Assessing Challenges to Solid Waste Management in Urban Local Authorities in Uganda: A Case Study of Arua Municipality

Adebuason Robert

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School of Social Sciences, Uganda Christian University Arua Campus

Abstract

Purpose: Waste generation is associated with and comes with human activities and as such, waste management is an issue which should be shared by every individual, community, organisation or Country worldwide. Depending on climate, life style and behavioural differences, level of industrialisation, available waste management programmers and economic incentives, the problem of waste generation and its management continues to be a major environmental problem in urban centres worldwide. This Paper attempts to assess the Challenges to Solid Waste Management in Urban Local Authorities in Uganda with specific reference to Arua Municipality in North Western Uganda. A Case study design was used.

Materials and Methods: A sample of 391 respondents was selected out of a Target population of 7,881 which included; Heads of Households, Business Operators, Elected leaders, Heads of Departments and Solid waste Collectors. The Methods for data collection adopted were Questionnaires, Interviews, Observation and Documentary Review. The Researcher used Regression Technique for data analysis.

Findings: The study findings showed that, urban population growth had an inverse relationship with solid waste management while funding had a positive significant effect on solid waste management. The study further found out that,

urban population behaviour had a negative relationship with solid waste management.

Implications to Theory, Practice and Policy: From these findings the researcher concluded that lack of waste segregation; inadequate facilities and equipment, lack of legislation and bye-laws, and ineffective enforcement are among the major challenges to solid waste management in Arua Municipality. Based on the above findings, the researcher recommends the following; Solid waste segregation (separation), enforcement, legislations and bye-laws, provision of adequate solid waste management facilities and equipment and training/Capacity building programmes on solid waste management**.** The study findings will help policy makers in formulating sustainable solid waste management policies and designing appropriate methods of managing solid waste in urban Local Authorities. The study findings will help raise awareness on issues pertaining to solid waste management at community level. This awareness will help build initiatives to reduce the solid waste management problem in Arua Municipality. The study will further contribute to the body of knowledge on the studies already conducted on solid waste management in developing countries.

Keywords: *Solid Waste Management, Urban Local Authorities, Arua Municipality*

1.0 INTRODUCTION

Globalisation which implies a strong cultural, technological and especially economic interconnection between people and countries has been widely promoted as a process, which will improve the wellbeing of both the developed and developing worlds (Horst & Tannya, 2001). However, Rakodi (1997) mentions that for the developing world including Africa, globalisation has raised some troubling concerns and one such concern is its impact on urbanisation and the ramifications that go with it. Urban areas are traditionally engines of social modernization and economic growth and at the same time the theatres in which globalization stages its actions. For Africa, this has meant fuelling the already unprecedented urban growth phenomenon and increasing the challenges that go with it. According to Achankeng (2003), one key challenge is the management of municipal solid waste. Globalization has been identified as playing a negative role in solid waste management in African cities.

Its impacts include; the transfer of internationalized waste management methods and ideologies and conflicting involvement of multi-national companies with local initiative groups, city and national government in waste management matters and other issues which directly or indirectly affect the waste sector (Rakodi, 1997). The forces, behind this unprecedented urban growth in Africa, other than the ones already given above, are many. Globalisation specifically affects solid waste management in Arua Municipality in the sense that it has led to an increased volume and variety of waste, resulting from increased inflows of people of various nationalities and multicultural backgrounds into the Municipality which has changed the life style especially a shift in consumption patterns from traditional food like cereals such as millet, rice which produce less waste to modern foods such as bananas which produce a lot of wastes because 2/3 of the bananas are consumed and 1/3 is thrown away as waste.

However, some authors have identified the following; rural-urban migrations, natural population increase, engulfing of peripheral rural settlements by urban expansion and in some cases, conflicts. The push factors from rural areas have been declining agricultural productivity or low prices, lack of employment opportunities, basic physical and social infrastructure. On the other hand, the expectations of better employment opportunities and better life in the cities account for the attractiveness that cities offer (Harsch, 2001). Thus, cities have provided an avenue for upward mobility and for that reason have remained a magnet for rural migrants (Freire& Strein, 2001). One obvious consequence of rapid urbanization is the growing generation of solid waste and many City authorities face unprecedented challenges in managing these, including problems of coping with their collection, and disposal. Despite the importance of adequate Solid Waste Management to the urban environment, the performance of many city authorities in this respect leaves much to be desired (Ogu, 2002). In the United States of America (USA), thousands of former Industrial sites, Municipal landfills, and Government facilities are contaminated with oil, solvents, other industrial chemicals and radioactive wastes which threaten ecological systems and both the human and economic health of the communities in which they are located (Serageldin, Cohen & Sivara makrishnan, 1995).

