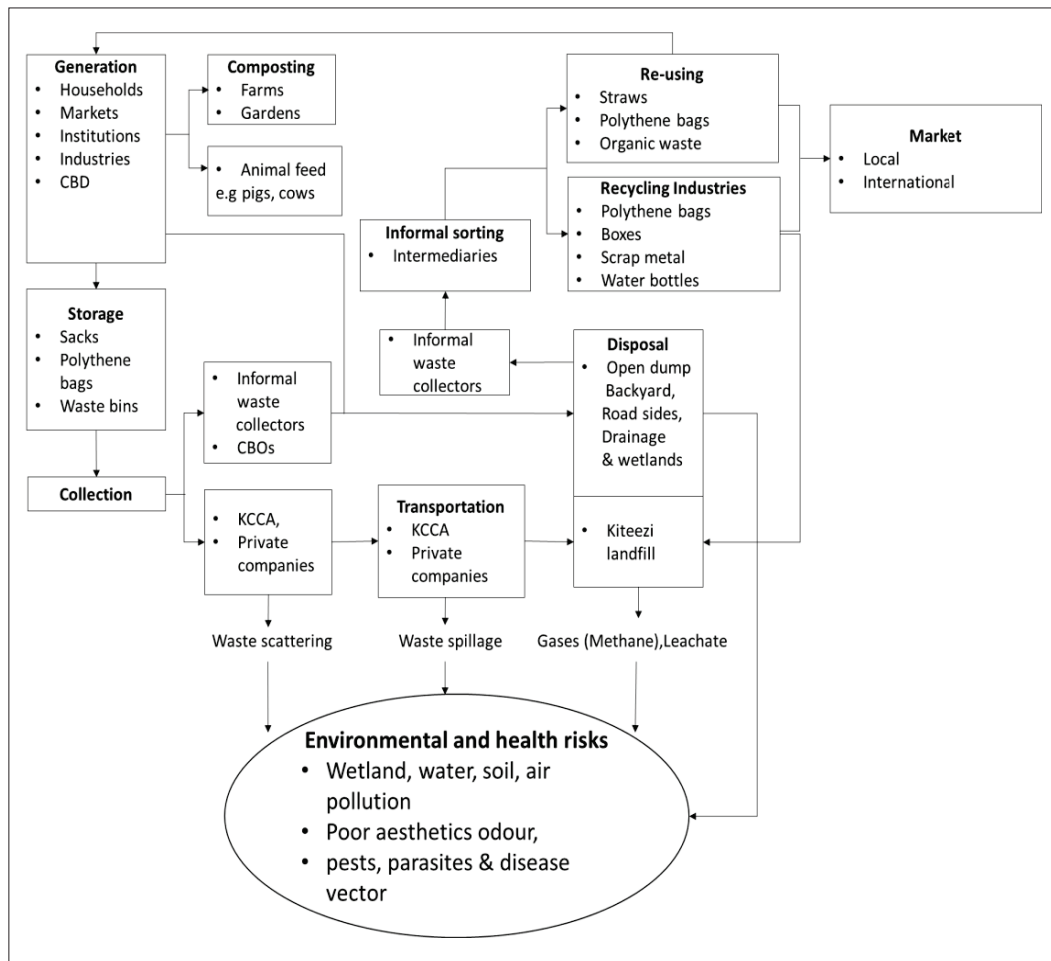


Figure 30. Functional components of solid waste management in Kampala

5. STRATEGIES FOR IMPROVEMENT

This chapter builds upon the results discussed in the previous chapters. It proposes interventions or strategies that could help to overcome some of the challenges discussed in the foregoing chapter.

5.1. Key research findings to be addressed

From the previous chapter, key issues that need to be seriously addressed in order to improve solid waste management in Kampala include the following:

1. High waste generation rate
2. High organic waste stream and low composting and recycling activities
3. Inadequate waste storage facilities and sorting
4. Inadequate collection of waste in unplanned neighbourhoods
5. Indiscriminate disposal of waste
6. Lack of recognition of informal sector contribution
7. Conflicts among waste service providers
8. Poor awareness and community participation
9. Poor monitoring and inadequate law enforcement
10. Inadequate legal provisions to support improvement of SWM
11. Financial constraints
12. Lack of accurate SWM data

Therefore, these key issues highlighted above form the basis for strategies proposed and discussed below.

5.2. Reducing waste generation

One key issue Kampala is challenged with as shown above is the relatively high waste generating rate amounting to 0.89 kg/person/day leading to a production of approximately 1,780 tonnes of waste per day contrary to other low income cities who produce 0.4 - 0.6 kg/person/day (Chandrappa & Das, 2012), more efforts should be made to address the consumption pattern of the people as well as their attitude and behaviour so that the waste generating rate can be reduced. This is much more important considering that there are inadequate collection, transportation and recycling activities in the city and that the Kiteezi landfill is about to be full. However, this change can only come if the population is adequately sensitized. Information passed on to the public during the sensitization or awareness campaigns should focus on the prevention or reduction, reusing and recycling of waste.

It is also important to emphasize that almost any kind of waste can be reused or recycled. To achieve this, the awareness campaigns should be visible and practical. Information on simple measures on how to prevent or reduce waste generation and how to reuse or recycle should be demonstrated to the public. Moreover, awareness campaigns on the prevention of waste should be targeted to specific groups in the city such as marketeers, households, industries, businesses and organizations. To do this, it is important to identify the type of waste that each of the groups generates so that the information on waste prevention is specific (European Union, 2012). Households in planned neighbourhoods who generate more waste can for instance be encouraged to buy food in bulk to avoid small individual packages of plastic, paper or

boxes. Moreover, the use of more durable shopping bags like the ones made from recycled drinking water straws (figure 21) made by local community groups can be encouraged instead of plastic bags which are often used once and disposed of.

Although the survey findings reveal that at 55 percent of the households received information on SWM in the past 12 months in Kampala, further analysis reveals that the households do not receive adequate information to bring about a positive change in behaviour because the local leaders used to raise awareness lack proper information and education on SWM. Moreover, it was discovered that there is inadequate involvement of the civil society and the media in raising awareness hence the public does not seem interested to get involved. This likely explains their poor attitude and their inability to be involved in the monthly clean ups in their community as well as their views that it is KCCA's responsibility to manage their waste. Therefore, civil society organizations such as CBOs and NGOs as well as the media should be brought on board as important stakeholders in solid waste management. This is because the civil society can help to supplement KCCA's efforts in raising awareness to the public more effectively since they operate within the community hence they tend to be more aware of issues to target. The media through radio, newspaper and television can not only help to disseminate information continuously but can also help to inculcate a positive attitude and behaviour towards waste management. There is need therefore to adequately train the local leaders as well as the waste collection drivers if better SWM practices are to be passed on to the public and adhered to. Besides, the enforcement department of KCCA needs more training in the solid waste management laws, regulations and ordinances for them to realize the need to avoid corruption and strictly enforce the laws and regulations to protect people's health and the environment.

Furthermore KCCA staff should be actively involved in raising awareness to the public and deliberate programmes of reaching out to the public should be established. Moreover, more stakeholders such as education institutions should be engaged by KCCA to help in raising awareness. For instance a component of waste prevention and better solid waste management in general should be introduced in the primary school curriculum to ensure that even those who do not have secondary education have the necessary knowledge to properly manage their waste. Moreover, informal activities such as drama, songs in markets and other public places can also be used to reach out to more people and the use of Luganda-the local language which is widely used in the city can help to reach out to as many people as possible in the city during the awareness campaigns..

5.3. Waste storage facilities

Another key issue raised is that households have inadequate storage facilities. The survey findings indicate that 50 percent of the respondents use sacks to store their household waste and only 30 percent use polythene bags and 20 percent use dust bins. The use of polythene bags and particularly dust bins should be encouraged.

The results also indicate that households in planned neighbourhoods who are mainly serviced by private companies use sacks because they are free and readily available in almost every household. It is also because planned neighbourhoods produce more waste which provided polythene bags can not adequately handle. This is however of concern considering that more than 70 percent of the waste is organic and it is of high moisture content. The concern is that the places where the sacks are placed tend to have a bad odour and attract flies and vermin. This is due to the inability of the sacks to hold the moisture of the waste. Hence this kind of storing waste poses environmental and health threats to their surrounding and people respectively. Therefore the private companies should provide bigger polythene bags to their clients so that the use of sacks is stopped. Informal neighbourhoods should also be encouraged to use polythene bags. To reduce costs, households can be encouraged to reuse polythene bags they receive after doing

their shopping. Preferably KCCA should provide subsidized dust bins to the households in both informal and planned neighbourhoods. The dust bins are better because they are reusable. The use of dust bins will also reduce the loading time and help to improve the efficiency of service providers. In the event that polythene bags are encouraged stronger control measures should be initiated to avoid people indiscriminately dumping polythene bags full of waste. This is because they can block drainages thereby contributing to floods. Besides, polythene bags adversely affect soil quality and can be breeding grounds for mosquitoes (Nyakaana et al., 2000). However, with an improved sorting ethos dry waste can be stored using the readily available sacks.