Solid waste generation, as one would expect, varies between countries, cities, and parts of cities in Africa (Thando, 2003). Insurgence of war, economic crises or booms, political strife to mention but a few can have immediate and profound changes on waste generation and management. Friesecke (1999), states that today' s wars in Africa are, first of all caused by decades of economic devastation through the International Monetary Fund-World Bank policies of brutal Structural Adjustment Programs. As Medina (1999) rightly contends, this policy meant that debt payment to international creditors come first, and the people last-if at all. In the meantime, there is no hope for the population, who continue to live in ever-worsening poverty. These situations can cause abrupt stop of waste management, reduce generation or completely stop removal. For example, in Mogadishu (Somalia), huge heaps of garbage accumulated over the city over ten years of a civil war (Barise, 2001). Barise (2001), explains that soldiers turned this problem into an opportunity to get money as they interrupted clean-up operations demanding payment for allowing refuse to be removed.

Even though many factors influence municipal solid waste management, population size is an important one. According to Thando (2003), there is a positive correlation between city population size and both the percentage of waste moved and rate of households enjoying regular waste collection. This suggests that increasing city size poses a greater problem to the solid waste management in Africa. In Yaoundé City for example, current figures show that the current population is estimated at 1.2 million people, up from 600, 000 in the 1960s. Not only have the quantities, of the waste increased from about 300 to 1200 tons per day but also the variety (Achankeng, 2003). Achankeng (2003) notes that in Cameroon, even though more than half of the entire waste management budget is dedicated to waste transportation alone, only a very limited percentage is moved to the waste treatment centre or disposal.

Accordingly, Municipal solid waste management constitutes one of the most crucial health and environmental problems facing governments of African cities. This is because even though these cities are using 20-50 percent of their budget in solid waste management, only 20-80 percent of the waste is collected. The uncollected or illegally dumped wastes constitute a disaster for human health and the environmental degradation (Achankeng, 2003). It is believed that, in poorest communities many of which are in Sub Saharan Africa, 80 to 90 percent of wastes generated are not collected for safe disposal. They usually end up as illegal dumps on streets, open spaces and wet land (Ogu, 2002). The Egyptian city of Alexandria for example generates approximately 1,720 tonnes daily of domestic solid wastes but waste collection service covers only about 60 percent of the population (Serageldin, et al, 1995). In Nigeria, the problem of country's cities has become one of the most intractable environmental problems. In many cities, the volume of solid wastes has overwhelmed urban administrator's capacity to plan for their collection and disposal. Thus, it is not uncommon to find urban streets and roads practically blocked by solid wastes (World Bank, 2002). In Dar-es Salaam (Tanzania), the proportion of solid waste collected and disposed of is less than 25 percent (Atieno, 2005).

In Nairobi City,16 million tones of solid waste is generated daily but only 30 percent is collected by both the City authorities and individual residents leaving all the other 70 percent un disposed of (United Nations, 2002). In some African cities, garbage collection

was re-contracted to private companies but later withdrew for not being paid by the central government. In many African countries, various categories of collection dumper trucks fitted with corresponding specialized devices for removing and dumping waste have been imported for use. However, these equipment breakdowns quite often and they are also very expensive to run and maintain.

In Uganda, the responsibility for solid waste management (SWM) lies with local governments as specified in the Public Health Act, 1964 and the Local Governments Act, Cap 243. However, solid waste management is one of the pressing problems facing municipal areas, arising from rapid urbanization due to the growing number of unplanned settlements (Matovu, 2002). Polythene bags and plastic waste have become a serious health and environmental hazard in residential and commercial areas because in addition to their traditional use as food containers, some residents use polythene bags as 'toilets' which are dumped in trenches, on the streets, garbage heaps, around homes and water sources leading to constant outbreaks of cholera, malaria, and typhoid. In Kampala city alone, domestic Waste generation rates range between 0.5kg and 1.1kg per capita per day. The estimate of waste per capita generation per day is 0.5kg.

In Uganda, there is lack of a deliberate policy and frame work for solid waste management at community and institutional levels (Mugenyi, 2007). In Kampala City, it is common to see heaps of garbage on the road sides or a garbage container that is long overdue for collection, buzzing with flies and emitting a foul smell. This scenario is common all over the city suburbs, showing clearly a big problem in the city's garbage management and disposal system (The Daily Monitor, May, 24[th,] 2007). In Fort Portal Municipality, daily garbage generation stands at five tonnes while actual daily disposal is only three tonnes implying that each day, two tonnes remain uncollected, a total of 60 tonnes each month, a situation that poses serious health problems to the urban dwellers (The Daily Monitor, 1st June, 2007). It is worth noting that, population dynamics is indeed an important component for national and urban sustainable development. An increase in total population holding other factors constant leads to an increase in the demand for goods and services and in turn an increase in demand for environmental resources (Nyakaana, Sengendo & Lwasa, 2007). Population dynamics are the underlying drivers of development and environmental change in urban areas.

The population of Arua Municipality like that of other urban centres in the country has been increasing. This has mainly been due to high fertility, natural increase, internal and international migrations (UBOS, 2002). Arua municipality has continued to be one of the primate cities and a hub of economic, social, commercial that attract both internal and external migrants. According to the 2002 National Housing and Population Census, it has a total night population of 43,929 and 7,443 households (UBOS, 2007) but the day population fluctuates between 70,000 and 100,000 people. According to the records of Arua Municipal Council, Arua Municipality has a lot of business opportunities because of her proximity with the Democratic Republic of Congo and the Southern Sudan and the neighbouring Districts hence a lot of solid waste is generated daily. Records from Arua Municipal Council Health Department indicate that, the quantity of solid waste produced monthly rose from 120 tonnes in 1993 to 170 tonnes in 1998 but currently, the annual

quantity of solid waste generated in Arua Municipal Council stands at 5400tonnes.Therefore, the rapid increase in volumes of unattended to solid wastes in the municipality with the associated risk to human health is a source of concern. There is also a steady increase in the cost and logistical difficulties of municipal solid waste management. This has put increasing pressures on the infrastructure and authorities responsible for the management of waste. This study explores the challenges to solid waste management in urban local authorities in Uganda and more particularly in Arua municipality. one key challenge is the management of municipal solid waste.

Statement of the Problem

Cities in the developing world are confronted with a twin dilemma of rapid urban population growth which calls for increased demand for solid waste management services and a traditional public sector that is resource constrained to effectively respond to these demands (Ahmed & Ali 2006). This trend of urban population growth has by-passed the capacity of many urban local authorities to provide effective and efficient SWM services, as manifested by inappropriate solid waste disposal practices such as indiscriminate open dumping and solid waste burning (Klundert & Anschutz 2000). In Arua Municipality, the worst hit area is the Central Business District which is a point of concentration of business, Residential and institutional premises, characterized by delays in disposing off garbage to the land fill, over flowing of skips, careless and indiscriminate open dumping of garbage on streets, frequent cholera out breaks, blockage of drainage systems, filthy and unsanitary conditions and garbage ordour (The Daily Monitor, June 5th, 2007). However, this scenario if not urgently addressed will escalate environmental pollution, encourage the breeding of disease-vector insects, animal scavengers and rodents, and result in a range of diseases through different routes of exposure such as faeco-oral and soil transmitted mechanisms. This shows that, the problem is getting out of proportion and hence poses a number of challenges. Unfortunately, the underlying challenges have not been scientifically assessed.

Despite the fact that several studies have been carried out on Solid waste management around the world, no study has been conducted in the context of Arua Municipality. The focus of this study was to conduct a scientific assessment of the challenges to solid waste management in Arua Municipality in order to bridge the gap.

Purpose of the Study

The Purpose of this Study was to assess the Challenges to Solid Waste Management in Arua Municipality.

Objectives of the Study

i.   To assess the effect of urban population growth on solid waste management in Arua Municipality.

ii. To investigate the effects of funding on Solid waste management in Arua Municipality.

iii. To establish the relationship between urban population behaviour and solid waste management in Arua Municipality.