5.4. Improving waste collection, transportation and disposal

The household survey results indicate that provision of communal disposal containers could help to improve waste collection the neighbourhoods. This suggests households' desire to quickly get rid of waste as early as it is generated. However, according to KCCA key informants, communal containers were used before in Kampala but were abolished due to the unsanitary conditions they created. Besides, the survey also shows that the majority of respondent think that having more trucks and frequent collections of waste will help to deal with the SWM problems they are experiencing in their neighbourhoods. However, key informants including those from KCCA indicated that that instead of communal containers, it could be helpful to have Waste Transfer Stations in strategic areas or at division levels. This is because transfer stations allow temporarily disposal of waste like communal containers. "The main objective for the implementation of a transfer system is to establish efficient collection, transportation and disposal systems and thus, conserve resources" (UNEP, 2005, p. 107).

The transfer stations should however, be adequately fenced with enough space to sort and clean the waste. Weighing mechanisms should also be put in place to ensure that the amount of waste coming in and those going for reuse, recycling, composting is recorded. These records are helpful in planning and designing of further interventions. Besides, the low (16 percent) proportion of household sorting waste will also be overcome because transfer stations will provide an alternative sorting point before waste is composited, recycled and landfilled. However, to encourage sorting at the household level, those who do not sort their waste can be charged a high price (Gunsilius et al., 2011). Sorting of waste at the household level will make the activities of the informal waste collectors cleaner and fetch better prices when the waste is sold to recycling industries.

Besides, since the landfill is more than 12 kilometres from the city coupled with high traffic congestion, the transfer stations will also reduce the total cost of collection and haul and promote the use of the suitable vehicles (UNEP, 2005).

To optimally establish the right number of efficient transfer stations Geographic Information System (GIS) and remote sensing techniques can be used. The allocation maps can therefore be used by KCCA in consultation with stakeholders which include waste service providers, CBOs, NGOs and community representatives to make decisions on the actual locations of the waste transfer stations. Incorporating participatory approaches in decision making will not only promote a sense of ownership by the stakeholders, but will help to take into account the household concerns of odour or aesthetic value of the Waste Transfer Stations that could not possibly have been taken into account by the GIS model (McCall & Dunn, 2012). It will also help to illegal dumping of waste by the service providers and the community.

5.5. Community involment and financial sustainability

"KCCA spends a lot of money on SWM but this does not always translate to proper solid waste management", remarked one of the key informants. This suggests that KCCA spends considerable amount of money on waste

management but the money is channelled in mechanisms that are not very effective in the city such as the “bring to the truck” self-loading strategy hence KCCA in the end have financial constraints. Plans are made without adequately consulting the community hence implementation of some initiatives has been negative. Therefore community driven and low cost initiatives could therefore help to have financial sustainability.

A number of steps have to be considered to encourage the community to be partners in dealing with SWM. KCCA should take the first step of identifying groups that are already involved in SWM. These groups include community leaders, informal waste collectors, recycling intermediaries, private companies, CBOs and NGOs like the KIWI as well as others with a stake in SWM. Meetings with representatives of these groups can then be organised to establish a shared vision of improving waste management in the neighbourhoods. From the meetings solutions to deal with the most problematic issues such as indiscriminate dumping of waste can be established. The group of community stakeholders can later be used as a stakeholder platform. Once a strategy to improve SWM has been devised, the groups can then inform the community of the plans that all stakeholders having joined hands to deal with the waste problem and ask the community to cooperate with them (Muller & Hoffman, 2001). Posters, community meetings, newspaper, radio and television can be used to raise awareness. When the public takes ownership of an initiative or plan the chances of its success are higher (Coad, 2003). The household survey results indicate that 94 percent of the respondents are willingness to participate in better solid waste management. Therefore if deliberate mechanisms to engage the community are in place complaints of poor community involvement during monthly clean ups and other SWM initiatives could be addressed.

The city of Dar-es-Salaam has characteristics similar to Kampala such as high population growth, high waste generation rate coupled with the mushrooming of informal settlements. In Dar-es-Salaam, community groups have helped to increase waste collection and decrease indiscriminate dumping of waste. For instance a CBO called MABIBO collects waste at a fee in low and middle income households. It then takes the waste to the transfer station. After the waste is sorted the municipality transports the waste to the disposal site. In an event that the municipality has delayed to collect the waste, the CBO hires trucks to transport the waste to the disposal site (Muller & Hoffman, 2001). Therefore based on this experience in Dar-es-Salaam, it would be helpful to allow and empower informal waste collectors (organisations) and CBOs to collect waste in their neighbourhoods. This will provide a better alternative to the erratic and inequitable waste collection provided by KCCA. However, for informal waste collectors and CBOs to be more effective, providing them with affordable licenses will be helpful. New community groups should also be encouraged to have more competition and improvement of service delivery. Moreover, there is need to put in place clear regulations and control measures to ensure that these service providers operate in accordance to service standards that also includes protecting people’s health and the environment.

With simple modes of collection, waste will be frequently and regularly collected including in less accessible areas of the neighbourhood. Waste services will also be provided in ways which meet the needs of the people and at a socially acceptable fee. For instance, the survey findings reveal that households not paying for waste collection are willing to start paying an average amount of 7,050 UGS per month (i.e. 2.80 USD). Informal waste collectors and CBOs live or operate within the community and they know what most people can afford. Besides, allowing groups involved in reusing and recycling of waste to collect waste in their neighbourhoods will give them the impetus to provide better waste collection services because of their interest in making use of the waste (Gunsilius, 2010). Those who for whatever reasons may not manage to pay for waste collection should be encouraged to take the waste to the transfer station. This in turn will help to reduce indiscriminate disposal of waste as well as burning of waste in the backyard.

Apart from building capacity in the informal waste collector organisations, KCCA should ensure that there is regular monitoring of transfer stations to foster adherence to operational standards. Failure to do this may result into unsanitary and poor working conditions. The financing and building of capacity in the informal waste collector organisation and CBOs to operate the transfer stations could be a challenge in the short term but helpful and sustainable in the long term because the organisations will not only collect waste at a fee but they will also be involved in selling recyclable waste materials to other groups and recycling industries. The fees that these groups will be paying for licenses can be revenue (albeit not adequate) that KCCA can use for monitoring or law enforcement.

The secondary transportation of waste to composting centres, recycling industries and landfill provides an opportunity for these organisations operating the transfer stations to partner with private companies and KCCA. This is because research findings indicate that the informal waste collectors and CBOs in Kampala do not have the capacity to transport the waste to the landfill. Compactor trucks can then be used at this stage because the waste would have been adequately sorted.

Community illegal dumping hotlines can also be established in each neighbourhood. A toll free number or social media like Facebook can be used to report illegal dumping in the neighbourhood. This will encourage community participation and policing. Besides it will help local leaders to swiftly coordinate a clean-up by people around that street or area so that illegal dumpers of waste are not given the reason to dump more waste on the roadsides or open spaces. Reducing the accumulation of waste in the neighbourhood will contribute to better aesthetic, health and environmental wellbeing of the community. Hefty fine for illegal dumpers should also be introduced.

Furthermore, the research findings show that there is no standardized fee charged by service providers. This is in spite of section 4 (4) of the solid waste management ordinance empowering KCCA to prescribe fees for collection. There is need for KCCA in consultation with the service providers and the community to prescribe fees for waste collection. The fees should also be socially accepted and profitable enough for private companies and reasonable enough to sustain the livelihoods of informal waste collectors and CBOs involved in waste collection.

5.6. Composting and Recycling

Since it is challenging to establish a recycling company in Kampala as indicated by key informants interviewed. There is need to introduce measures that will attract both local and foreign investors to establish recycling industries. One such measure is the provision of incentives such as tax holidays. Such incentives can also be used to help diversify the waste materials for recycling. Particularly more industries are needed for sacks, bones and glass.

The Extended Producer Responsibility (EPR) measures should be introduced to ensure that producers make items that are reusable, repairable and recyclable. Producers should somehow be able to bear the cost of waste disposal. This can be done by making them invest in more efficient materials which have a high life cycle. This will also help to reduce the quantity of waste in the end (European Union, 2012).

Considering that the more that 70 percent of household waste in the city is organic, households should be encouraged to compost waste much more. Vermicomposting at the household level is easy and can be undertaken. Vermicomposting produces nutrient-rich soils from organic waste with the help of using worms and micro-organisms. (Cochran, 2014). The nutrient rich soils can be used in people's backyard gardens as well as those in the sell of seedlings. On a larger scale the youth and women groups can be encouraged and trained in composting waste. Recycling and composting activities are important not only because they will create jobs for the youth and women or reduce the amount of waste going to the landfill

they will also help to reduce greenhouse gases (Couth & Trois, 2010). KCCA should therefore facilitate the acquisition of land where the composting activities can be undertaken by community groups. To further make composting activities more successful and up scaled, more training should be given to the groups and more importantly a market for compost manure should be created.

5.7. Dealing with service provider conflicts

Another key issue coming out of the research findings is the conflict of service providers. These conflicts are generally due to poor control and regulatory framework to supervise the work of private companies collecting waste in the neighbourhoods. Therefore to reduce these conflicts there is need to apportion service providers in well demarcated waste collection zones as recommended by a number of key informants.