Research Hypotheses

H_1: Urban population growth has no significant effect on solid waste management in Arua Municipality.

H_2: Funding has no significant effect on solid waste management in Arua Municipality

H_3: Urban population behaviour does not significantly affect solid waste management in Arua Municipality
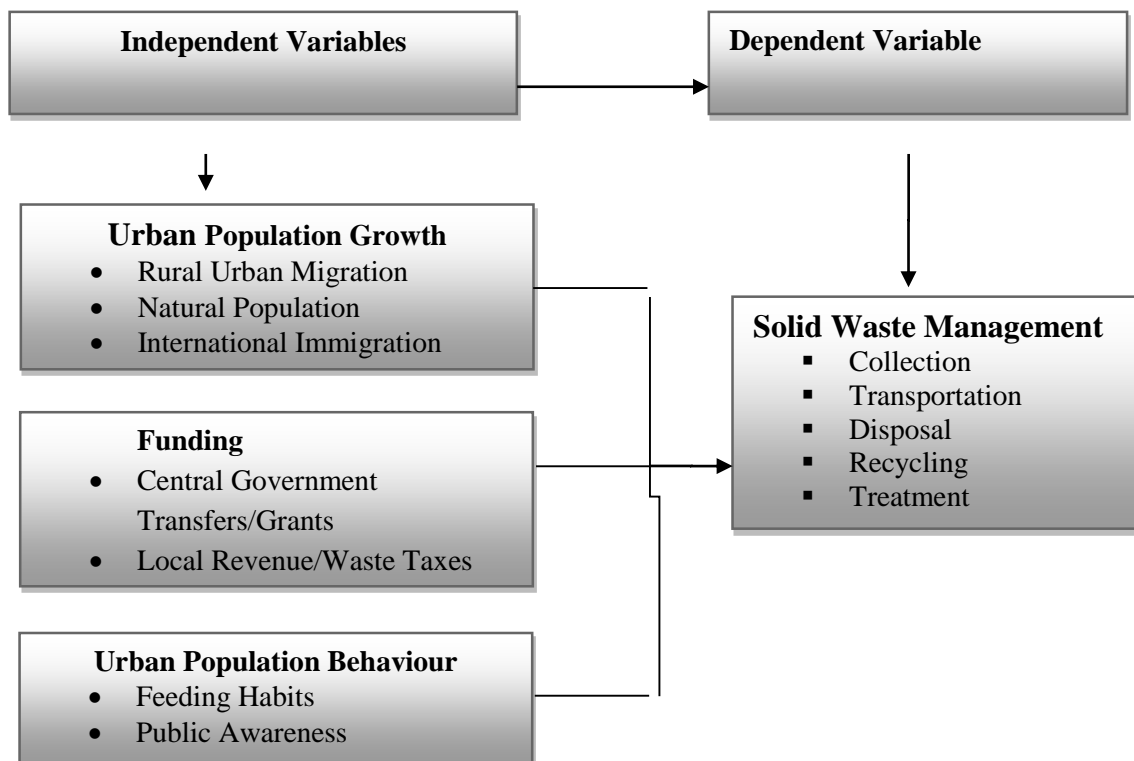
Conceptual Framework

Figure 1: Conceptual Framework Showing the Effect of Urban Population Growth, Funding and Urban Population Behaviour on Solid Waste Management

Source: Author (2008)

From the above conceptual framework, the dependent variable is solid waste management which has been operationalised as collection, transportation, disposal, recycling and treatment of waste while the independent variables are; urban population growth, funding and urban population behaviour. Urbanization leads to increase in population in urban areas. This population is drawn from different socio-cultural backgrounds. This results into indiscriminate solid waste disposal in streets and open spaces and the same population can be taxed of fined to generate funds to purchase refuse collection trucks, refuse skips and refuse bins for solid waste management. This Conceptual Framework offers a basis for an assessment of the linkages and derivation of policy recommendations for sustainable management of solid waste in urban Local authorities.

Justification of the Study

Increasing Population in urban areas without proper solid waste management can be a threat to health, the environment and urban productivity. With the increasing population in Arua Municipality, there has been an increase in solid waste generation through domestic, commercial and industrial activities. Despite the fact that Arua Municipal Council spends about 25 percent of her locally generated revenue on solid waste management, the waste management service provided is still far from the satisfaction (expectations) of the urban population. The above phenomenon necessitates protecting and improving the urban environment. It was on the above basis that the researcher was prompted to undertake the study.