Key informants in Kampala are of the view that the zonal system will not only reduce conflicts but it will also enhance service delivery and promote accountability among service providers. Besides it will be easier for KCCA to monitor the services provided by the operators hence it will be easier to identify and prosecute illegal waste operators.

In his PhD thesis Twinomuhangi (2010) used the 'what if' location-allocation approach in GIS and came up with five waste collection zones cut across low, medium and high income groups in Rubaga division (one of Kampala's five divisions). Apart from the income group data, population size and density; road network classified into major, secondary and tertiary; dwelling units and an annual waste generation rate of 30,000 tonnes were used to make equitable waste collection zones.

However, to have more efficient waste collection zones, it is important to make homogenous waste collection zones. Homogeneous waste collection zones will for instance ensure that appropriate waste collection methods or interventions are applied in a particular zone. Therefore in delineating homogenous zones, it is also important to consider the waste generation capacity for each income group, width of the road and the type of collection vehicle used (Ghose, Dikshit, & Sharma, 2006) as well as land use and elevation data. Other parameters that should be considered in the GIS model include the availability of space, considering that a number of open spaces are wetlands in Kampala. The established waste collection zones and transfer stations should be allocated to service providers and informal waste collector organisations in an equitable and transparent way and this can be done through a clear checklist that KCCA should adhere to. The checklist should also be made available to the service providers and public.

There is also need for KCCA to engage NEMA for them to reduce the amount that private companies have to pay to get a license to authorise them transport waste to the landfill. This will enable many of the private companies operating illegally to manage to pay for the license thereby enabling them to operate legally. Moreover, the license should enable the private companies to not only transport the waste to the landfill but also allow private companies to sell recycled waste material to those involved in the reusing and recycling of waste such as CBOs and informal waste collector organisations.

5.8. Recognition of informal sector contribution

As discussed in the foregoing chapter, the undisturbed (no victimisation) operations of informal waste collectors in the streets and landfill coupled with their provision of waste services to all income groups as indicated by the research findings in Kampala suggests that KCCA recognises the contributions of the informal sector although without any legal or regulatory basis. Recognising the contribution of the informal sector in SWM can provide a win-win of opportunities in the city. It can help to protect and developing people's livelihoods; address negative health and environmental impacts; and reducing cost of

managing waste in the city as well as promote the reuse and recycling of waste (Paul et al., 2012; Scheinberg et al., 2010; Velis et al., 2012; Wilson et al., 2006). Besides, recognising of the informal waste collectors in the policy documents will also make their operations not to be in violation of the solid waste management ordinance which prohibits them to collect waste.

For the recognition of the informal sector contribution in solid waste management to have a positive impact, it is important for the national policy to make provisions for their operation. This will provide a basis for a positive attitude towards informal waste collectors by the local authority and their willingness as well as their creativity to create initiatives with the informal waste collectors to improve SWM in the city (Gunsilius, 2010). Hence reforms in the SWM policies or laws as well as regulatory guidelines are need in Kampala to provide KCCA a basis upon which to formerly recognise the informal waste collectors and engage them as major stakeholders in SWM in the city.

However, engaging individual informal waste collectors is in itself not any easy task. It could therefore be easier when they are organised into cooperatives or associations or indeed any other which requires minimum registration requirements (Gunsilius et al., 2011).

5.9. Formation of organisations

Formation of informal waste collector organisations with their respective leaders will provide an easy entry point to these service providers. Experiences from Asia and Latin America have shown that organising workers in the informal system into organisations to collect waste, manage sorting centres and recycling points have been successful. Due to these organizations it has been easy for local authorities as well as other stakeholders to engage the informal waste collectors in SWM. To encourage the formations of organizations, the local authority in Brazil allowed organized informal waste collectors to be beneficiaries of the waste generated from state buildings. In the Philippines waste collectors at the disposal sites were supported by the local authority to operate a sorting centre. The group elected leaders and now have merchandised equipment such as a conveyor belt and a drum sieve. They also have initiated new activities like composting. Besides, informal waste collectors that are operating in organisations such as cooperatives earn 50 to 100 percent more than before and they also benefit from better working and health conditions (Gunsilius, 2010).

It is therefore important that KCCA facilitates the formation of organisations. The starting point could be to educate the informal waste collectors of the significance of the organisations. The formation of these organisations could provide an opportunity for the informal waste collectors to earn more than they do currently. This is because they can be able to sell more recyclable materials to recycling industries. A key informant from one of the recycling industries indicated that 3 informal waste collectors teamed up. This group now supplies the industry with an average of 12 tonnes of recyclable material per month. Apart from being allocated a waste collection zone, informal waste collectors can also be contracted by KCCA in street sweeping, slashing and desilting of drainages. For the informal sector organisations to be effective and successful, they should be operated as a business (Couth & Trois, 2010). Loans and other financial incentives could be easily facilitated for organised informal waste collectors (Cardenas, 2009).

Moreover, forming organisations will help to attract both local and international partners and also provide a platform for informal waste collectors to have a voice in SWM in the city. Training or sensitization in regulatory requirements, business management, access to credit as well as health, safety and environmental standards can be easily done to an organised group. Besides it will be easy for them to share experiences and get statistics on their activities which can be used in planning and designing better policies (Gunsilius, 2010).

It is worth noting that KCCA has also started moving in this direction. On the 28th of April, 2013, it facilitated a meeting which was attended by 300 participants who included private companies, CBOs, NGOs, as well as informal waste collectors. The meeting culminated in the formation of an organisation called the Urban Waste Management Association (UWMA) which is now a registered solid waste management organisation. An executive committee composed of thirteen (13) people was selected to steer up the organisation. The organization has a representative in every division, parish and village of Kampala.

5.10. Challenges and the future of UWMA

The objectives of UWMA are to have all the players on board and enhance networking in solid waste management. Other objectives include sensitizing the community, and value addition to waste in order to create jobs. The association is to act as a link between KCCA and waste service providers.

In as much as formation of this association is a big step in the right direction, a number of issues have to be addressed. The association for instance does not seem to have a clear roadmap relating to where to start from and where they want to be in the next few years and how they will get there. Moreover, the association does not have adequate financial resources to even rent an office and let alone sensitize the public about its existence and SWM in general.

By October, 2013 the association had eight six (86) members from private companies but only six (6) were paid up members. Their registration fee is 500,000 UGS per year. Thirty six (36) CBOs and NGOs are members paying a registration fee of 150,000 UGS but, only two (2) members were paid up members. There is however no information on the number of informal waste collectors registered as members and let alone the paid up members. It therefore appears that the informal collectors do not have much stake in the association. This is probably due to their perceived illegality. It is therefore important that informal waste collectors form their own organisation. Their representatives can then be part of the executive committee. In this way the informal waste collectors can also have a voice. Furthermore the association should embrace and assure all members and ensure that there is trust and confidence in the organisation. Already some big and well established private companies are jittery about the association. This is because they suspect the associate to have plans of reducing their business prospects in the city.

Therefore, due to the infancy of the organisation KCCA should help to build capacity in the executive members of the organization. The organisation should be helped to come up with a strategic plan that has a proper vision as well as clear and achievable objectives.

5.11. Integration of informal and formal solid waste management systems

The success of sustainable solid waste management in Kampala to a large extent hinges on the improvement of the informal solid waste management system. This is because 60 per cent of the population lives in informal neighbourhoods where informal waste collectors are prominent. Despite health and environmental concerns associated with poor disposal patterns, their contribution particularly in collecting waste from households, reusing and recycling has no legislation or guidelines. “Laws at national, state or local, levels, decrees, ordinances and regulations form the backbone upon which integrative waste management schemes are built” (Dias, 2011, p. 1). Therefore to undertake this task political will is important. An overwhelming response of 85 percent from household respondents, are of the view that integrating informal and formal SWM systems is a good idea and would help improve SWM in Kampala. This view is also shared by all the key informants interviewed. This is because integration is seen to be one of the solutions for ensuring that the waste collection coverage expands to inaccessible areas. Integration is also seen as a way of improving the social perception, working conditions and capacity of those involved in the informal solid waste management system.

As discussed in the literature review chapter, integration in this thesis is defined as adjustments in the city SWM system facilitated by the local authority which allows for beneficial interdependence or cooperation of both informal and formal systems to promote sustainable solid waste management.

Once a legal framework is in place, a new solid waste management plan should be devised. This plan can have goals that include the following (Chiu, 2010):

1. Recognising the role played by informal waste collectors in the collection, reuse and recycling of waste.
2. Supporting informal waste collectors to expand and enter into new zones of waste separation, collection, reusing, recycling, and composting.
3. Guaranteeing their access to transfer station and landfills.
4. Opening channels of communication and networking with formal stakeholders and decision makers as well as their involvement in planning as processes.
5. Providing a platform for them to have a voice. This can be through the formation of informal waste collector organisations.
6. Building their capacity and improving their work conditions for them to adhere to health, environmental and safety practices
7. Providing financial assistance in order to upscale their activities.

Moreover integrating the informal will afford KCCA and government at large the benefits of enhanced collection in inaccessible areas as well as enhanced recycling rates which diverts waste at a less cost and reduces pressure at the landfill. The registration and formation of organization for the informal sector operators is an important step in the integration of the informal and formal solid waste management systems. In Mumbai, registered informal waste collectors were given cards. The ones with cards were the only ones allowed to collect waste door to door (Gunsilius et al., 2011). Therefore integration in Kampala can mean that the informal waste collector organisation are formed and officially recognised by KCCA by offering them certificates to collect waste in particular zones. Each member of this organisation should also have unique identity cards to for them to collect waste from the households.

5.12. Barriers to the integration of formal and formal SWM systems

In a much as the integration of the informal and the formal SWM systems is a good idea for improving SWM in Kampala as indicated by household respondents and key informants as well as experiences in other developing countries. There are existing barriers that need to be overcome in Kampala to facilitate the integration. Apart from financial constraints which have resulted in inadequate provision and maintenance of waste collection vehicles as well KCCA's inability to support community organisations involved in the recycling of waste, the apparent value of private companies over informal waste collectors, CBOs and NGOs by KCCA is another barrier. This barrier has led to the use of inappropriate technology such as the use of compactor trucks in spite of the high organic content and high density of the waste in Kampala. Hence informal neighbourhoods are not adequately serviced. There is there a need for a change in policies so that wheel borrows, motor bikes and other equipment that can easily navigate and have access the waste generated in informal households Political interference in the operations of CBOs and NGOs should be avoided. Therefore when informal waste collectors form organisations and start operating in their neighbourhoods, it is possible that they can be accused to be political mobiliser especially close or during elections. To avert this situation is important that these organisations operate in a transparent manner and should incorporate as many stakeholders as possible. The informal waste collector should first of all be recognized by the law and then their organisations and that of CBOs and NGOs formalised in policy documents in the most clear possible terms (Tukahirwa, Mol, & Oosterveer, 2010).

The other challenge is the health and environmental concerns coming from illegal dumping practices associated with informal waste collectors resulting from their inability to transport the waste they get from households to the landfill. The other barrier is that there are very few studies done on the informal waste collectors which shows the actual figures of how much waste they collect, reuse or recycle as well as the economic and environmental value of their activities in Kampala (Oguntoyinbo, 2012). Part of the problem is negative community perception of informal waste collectors. The perception as indicated from the findings is that informal waste collectors are considered by the community as insane or cursed people. It is therefore a challenge to convince policy makers and the local authority to see the contribution of the informal waste collectors and let alone provide a legal framework for their recognition and subsequent integration with the formal SWM system.

5.13. Legal or regulatory reform

Additionally, the solid waste management ordinance and the solid waste management strategy are more biased towards waste collection and disposal. In spite of this, KCCA has failed to improve to achieve their targets. There is therefore agreement among the key informants interviewed that the laws relating to SWM management in Kampala need adjustments. There is need to shift the focus to reducing waste, reusing and recycling through the enactment of laws that promote the 3Rs (i.e. Reduce, Recycle and Recover) For instance licences offered to private companies involved in waste collection should be reviewed to allow for them to sell recyclable waste to informal waste collector organisations instead of directly transporting the waste to the landfill as is the case now. Doing this, could be an incentive for private companies to reduce their collection charges to the households. It will also give them the impetus to encourage their clients to sort their waste.

About 500 informal waste collectors operate at the landfill every day according to key informants at the landfill and the number is much more in the streets and neighbourhoods of Kampala. Most of these people earn a living by selling recyclable waste materials to intermediaries or directly to recycling companies. The intermediaries however have a tendency to exploit them through low and fluctuating prices. Therefore to secure the livelihoods of informal waste collectors it would be helpful for their organisations to be the only ones allowed to sell recyclable materials to recycling industries. This will not only make them supply more waste materials for recycling but will help them earn more money. This will in turn help to eradicate poverty and ultimately help to achieve the MDGs.

Legal reforms are needed in order to have a robust legal framework that also considers the workers in the informal waste management system as important actors and partners in solid waste management in Kampala. The framework should also allow the formation of informal sector organization and their eligibility to be contracted by KCCA in waste collection, street sweeping and drainage desilting. The collection of waste by one service provider in a particular zone should also have a place in the legal framework.

5.14. Enforcement

The Uganda constitution, the public health act, the solid waste management ordinance and the solid waste management strategy are important policy and legal frameworks that guide solid waste management as well as protect people's health and the environment in Kampala. But most of these laws are not known by the public due to adequate awareness as suggested from the survey finding as well as poor enforcement by KCCA. This is despite of having a fully fledged enforcement department at each KCCA division office. The findings also indicate that there are corrupt tendencies being exhibited from this department and that the public health department at times report culprits but no action is taken because some offices allegedly take bribes. Hence offenders are neither prosecuted nor made to pay a penalty fee to KCCA. As a result

of this poor enforcement some areas have poor aesthetics, health and environmental threats. Illegal private companies also find it easy to operate in the city.

Additionally, the challenges to adequately provide waste collection to the majority of the population many of whom are living in unplanned neighbourhoods coupled with KCCA conflict of interests as indicated by the survey results pose problems for KCCA to adequately enforce most of the laws and regulations. It would therefore be helpful for KCCA to withdraw from the primary collection of waste for it to focus on improving SWM infrastructure such as roads in informal neighbourhoods, monitoring, building capacity and raising awareness to the service providers and the public. It should also focus on providing adequate regulatory and control measures for service providers. “This regulation and control is needed in three major areas – environmental protection, service standards and enforcement agreements” (Coad, 2003, p. 17). Particularly as indicated by the survey results, the widespread tendency to dump the waste indiscriminately as well as burning of waste in the backyard and open spaces should be addressed by these regulations. Stiffer penalties and prosecution of offenders can help to address this problem. Revocation of a license for private companies who do not oblige to these regulations can send a strong warning to would be offenders.

To ensure that service providers provide a good service to the public, licenses and contracts should be very clear stating what should be done and what can not be done as the penalty associated with each offence. Besides, in informal neighbourhoods the engagement of informal waste collector organisations who live with the community provides a greater opportunity for them to abide by the service standards because they are moral obligation to provide better service to the benefit of their families and the community as large (Coad, 2003). More involvement of CBOs and NGOs can also help in law enforcing because these organisations operate within the community and they understand better what is going on in the community.

5.15. Kiteezi landfill

Since the Kiteezi landfill is about to be full and has massive potential for the extraction of gas for electricity generation there are plans by KCCA with the help of the World Bank, International Finance Corporation (IFC) to expand the landfill and possibly extract gas (Kampala Capital City Authority, 2013). These plans however should guarantee the informal waste collectors access to waste since about 500 of them operate at the landfill everyday and depend on it for survival. This is to protect people’s livelihoods as well as to protect the environment through the reduction of green gas emission as a result of recycling the waste. However, there is need to provide a platform with a shelter were the sorting of waste can be done. This will help to improve the working conditions of the informal waste collectors at the landfill. There is also needed to sensitize the informal waste collectors go for regular health check ups.

5.16. Solid waste management indicators

To deal with the problem of unreliable data on solid waste management in Kampala indicators can be useful. The use of indicators is very important in identifying weaknesses, tracking achievements and measuring the performance of a SWM system. Indicators can also help to guide future actions by setting targets, clarifying objectives and setting priorities at a city or national level thereby helping in the formulating of policies. Besides, indicators can facilitate communication between stakeholders. Indicators are therefore important for measuring and reporting progress towards sustainable development (Ristic, 2005; Whiteman, Smith, & Wilson, 2001).

The variables for indicators that were validated and improved by key informants in Kampala as discussed in the foregoing chapter were synthesised into six indicators (table 7). These indicators can be used to

measure the performance of the SWM system at a disaggregated level, which could be the waste collection zone level. At this level the variation between individual indicators for instance service provider responsibility can be compared between or among zones. Besides, these disaggregated indicators can also be combined into two composite indicators or into a single value for the overall performance of SWM in the zone (figure 31).

Maximum standardization can be used and variables which include specific waste generated, service provider conflicts and operational cost are a cost (i.e. the lower the value the better) in the calculation and the rest of the indicators are benefit (i.e. the higher the better). To easily operationalise these indicators, benchmarks can be set and used to measure the performance of each indicator. International benchmarks can be used or adapted into realistic benchmarks for the city. For instance the international benchmark value for the extent of solid waste sorted in the city is 100 percent (Government of India, 2008), however findings from the sampled households in Kampala show that only 16 percent of households sort their waste.

Table 7 Indicators and policy objectives for improving SWM as recommended by Key informants in Kampala.