Scope of the Study

The study was carried out in Arua Municipality in Arua District in the Divisions of Arua Hill and River Oli. The key issues assessed in this study were the challenges as the independent variables and solid waste management as the dependent variable. The study assessed urban population growth, funding and urban population behaviour as challenges to solid waste management from 2005 to 2008.

2.0 LITERATURE REVIEW

Theoretical Framework

Several Theories or Models of waste management have evolved. These decision support models involve the use of methods and tools such as Cost Benefit Analysis (CBA), Life Cycle Analysis (LCA) and Integrated Waste Management (Morissey & Browne, 2004). Waste management systems based on CBA usually convert all economic, social and environmental challenges into monetary terms (Berkhout & Howes, 1997). In this case, economic impacts are readily obtained by the cost of building waste management facilities and the revenues generated from such facilities. Social and environmental impacts are estimated by the cost of abating pollution from a waste treatment facility and or how much the public is willing to pay for an environmental improvement. These estimations go into deciding which waste management option offers the best benefit. Maximizing economic efficiency is usually the dominant factor in CBA at the costs of environmental and social criteria, which is not a sustainable approach to waste management.

The Limitations of CBA in waste management include; valuing non-market goods can be complicated, e.g. in landscape and wildlife; a comprehensive CBA model for a SWM system can be time consuming; there is much difficulty in measuring the project's benefits and costs regarding impacts in ecosystems, due to complexity of these systems; Values of the variables used in the financial/economic analysis may have a high non-forecasted variation throughout the waste programme life-cycle, changing the preferred option, for instance; changes in landfill costs may impact on how much waste is recycled (Morissey and Browne, 2004).   A study on Costs Analysis of Municipal Solid Waste Management Scenarios in Romania in terms of the economic impacts of four waste management scenarios observe that the calculation of benefits would be necessary in an integrated CBA, in order to establish the economic feasibility

associated with the implementation of different waste management scenarios (Ghinea & Gavrilescu, 2016).

According to Morissey & Browne (2004), those waste management practices based on the LCA of products involve the evaluation of the environmental aspects and potential impacts throughout a product's life from raw material acquisition through production, use and final disposal. Very recent waste management theories are on the other hand concerned with the whole life cycle of products (McDougall et al., 2001) with the aim of making a complete assessment of the systems environmental impact. This approach is essentially for waste minimization as it affords the producers the opportunity to alternative production routes and waste reduction strategies. LCA is however, a specific and technical environmental accounting process that is unable to deal effectively with social issues. Petts (2000) observes that LCA though covers environmental and economic sustainability does not consider social aspects such as health effect predictions and therefore, cannot be considered a sustainable waste management system. Other waste management systems are based on integration of different waste management practices. The concept of integrated waste management developed by McDougall et al. (2001) links waste streams, waste collection, treatment and disposal methods with the LCA concepts while aiming at achieving environmental benefits, economic optimization and social acceptability. According to Nilsson-Djerf and McDougall (2000), for a waste management model to be sustainable, it needs to be environmentally effective, economically affordable and socially acceptable. This point is supported by Petts (2000) who stressed that the best solid management tool must be related to local environmental, economic and social priorities and must go further to involve the public before important waste management decisions are made. Social, environmental and economic compatibilities are therefore observed to be the dimensions of sustainable waste management models.

However, owing to the diversity of different system components that need to be addressed and the inability of a single tool to assess all components, there is need for an Integrated Solid Waste Management (ISWM) Approach which considers not only environmental and economic but also social aspects. ISWM according to Klundert & Anschutz (2000) is a waste management system that best suits the society, economy and environment in a given location. A part from technical or financial-economic aspects that characterise the conventional model of ISWM, the concept also considers the socio-cultural, environmental, institutional and political aspects that influence overall SWM sustainabilty. Shekdar (2008) mentions that ISWM involves selection and application of suitable techniques, technologies, management approaches, socio-economic conditions, operating environment and actions of urban authorities to achieve specific goals. Klundert & Anschutz (2000) further point that, ISWM differs from conventional approaches to waste management by upholding stakeholder participation and inclusion of waste prevention and resource recovery in addition to encouraging analysis of interactions with other urban systems and promotion of an integration of different habitat scales and this approach is ideal in addressing the solid waste management challenges in Arua Municipality considering the local conditions. However, the key question here is how sustainable is the solid waste management service delivery in Arua Municipality?