Indicator	Variable	Definition	Proposed policy objective
Individual responsibility	Specific waste generation	Percentage of specific waste streams produced from households	Implementation of producer responsibility e.g. charges for hazardous and unrecyclable products to importers and manufactures
	Waste composting	Percentage of organic waste stream composted	Establishment of composting centres and market
	Sorting of waste	Percentage of household waste sorted before collection	Sorting of waste at source i.e. bio-degradable, no-biodegradable and hazardous waste e.g. batteries
	Recycling	Percentage of waste recycled or recovered before disposal	Providing incentives for the establishment of recycling industries. Extended Producer Responsibility policies.
Community responsibility	Handling	Percentage of waste collected compared to generated waste in a neighbourhood or zone	Engaging informal and community organizations for waste collection especially in informal settlements. Establishment of transfer stations in strategic areas
Service provider responsibility	Accountability	Degree of holding service providers answerable for the service they provide to the community	Putting in place clear standards and control measures and reporting mechanisms
	Employment	Number of workers employed in SWM	Empowering and engaging informal waste collector organisations in waste collection, composting and sell of recyclable waste. Value addition to waste
	Service provider conflict	Number of conflicts registered and resolved in service areas	Exclusivity of waste service providers in operation areas e.g. Zones for waste collection for each service provider
System efficiency	Disposal	Percentage reduction of waste disposed at the landfill after recovery	Diversion of waste from the landfill e.g. landfill levy.
	Access to service	Percentage of inhabitants provided with regular waste collection per week	Integration of informal waste collectors to help reach inaccessible areas. Provision of socially acceptable waste collection fees

	Operational cost	Average cost per tonne of waste	Establishing transfer stations and engaging informal waste collector organisations in collection and sorting of waste
	Financing	Percentage of municipal budget on waste community initiatives and recycling activities	Financing and up-scaling of recycling and composting activities taking at micro levels
	Illegal waste dumping	Number of illegally dumped waste completely cleaned up within 24 hours of being reported	Higher fines for illegal dumping. Increase community policing. Regular and frequent collection of waste
System involvement	Social perception	Degree of inhabitants satisfaction	Engaging the community in assessing the quality of service being offered
	Stakeholder participation	Degree of stakeholder involvement in planning and service delivery	Participatory approaches to planning and implementation
	Inter-sectoral collaboration	Degree of institutional collaboration in solid waste management	Integrated planning and implementation among sectors
	Awareness and behaviour change	Proportion of people informed on better solid waste management practices	Involvement of more stakeholder the civil society and the media in awareness raising
System control of abuses	Transparency	Degree of publication of SWM regulation and procedures for participation	Making SWM information available to the public
	Enforcement	Number of offenders successfully reported and prosecuted	More capacity building for agencies involved in law enforcement

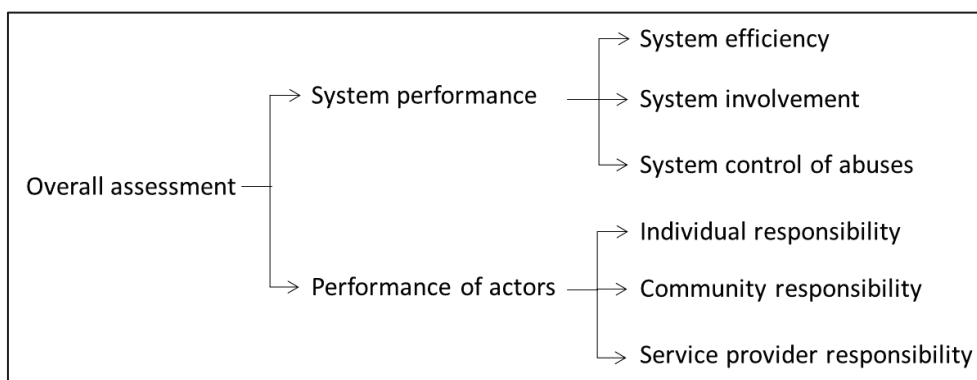


Figure 31. Indicators index for measuring SWM performance in Kampala

5.17. Operationalization of the proposed SWM system in Kampala

Apart from zones helping to reduce service provider conflicts, the zonal system will enhance accountability of service providers as well as their adherence to service standards, the zonal system will

help also help to know how much waste is generated and collected, reused or recycled and landfilled from a particular zone hence more accurate statistics can be obtained for the whole city. In the end less waste will be landfilled. Figure 32 shows the proposed structural of the SWM management system as discussed in this chapter.

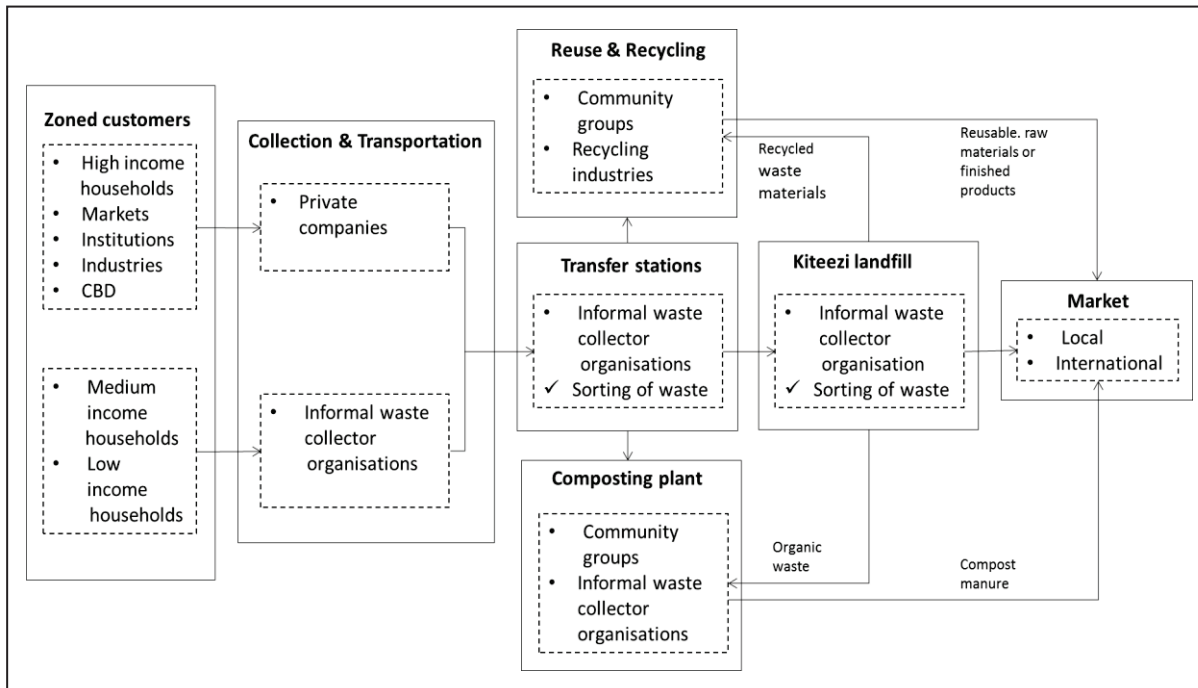


Figure 32. Proposed SWM structure in Kampala

5.18. Summary

Solid waste management can still be improved in Kampala. The starting point is for KCCA to consider other strategies of dealing with waste instead of the old and traditional way of desiring to make the city clean by transporting the waste to the landfill. There is also need to revise the solid waste management legal framework and plans in Kampala in order to incorporate and implement international best practices such as formation of organization, integration of the informal and formal solid waste management systems and adherence to the 3Rs. GIS and remote sensing can help to find out the number, size and suitable location of the waste collection zones and waste transfer stations respectively. Moreover, the bottom up approach should be adopted in the planning and implementation of solid waste management to ensure that real community issues are addressed. Involving more civil society organization and the media can play a very significant role in raising awareness to the public. KCCA should withdraw from the door to door collection of waste and concentrate on its regulatory monitoring mandate as well as strict enforcement of the law.

6. CONCLUSION AND RECOMMENDATIONS

A mixed method approach was used in order to understand and establish ways of improving the informal and formal SWM systems in Kampala. The systems were analysed from the moment waste is generated at the household level until it is disposed of at the landfill. Having been giving a summary for every chapter discussed, this chapter gives a conclusion and recommendations from the research findings.

6.1. Conclusion

The high population growth coupled with economic growth in Kampala has not only led to the increase of people in Kampala but has also contributed to the mushrooming of informal neighbourhoods and challenges in managing solid waste. Therefore the high generation rates coupled with higher levels of organic waste have not been easy to handle particularly in unplanned neighbourhoods due to narrow and inaccessible roads as well as erratic waste collection by KCCA. The result has been indiscriminate dumping of waste on the road side, backyard and wetlands thereby contributing to floods due to blocked drains in low lying areas, health and environmental threats.

The findings reveal that the community is willing to participate in better SWM but there are limited mechanisms to engage them. An Integrated Solid Waste Management approach can provide a robust mechanism towards engaging community actors in SWM in Kampala. Governance elements appear to be paramount in all efforts to improve SWM in Kampala. Particularly access to information and education, financing, legal reform and the recognition of informal sector contribution are seen by my many stakeholders as key to the improving SWM in Kampala. Other key governance elements include the formation of organisations and partnerships. However, structural-operational elements such as frequent waste collection, increasing waste recovery and recycling as well as use of appropriate technology are also critical.

The stakeholders are willing to see the informal and formal SWM system integrated to improve the management of solid waste in the city. Besides, the zonal system is an important control mechanism that can help to reduce conflicts among service providers and increase accountability as well as help to curb illegal waste operators. The establishment of transfer stations is a structural measure that can also help to enhance waste collection and reduce illegal dumping of waste and protect people's health as well as the environment.

KCCA in consultation with the service providers and the community should also come up with a socially acceptable and standardised waste collection fees. The findings of this research reveal that households sampled and currently not paying for waste collection are willing to start paying an average amount of 7,050 UGS per month.

Allowing informal sector organisations to legally collect waste and operate transfer stations and permitting them to sell recyclable waste to recycling industries should lead to frequent and regular collection of waste and protection of people's health and the environment. It will also create employment for the youth and women as well as secure livelihoods of the poor. These activities will therefore also help in achieving the MDGs.

6.2. Recommendations

Therefore in view of the research findings, recommendations of this thesis include the following:

- Pilot the use of transfer stations operated by informal waste collector organisations as well as the zonal system to be operated by all service providers.
- Abolish the self loading “bring to the truck” strategy of collecting waste in informal neighbourhoods. This is because it is ineffective in having collected in informal neighbourhoods and is a conduit for conflict or fights in the neighbourhoods. It also exacerbates the break down of waste collection trucks in the city. The involvement of informal waste collectors and community groups would lead to frequent and regular collection of waste in informal neighbourhoods.
- KCCA should withdraw from the primary (door to door) waste collection and concentrate on the secondary waste collect (from Waste Transfer Stations to the landfill), regulation, control, monitoring, enforcement and providing an enabling environment for involvement and operations of other service providers and stakeholders like CBOs, NGOs and the media.
- Need for law reforms to improve the legal frame supporting solid waste management. The reforms should lead to plans that harmonise its objectives to waste reduction, recycling and recovery. They should also recognise the informal waste collectors as important partners in SWM in the city.
- There is a need to adopt the bottom-up approach in SWM planning so that the community input is taken on board not only in planning but in the implementation of SWM initiatives also. Besides, participatory planning can help to address the mushrooming of illegal settlements.
- Provide financial support to groups involved in waste reuse and recycling for them to upscale their activities.
- Conduct regular research on the composition of waste to help in planning and formulation of interventions for reduction, reuse and recycling.
- Conduct a detailed research to find the willingness of households to add a waste collection fee to house rentals and look at the implications of this course of action.

LIST OF REFERENCES

- Agamuthu, P. (2003). Solid waste management in developing economies - Need for a paradigm shift. *Waste Management & Research*, 21(6), 487-487.
- Ahmed, S. A., & Ali, M. (2004). Partnerships for solid waste management in developing countries: linking theories to realities. *Habitat International*, 28(3), 467-479. doi: 10.1016/s0197-3975(03)00044-4
- Atienza, V. (2011). Review of the waste management system in the philippines: Initiatives to promote waste segregation and recycling through good governance. In K. Michikazu & M. Etsuyo (Eds.), *Economic Integration and Recycling in Asia*. Chosakenkyu Hokokusho.
- Cardenas, L. C. (2009). Integrating the informal waste sector to the formal solid waste management system: Solid Waste Management Association of the Philippines.
- Chandrappa, R., & Das, D. (2012). Waste Quantities and Characteristics *Solid Waste Management* (pp. 47-63): Springer Berlin Heidelberg.
- Chiu, A. (2010). The 3Rs and Poverty Reduction in Developing Countries: Lessons from implementation of ecological solid waste management in the Philippines *Asia Resource Circulation Policy Research* Philippines: Institute for Global Environmental Strategies.
- Coad, A. (2003). Solid waste collection that benefits the urban poor: Dar es Salaam, Tanzania. Switzerland: The Skat Foundation.
- Cochran, S. (2014). Vermicomposting: Composting with Worms. Retrieved 5th February, 2014, from <http://lancaster.unl.edu/pest/resources/vermicompost107.shtml>
- Cointreau-Levine, S. (1994). *Private sector participation in municipal solid waste services in developing countries : Vol. I. the formal sector* (Vol. 13). Washington, D.C.: The World Bank.
- Cointreau, S. J. (1982). *Environmental management of urban solid wastes in developing countries : A project guide* (Vol. 5). Washington, D.C.: The World Bank, Urban Development Department.
- Couth, R., & Trois, C. (2010). Carbon emissions reduction strategies in Africa from improved waste management: A review. *Waste Management*, 30(11), 2336-2346. doi: <http://dx.doi.org/10.1016/j.wasman.2010.04.013>
- Deininger, K., Selod, H., & Burns, A. (2011). *The Land Governance Assessment Framework: Identifying and monitoring good practice in the land sector*: World Bank.
- Dias, S. M. (2011). Overview of the legal framework for inclusion of informal recyclers in solid waste management in Brazil *Women in informal employment: Globalization and organization policy brief* (Vol. 6).
- European Union. (2012). Guidelines on waste prevention programmes. Retrieved 16th December, 2013, from http://ec.europa.eu/environment/waste/prevention/pdf/Waste%20Prevention_Handbook.pdf
- Ezeah, C., & Roberts, C. L. (2012). Analysis of barriers and success factors affecting the adoption of sustainable management of municipal solid waste in Nigeria. *Journal of Environmental Management*, 103(0), 9-14. doi: <http://dx.doi.org/10.1016/j.jenvman.2012.02.027>
- Gerold, A. (2009). Integrating the Informal Sector in Solid Waste Management Systems. Basic Aspects and Experiences.
- Ghose, M. K., Dikshit, A. K., & Sharma, S. K. (2006). A GIS based transportation model for solid waste disposal – A case study on Asansol municipality. *Waste Management*, 26(11), 1287-1293. doi: <http://dx.doi.org/10.1016/j.wasman.2005.09.022>
- Government of Canada. (2013). Environment Canada. from <http://www.ec.gc.ca/gdd-mw/default.asp?lang=En&n=684B44DD-1>
- Government of India. (2008). Handbook on Service Benchmarking. New Delhi, India: Ministry of Urban Development.
- Gunsilius, E. (2010). Role of informal sector in solid waste management and enabling conditions for its integration. Experiences from GTZ. *German Technical Cooperation Agency*.

- Gunsilius, E., Sandra, S., & García-Cortés, S. (2011). Recovering resources, creating opportunities: Integrating the informal sector into solid waste management. Eschborn, Germany: The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).
- Gutberlet, J. (2008). *Recovering Resources – Recycling Citizenship: Urban Poverty Reduction in Latin America*. Aldershot: Ashgate.
- Hall, C., & Day, J. (1977). *Ecosystems Modelling in Theory and Practice. An Introduction with Case Histories*. New York: John Wiley and Sons.
- Hoorweg, D., & Bhada-Tata, P. (2012). *What a Waste: A Global Review of Solid Waste Management*. Washington DC: World Bank.
- Jaramogi, P. (2013). Scrap dealers want ban on exports lifted, *New Visions: Uganda's leading daily*. Retrieved from <http://www.newvision.co.ug/mobile/detail.aspx?newsid=631429&catid=3>
- Kampala Capital City Authority. (2012). Kampala physical development plan. Kampala, Uganda.
- Kampala Capital City Authority. (2013). Kampala Solid Waste Management PPP Project: Pre-bid Investor Conference. Kampala, Uganda.
- Kampala City Council Solid Waste Management Ordinance. (2000). Kampala, Uganda.
- Kampala City Council Solid Waste Management Strategy. (2002). Kampala, Uganda.
- Katusiimeh, M. W. (2012). *Public and Private Service Provision of Solid Waste Management in Kampala, Uganda*. (Phd), Wageningen Universit, Wageningen, Netherlands.
- Katusiimeh, M. W., Burger, K., & Mol, A. P. J. (2013). Informal waste collection and its co-existence with the formal waste sector: The case of Kampala, Uganda. *Habitat International*, 38(0), 1-9. doi: <http://dx.doi.org/10.1016/j.habitatint.2012.09.002>
- Katusiimeh, M. W., Mol, A. P. J., & Burger, K. (2012). The operations and effectiveness of public and private provision of solid waste collection services in Kampala. *Habitat International*, 36(2), 247-252. doi: <http://dx.doi.org/10.1016/j.habitatint.2011.10.002>
- Kulabako, R. (2010). *Environmental sanitation situation and solute transport in variably saturated soil in peri-urban Kampala*. (PHD), Royal Institute of Technology, Stockholm, Sweden. Retrieved from http://www2.lwr.kth.se/Publikationer/PDF_Files/LWR_PHD_1059.pdf
- Kulabako, R., Nalubega, M., & Thunvik, R. (2007). Study of the impact of land use and hydrogeological settings on the shallow groundwater quality in a peri-urban area of Kampala, Uganda. *Science of The Total Environment*, 381(1–3), 180-199. doi: <http://dx.doi.org/10.1016/j.scitotenv.2007.03.035>
- Kumer, R. (2005). *Research Methodology: A step by step guide to beginners* (2nd ed.). London: Sage Publications.
- Lwasa, S., Koojo, C., Mabitizi, F., Mukwaya, P., & Sekimpi, D. (2011). Vulnerability assessment on climate change in Kampala and Uganda *United nations human settlements Programme un-habitat Sud-net cities in climate change initiative*.
- Massoud, M., & El-Fadel, M. (2002). Public-private partnerships for solid waste management services. *Environ Manage*, 30(5), 621-630. doi: 10.1007/s00267-002-2715-6
- McCall, M. K., & Dunn, C. E. (2012). Geo-information tools for participatory spatial planning: Fulfilling the criteria for 'good' governance? *Geoforum*, 43(1), 81-94. doi: <http://dx.doi.org/10.1016/j.geoforum.2011.07.007>
- Medina, M. (2002). Globalization, development, and municipal solid waste management in third world cities. *Tijuana, Mexico: El Colegio de la Frontera Norte*(199), 1-38.
- Moser, C. O. N. (1978). Informal sector or petty commodity production: Dualism or dependence in urban development? *World Development*, 6(9–10), 1041-1064. doi: [http://dx.doi.org/10.1016/0305-750X\(78\)90062-1](http://dx.doi.org/10.1016/0305-750X(78)90062-1)
- Mugaga, F. (2006). *The Public –Private Sector Approach to Municipal Solid Waste Management. How does it Work in Makindye Division, Kampala District, Uganda?* (Academic Thesis Phd Thesis), Norwegian University of Science and Technology, Trondheim. Retrieved from <http://ntnu.diva-portal.org/smash/get/diva2:126252/FULLTEXT01>
- Muinde, D. K. (2013). *Assessing the effects of land tenure on urban developments in Kampala*. (MSc thesis), University of Twente Faculty of Geo-Information and Earth Observation (ITC), Enschede. Retrieved from http://www.itc.nl/library/papers_2013/msc/upm/muinde.pdf
- Muller, M., & Hoffman, L. (2001). *Community Partnerships in Integrated Sustainable Waste Management: Tools for Decision-makers, Experiences from the Urban Waste Expertise Programme (1995-2001)*. Gouda, Netherlands: WASTE.