Empirical Review

Urban Population Growth and Solid Waste Management

One of the principal responsibilities of government is to ensure the safety and prosperity of its citizens. This has different meanings to various nations, depending on factors such as their geography, demographics, climate, and political environments. The developing world is experiencing rapid population growth and a massive shift in where these people are living. Infact in 1998, the world's population grew by over 78 million people with 97% of this growth occurring in the poorest countries (The Population Institute, 1999). Urban centres are experiencing the brunt of this growth and most are ill equipped to handle these added stresses. On this note, Stessel (2000), points out that health in the human environment is the first quality to become jeopardized when urban infrastructure is unable to cope with increasing demands. Proper sanitation is difficult to maintain when city services cannot expand into growing areas at the pace required of them. Third World cities have undergone a rapid urbanization during the past fifty years and the number of urban dwellers is expected to double between 1987 and 2015 (Furedy, 1991). Nearly 90 percent of this increase will take place in the Third World, where growth rates exceed 3 percent a year, three times that of the industrialized countries. Urbanization in the Third World implies the expansion of slum areas and the creation of new ones. Population growth intensifies the pressure on urban infrastructure in many cities already overburdened with the provision of urban services. Most Third World cities lack the resources to meet the demand for services such as water, sanitation and solid waste management.

The insufficiency of services results in a deterioration of the urban environment in the form of air, water and land pollution that poses risks to human health and the environment. In Manila, a city of over 10 million people, only 10 percent of the population is served by sewers. Raw sewage generated by Manila residents regularly pollutes water supplies, canals, lagoons, the Pasig River (which runs through the city), and Manila Bay (Furedy, 1991). Worldwide, over two-thirds of human waste is released to the environment as sewage, often polluting surface waters and posing significant risks to human health (Arefin, 1993). With a population density of over 800 people per square kilometer, management of waste, especially solid waste, is a monumental problem for Bangladesh (Badiul, 1998). Rapid population growth will only further accentuate the problem in the future. The problem of waste is primarily an urban phenomenon. Rapid urbanization and indiscriminate setting up of industries within cities worsen the problem. Badiul (1998), maintains that, about a fourth of Bangladesh's population of over 120 million currently live in urban areas, which is expected to increase to 68 million in 2015. He further notes that, of the current urban population of 30 million, nearly a fourth live in the Dhaka city which has an area of 344 square kilometer. Such high concentration of population makes solid waste management a serious problem for the municipal authorities of Dhaka city (Badiul, 1998).

In the same vein, the growing waste management problem in the Kingdom of Swaziland can be seen as a symptom of many factors with the sky rocketing growth in the population, Industrialization and urbanization contributing a significant percentage. This has prevented the implementation of appropriate remedial action such as changes in behavioral patterns;

establishment of waste infrastructure and the development of required legislation in order to prevent, recycle and eventually handle waste that must be collected, treated and disposed[1]. With the increasing pressure of population growth coupled with the investments being made into economic infrastructure, urban areas located in developing countries as Furedy (1991), rightly puts it, there is an urgent need to identify appropriate means to improve waste management in these areas. This is relevant for household waste, waste from commercial nodes, as well as health care risk waste from health care facilities. Globally, urbanization is becoming a world phenomenon, but its ramifications are more pronounced in developing countries (Yami, 1999). Natural growth of population, reclassifications of habitation and migration trends are important in urban population in several countries of the developing World. The population of urban India for example was 285 million as per 2001 census, which accounts for 27 per cent of the total population (Badiul, 1998). However, global experience shows that when a country's urban population reaches almost 25% of the overall population (as in the case of India), the pace of urbanization accelerates (Sunil, 2005).

Due to rapid urbanization and uncontrolled growth rate of population, solid waste management becomes acute in that particular country. As a result of high population growth, a major danger of poor solid waste management is the threat it poses to the environment and severe public health hazard to the population. In Liberia for example, Nyepon (2007), reveals that Municipal Solid Waste (MSW) has increased at an alarming rate due to Liberia's rural-urban migration and rapid population growth caused by 20 years of economic dislocation, conflict and free multi-party democratic elections. Population growth in Monrovia has quadrupled from 250,000 to well over 1.5 million inhabitants during this period along with significant increase in urban sprawl, which have made heavy demands on the environment as more resources are consumed, and large quantities of wastes and sewage are generated. Additionally, Yami (1999) maintains that, with the current growth rate of urban population in Ethiopia, it is estimated that the population of most urban areas especially small urban centres is doubling every 15-25 years. As solid waste generation increases with economic development and population growth, the amount in these urban areas will double within a similar time range so, is the cost for solid waste management. Thus, population growth and economic development have brought enormous amounts of solid waste to the urban areas (Sadiq, 2004).

According to Vitkovic & Godin (1997), the urban population is growing at a rate of more than 6 percent a year in the capital cities of West Africa as a result of both a natural increase in the cities and the continuing influx from the country side. Vitkovic & Godin (1998) observed that, the urban population is now majority. In the Sahelian region, urban dwellers constitute 35 percent of the total population (12 million out of 35 million) and they will account for 50 percent of the population within 25 years (34millon out of 68 million). Over the next 10 years, cities will grow by 6 million people or 50 percent more than their population today, and these will occupy an additional 100,000 hectares. In West Africa as a whole, the outlook is even more alarming; 63 percent of the population will be city dwellers in 2020(270 million out of 430 million) within 10 years, the population of West

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[1] http://www.environment.gov.sz/waste_man.htm

Africa will have increased by 43 million. Further still, Mwesigye (2003) also asserts that, there is a growing urban population in Uganda. He observed that, the proportion of the urban population has been on the increase for the last several decades. Between 1959 and 1969, urban population growth rate was 8.2 percent, 3.9 percent during 1969-1980, 5.8 percent during 1980-1991 and 4.6 percent between 1991 and 2002. He further observed that, a growing urban population has led to a lot of challenges for urban management. In this regard, Ecaat (2003) pointed out that, urban population growth has a direct effect on waste generation rate.

As the urban population increases, more waste is produced, this coupled with low technology of waste handling treatment and disposal leads to accumulation of waste within households, market places and commercial areas. In agreement with Ecaat (2003), Rwamushaija (2000) pointed out that, in Malukhu Squatter settlement in Mbale Municipality, the high population has increased the amount of waste generated and put pressure on the existing facilities. The skip only takes three days or less to fill up and yet only the market and a few houses near the market place use it. The rubbish pits are also filling up faster than anticipated. According to Fay and Opal (2003), migration whether circular, seasonal or permanent, is expected because people prefer wages in the city to alternative rural income. If urban wages are higher, rural people will be attracted to the city. The above assertion is supported by Mazumdar (1987) who observed that, if expected urban income is much higher than rural income, rural urban migration may occur even if the employment prospects in the city are dim. Migrants may be willing to endure a period of unemployment if expected urban income is sufficiently high. The foregoing review establishes the fact that, a positive correlation tends to exist between a community's population and the amount of solid waste generated. Worth noting is that wealthier individuals (who normally reside in urban areas) consume more than lower-income ones, which results in a higher waste generation rate for the former. The processes of accelerated population growth and urbanization translate into a greater volume of waste generated. This means that globalization can indeed promote economic growth, a desirable outcome. However, this economic growth in addition to population increase and urbanization seriously strain municipal resources to deal with a booming number of wastes. If those additional wastes resulting from population and economic growth are not collected, treated and disposed of properly, health and environment in Third World cities will further deteriorate (Furedy, 1991).

Funding and Solid Waste Management

The booming growth of cities of the developing world has outpaced the financial and manpower resources of municipalities to deal with provision and management of services, of which solid waste is the major one. Lack of these services greatly affects the urban poor, women and children who are vulnerable to health hazards. 22 human diseases are related to improper solid waste management (World Bank, 1997). To be successful, every solid waste management program needs funding. Unfortunately, especially in an era of tightening budgets, it may be difficult to find the needed resources. Remoteness, small community size, and lack of resources make this situation even more acute in Indian Country. While municipalities are committed to solving the persistent problem of solid

waste management, they lack the resources, manpower, political will and innovation needed to adequately address the problem. Nyepon (2007) observes that, throughout Liberia, especially in the Monrovia Metropolitan Area (MMA), the private sector is locked out of active involvement and participation in the sector.