- Niringiye, A., & Omortor, G. (2010). Determinants of Willingness to Pay for Solid Waste Management in Kampala City. *Current Research Journal of Economic Theory*, 2(3), 119-122.
- Nyakaana, J. B., Sengendo, H., & Lwasa, S. (2000). Population, Urban Development and the Environment in Uganda: The Case of Kampala City and its Environs Kampala: Makerere University.
- Oguntoyinbo, O. O. (2012). Informal waste management system in Nigeria and barriers to an inclusive modern waste management system: A review. *Public Health*, 126(5), 441-447. doi: <http://dx.doi.org/10.1016/j.puhe.2012.01.030>
- Okot-Okumu, J. (2012). Solid Waste Management in African Cities – East Africa. In L. F. M. Rebellon (Ed.), *Waste management-An Integrated vision*. Croatia: InTech.
- Okot-Okumu, J., & Nyenje, R. (2011). Municipal solid waste management under decentralisation in Uganda. *Habitat International*, 35(4), 537-543. doi: <http://dx.doi.org/10.1016/j.habitatint.2011.03.003>
- Paul, J. G., Arce-Jaque, J., Ravana, N., & Villamor, S. P. (2012). Integration of the informal sector into municipal solid waste management in the Philippines – What does it need? *Waste Management*, 32(11), 2018-2028. doi: <http://dx.doi.org/10.1016/j.wasman.2012.05.026>
- Practical Action. (2007, December 2007). Poverty and Services. Retrieved 31st May, 2012, from http://practicalaction.org/access-to-services/ia3_poverty_and_services
- Republic of Uganda. (1995). *The Constitution of the Republic of Uganda*. Entebbe, Uganda: UPPC.
- Republic of Uganda. (2010). Value for money audit report on solid waste management in Kampala *Office of Auditor General*. Kampala.
- Ristic, G. (2005). *Working and Living Environmental Protection*. Paper presented at the FACTA UNIVERSITATIS.
- Scheinberg, A. (2007). *Privatisation and the Informal Sector: Thinking locally, acting globally?* Paper presented at the Integrated Solid Waste Association (ISWA). http://www.iswa.org/uploads/tx_iswaknowledgebase/620431_Paper.pdf
- Scheinberg, A. (2012). Informal Sector Integration and High Performance Recycling: Evidence from 20 Cities *Women in informal employment: Globalization and organization policy brief* (Vol. 23).
- Scheinberg, A., Simpson, M., Gupta, Y., Anschütz, J., Haenen, I., & Tasheva, E. (2010). Economic Aspects of the Informal Sector in Solid Waste Management. Eschborn, Germany.
- Schubeler, P. (1996). Conceptual Framework for Municipal Solid Waste Management in Low-Income Countries. Gallen, Switzerland: UNDP/UNCHS (Habitat)/World Bank/SDC
- Sliuzas, R., Lwasa, S., Jetten, V., Petersen, G., Flacke, J., & Wasiga, J. (2013). *Searching for flood risk management strategies in Kampala*. Paper presented at the Planning for Resilient Cities and Regions, AESOP-ACSP Joint Congress, Dublin, Ireland.
- Teddie, C., & Tashakkori, A. (2009). *Foundations of mixed methods research: Integrating quantitative and qualitative techniques in the social and behavioural sciences*. Thousand Oaks, CA: Sage Publications.
- Troschinetz, A. M., & Mihelcic, J. R. (2009). Sustainable recycling of municipal solid waste in developing countries. *Waste Management*, 29(2), 915-923. doi: <http://dx.doi.org/10.1016/j.wasman.2008.04.016>
- Tukahirwa, J. T. (2012). Solid waste management in Kampala under the transformation process: Kampala Capital City Authority.
- Tukahirwa, J. T., Mol, A. P. J., & Oosterveer, P. (2010). Civil society participation in urban sanitation and solid waste management in Uganda. *Local Environment*, 15(1), 1-14. doi: 10.1080/13549830903406032
- Tukahirwa, J. T., Mol, A. P. J., & Oosterveer, P. (2013). Comparing urban sanitation and solid waste management in East African metropolises: The role of civil society organizations. *Cities*, 30(0), 204-211. doi: <http://dx.doi.org/10.1016/j.cities.2012.03.007>
- Twinomuhangi, R. (2010). *The use of Geo-information Technology in sustainable solid waste management in Kampala* (Doctor of Philosophy PhD Thesis), Makerere University, Kampala.
- Uganda Bureau of Statistics. (2002). Uganda Population and Housing Census. Kampala, Uganda.
- UN-Habitat. (2004). *Tools to Support Transparency in Local Governance*. Nairobi, Kenya: Transparency International and UN-HABITAT.
- UN-Habitat. (2007) Situation analysis of informal settlements in Kampala. Nairobi: Un-Habitat.

- UN-Habitat. (2009). Climate change assessment for Kampala, Uganda: a summary. from <http://www.urbangateway.org/sites/default/ugfiles/Summary%20Climate%20Change%20Assessment%20for%20Kampala.pdf>
- UN-Habitat. (2010). *Solid waste management in the world's cities : water and sanitation in the world's cities 2010*. London: Earthscan.
- UNEP. (2005). Solid waste management. California: United Nations Environment Programme (UNEP).
- UNEP. (2013). Guidelines for National Waste Management strategies: Moving from challenges to Opportunities. from <http://www.unep.org/ietc/Portals/136/Publications/Waste%20Management/UNEP%20NWS%20English.pdf>
- United Nations. (1992). *Agenda 21: Programme of Action for Sustainable Development*. Paper presented at the United Nations Conference on Environment & Development Rio de Janeiro, Brazil. <http://www.un.org/esa/sustdev/documents/agenda21/english/Agenda21.pdf>
- Van de Klundert, A., & Arnschutz, J. (2001). Intergrated sustainable waste management - the Concept. In A. Scheinberg (Ed.). Gouda, Netherlands: WASTE.
- Van de Klundert, A., & Lardinois, I. (1995). Community and private (formal and informal) sector involvement in municipal solid waste management in developing countries. Gouda, Netherlands: WASTE.
- Velis, C. A., Wilson, D. C., Rocca, O., Smith, S. R., Mavropoulos, A., & Cheeseman, C. R. (2012). An analytical framework and tool ('InteRa') for integrating the informal recycling sector in waste and resource management systems in developing countries. *Waste Management & Research*, 30(9 suppl), 43-66. doi: 10.1177/0734242x12454934
- Voinov, A. (2008). *Systematic Science and Modeling for Ecological Economic* (Vol. Oxford, UK): Academic Press.
- Whiteman, A., Smith, P., & Wilson, D. C. (2001). *Waste management: An indicator of urban governance*. Paper presented at the UK DFID submitted for the Global Habitat conference on Urban Development, New York, United States of America. http://www.davidcwilson.com/Waste_Management_An_Indicator_of_Urban_Governance.pdf
- Wilson, D. C., Rodic, L., Scheinberg, A., Velis, C. A., & Alabaster, G. (2012). Comparative analysis of solid waste management in 20 cities. *Waste Management and Research*, 30(3), 237-254.
- Wilson, D. C., Velis, C., & Cheeseman, C. (2006). Role of informal sector recycling in waste management in developing countries. *Habitat International*, 30(4), 797-808. doi: <http://dx.doi.org/10.1016/j.habitatint.2005.09.005>
- Yin, R. K. (1994). *Case Study Research: Design and Methods* (4th ed.). Newbury Park, CA: Sage Publication.

APPENDICES

Appendix 1: Sample of interview guide for key informants

Dear participant

I am a student at the faculty of geo-information science and earth observation of the University of Twente in the Netherlands. I kindly request you to participate in a research on evaluating ways of improving the informal and formal solid waste management systems in Kampala. The information you will provide will be treated confidentially and will only be used for this research. This interview will not exceed an hour. I further request that I record this interview so that important issues you raise are captured.

1. Which ministries are involved in solid waste management?
2. Which department of the council deals with solid waste?
3. How is its organisational structure?
4. How many staff members are involved in waste management?
5. What are their qualifications?
6. What equipment does the council have for waste management?
7. What is the council budget for waste management?
8. Is the budget sufficient enough to deal with solid waste in the Division?
9. What is the source of money spent on waste management?
10. Which regulations govern solid waste management?
11. Are there any by-laws on waste management? Yes or No?
12. If yes which ones are they?
13. If not, why not?
14. Which areas does the council serve in terms of waste collection?
15. How often is waste collected?
16. On average, how much waste is collected per day?
17. How much waste reaches the landfill?
18. Any recycling initiatives by the council? Yes or No
19. If yes, where do they take place?
20. How much waste is recycled?
21. If no, why not?
22. What can be done to increase recycling activities?
23. Does the council work partner with other stakeholders in waste collection?
24. If yes, who are these stakeholders?
25. In what ways do they partner?
26. Any kind of monitoring of these stakeholders?

27. Are there any best solid waste management practices in the city?
28. If yes, what are they?
29. Where do you they take place?
30. Do you involve any stakeholders in solid waste management planning? Yes or No
31. If yes, how?
32. If no, why not?
33. What challenges does the council meet in waste management?
34. Do you think integrating the informal and formal solid waste management operations can be one of the solutions to the waste management problem in Kampala? Yes or No
35. If yes, why do you think it is a good idea?
36. In which areas can this integration be done?
37. What aspects do you think are important in improving waste management?
38. Look at table 1, tick three (3) what aspects do you consider to be the most important to be addressed to improve informal and formal solid waste management systems in Kampala? Give them priorities 1 to 3. Number 1 for first priority. (3.2)
39. Tick the indicators on table 2 which you think can be used to measure the performance of solid waste management systems in Kampala? (4.3)
40. What other variables do you think should be added or removed from the list shown on table 2 to derive indicators for assessing the performance of SWM in Kampala? (4.3)
41. What measures can help facilitate the improvement of waste management in informal neighbourhoods? (3.3)
42. What other measure would be necessary in formal neighbourhoods to improve solid waste management?

Table 1. Aspects to be considered in improving solid waste management

Priority score (1 to 3)	Informal neighbourhoods (Tick only three)	Aspects for SWM	Formal neighbourhoods (Tick only three)	Priority score (1 to 3)
		Recognition of informal sector contribution		
		Physical operation		
		Access to information and education		
		Appropriate technology		
		Access to waste resources		
		Organisations		
		Partnerships		
		Legal reform		
		Institutional reform		
		Financing		

Table 2. List of possible solid waste management indicators

Variable	Definition
Generation	Quantity of waste per capita
Handling	Percentage of waste collected compared to generated waste
Collection	Percentage of inhabitants provided with regular waste collection
Recycling	Percentage of waste recycled and recovered before disposal
Disposal	Percentage of waste disposed at the landfill
Carbon footprint	Number of vehicles used
Financing	Percentage of municipal budget on waste
Operational; cost	Average cost per tonne of waste
Employment	Number of workers employed
Social perception	Degree of inhabitants satisfaction
Inspection	Ratio of workers to inspectors
Inclusivity	Degree of user inclusivity
	Degree provider inclusivity
Sound institutions	Degree of institutional coherence
Transparency	Degree of clarity in SWM laws and procedures
Enforcement	Number of successful enforcement actions against waste management offenders

Appendix 2: Household questionnaire

Dear participant

I kindly request you to participate in my research which aims at evaluating ways of improving the informal and formal solid waste management systems in Kampala. I am a student at the faculty of geo-information science and earth observation of the University of Twente. The information you will provide will be treated as confidential.

1. Gender
2. Occupation
3. Name of Zone
4. Educational level
 - Primary
 - Secondary
 - Tertiary
 - Other (specify)
5. What is the number of people in your household?
6. What is your monthly household income in (shillings)?
 - Less than 300,000
 - 300,000 to 700,000
 - 300,000 to 1,000,000
 - More than 1,000,000
7. Are you renting the house you are living in?
 - Yes
 - No
8. How do you pay for water, electricity bills or house rent?
 - I personally separately pay for water or electricity
 - Water or electricity bills are combined in the amount paid for renting the house
9. Is it a good idea to add waste collection fees to the money paid for house rent?
 - Yes
 - No
10. If No to the previous question, why do you think it is not a good idea to add waste collection fees to house rent?

.....

.....

.....

11. Who collects your household waste?

- Division or KCCA
- Private company
- Informal waste picker
- NGO
- Community based organization
- Ourselves
- Other (specify)

12. Do you pay for waste collection?

- Yes
- No (**If No is the answer go to 17**)

13. If Yes to the previous question, how much do you pay for waste collection in shillings?
.....

14. If Yes to the previous question, how often do you pay the waste collection fee?

- Per day
- Per week
- Per month
- Other (specify)

15. How was the amount paid for waste collection arrived at?

- Bargained
- Fixed
- Other (specify)

16. How do you rate the amount you pay for waste collection?

- Low
- Moderate
- High (**After answering this question go to question 21**)

17. If you **do not pay** for waste collection, where do you dispose of the waste?

- Within the plot
- On the road side
- At the place provided by the Division
- At an open space
- Other (specify)

18. If you **do not pay** for waste collection at the moment, are you willing to start paying for it?

Yes

No

19. If **Yes**, how much are you willing to pay in shilling for waste collection per month?

.....

20. If **No** to previous question, why are you not willing to pay for the collection of waste?

.....
.....
.....

21. What type of waste containers do you use to store your household waste before it is taken away?

Sack

Polythene bag

Dust bins

Other (specify)

22. What is the level of satisfaction with the way your household waste is managed?

Not satisfactory

Satisfactory

Very satisfactory

23. How can waste collection be improved in this neighbourhood?

.....
.....
.....

24. Do you sort or separate your household waste?

Yes

No

25. If yes, what kind of waste do you sort or separate?

.....
.....
.....

26. If yes to previous question, how do you separate your waste?

.....
.....
.....

27. If no to previous question, why don't you sort or separate your household waste?

- No time
- Limited space
- No storage container
- No demand for sorted waste
- Other (specify)

28. Are you are aware of recycling activities in Kampala?

- Yes
- No

29. If yes, where do these recycling activities take place?

.....
.....
.....

30. What kind of waste is recycled?

.....
.....
.....

31. How do you think waste recycling can be improved in this neighbourhood?

.....
.....
.....

32. Are you willing to participate in better management of your household waste?

- Yes
- No

33. If No to previous question, what is the reason why you are not willing to participate in better management of your household waste?

.....
.....
.....

34. In the last 12 months, have you received any information on solid waste management?

- Yes
- No

35. If yes to the previous question, what kind of information did you receive?

.....
.....
.....

36. How did you receive this information? Tick the appropriate answers.

- Mega phones
- Radio
- Television
- News paper
- Local meetings
- Other (specify)

37. Who organized these educational programmes?

- Nakawa Division or KCCA
- Community based organizations
- Non-governmental organizations
- Local leaders
- Other (specify)

38. What problems do you experience with the way waste is managed in your neighbourhood?

.....
.....

39. How can the problems stated in the previous question be addressed?

.....
.....
.....

40. Do you think KCCA or the Nakawa Division should encourage the private companies collecting waste to cooperate and work hand in hand with informal waste pickers in this neighbourhood?

- Yes
- No

41. If Yes to the previous question, why do you think this cooperation is a good idea?

.....
.....
.....

42. If No to the previous question, why do you think it is not a good idea? (Give reasons)

.....
.....
.....

Thank you for your co-operation

Appendix 3: Two proportion z test description

This is a test when finding out whether two groups or population differ significantly on some single characteristic (<http://stattrek.com/hypothesis-test/difference-in-proportions.aspx>)

Requirements:

- Use of random sample
- Independent sample
- Each population includes at least 10 successes and 10 failures
- Each population is at least 10 times as big as its sample

Steps

1. Define hypothesis

$$H_0: P_1 = P_2$$

$$H_a: P_1 \neq P_2$$

2. State the alpha

0.05 significance level

3. State the decision rule

If z is less than -1.96 or greater than 1.96, reject the Null hypothesis.

4. Calculate the test statistic

- Pooled sample proportion: $p = (p_1 * n_1 + p_2 * n_2) / (n_1 + n_2)$
- Standard error: $SE = \sqrt{p * (1 - p) * [(1/n_1) + (1/n_2)]}$
- Test statistic: $z = (p_1 - p_2) / SE$

5. State results

E.g. ($z=3.7.13, p>0.05$). Which means that the z is greater than 1.196 at 0.05 the significance level

6. State conclusion

State whether there is a significant difference or not in the two groups. Using the example above, it can be stated that there is a significant difference in the proportion of the two groups

Appendix 3: Frequency of aspects for improving SWM in informal and planned neighbourhoods