According to the UN, over 60 per cent of Monrovia's solid waste generated is not collected due to lack of human, financial and material resources. However, many residents argue that, the bulk of the city solid waste challenge is due to the lack of political will, vision and innovation. In this regard, Nyepon (2007) warns that, unless and until waste management is taken seriously, the problem will remain a severe challenge especially for urban dwellers, with low incomes, poor living conditions and low literacy levels which de-motivates many from adopting safe hygienic practices. There are numerous challenges related to funding of solid waste management. According to Schaeffer (2000), Central Government Transfers and Grants are the major sources of revenues to Local Municipal governments. According to the World Bank (2000), poor financing is characteristic of public waste service provision in Nigeria. The annual average financial resources allocated to sewerage, drainage and refuse services by all the states in Nigeria fell from nearly US $ 163 million between 1981-85 to only US$17.4 for the period 1990-92. World Bank (2000) further pointed out that, finance has always been a problem for urban waste management services in Benin city. In 1992, the City Council proposed spending US $ 0.1 million on refuse services of which only US $0.02(23 percent) was actually released and spent. Municipal Local governments' local revenues include; Service fees, licenses, rental income from buildings and facilities, interest income on investments, as well as income from sales of Municipal assets Schaeffer (2000). He observed that, for efficiency reasons, charges should be levied on the direct recipients of public service benefits. He pointed out the experience of service charges in developed and developing countries are not a simple one because the prices charged seldom reflect economic efficiency rationale.

In Alexandria, the financial resources of the department of public works which administers Municipal solid waste come from the 2 percent cleaning tax on the value of rental properties but the expenditure is not enough Serageldin et al (1995). Although the City sometimes seeks loans from various sources, to defray the costs of equipment, these loans of course carry interest charges, increasing expenditure burdens. For the case of Uganda, Mugenyi (2007) points out that inadequate funding for solid waste handling and disposal is one of the causes of the urban waste management problems. According to the Local Governments Act, Cap 243 Section 83, the types of grants by Central Government to Local Governments include unconditional, conditional and equalization grants. However, the above grants from Central Government have no provision for waste management. This study will assess the effects of funding on solid waste management in Arua Municipality. With resources shrinking, efforts to raise money through local taxation have been frustrated by tax payer resistance and attempts to improve Municipal revenue systems have been disappointing; moreover, the fiscal fragility of Local Governments stems from their own management short comings as from their dependence on central Government (Vitkovic & Godin, 1998).

In most developed countries' urban areas, the collection and disposal of solid waste is a service the producer of solid waste must pay for, just like it is done for the use of water, telephone and power Mushabe (2002). Casey (1999), points out that, in 1987, when, Landfill space ran out, most Danish Municipalities quickly adopted high waste tax and this led to the reduction of waste being accumulated and also generated more revenue to finance Municipal budget deficits. Solid waste management is becoming a major public health and environmental concern in urban areas of many developing countries. The situation in Africa, particularly in the capital cities is severe. The public sector in many countries is unable to deliver services effectively, regulation of the private sector is limited and illegal dumping of domestic and industrial waste is a common practice. In general, solid waste management is given a very low priority in these countries (United Nations, 2002). As a result, very limited funds are provided to the solid waste management sector by the governments, and the levels of services required for protection of public health and the environment are not attained.

The problem is acute at the local government level where the local taxation system is inadequately developed and, therefore, the financial basis for public services, including solid waste management, is weak (UNDP, 1997). Improper solid waste management leads to substantial negative environmental impacts (for example, pollution of air, soil and water, and generation of greenhouse gases from landfills), and health and safety problems (such as diseases spread by insects and rodents attracted by garbage heaps, and diseases associated with different forms of pollution). Municipal (or local) authorities charged with responsibility of providing municipal solid waste management services (together with other municipal services) have found it increasingly difficult to play this role. The difficulty has been aggrevated by lack of effective adequate funds and services, and inability of municipal authorities to provide the services cost-efficiently. Community members can participate in solid waste management by contributions in cash, kind or labour (BCAS, 2005). They can also participate by participation in consultation and by participation in administration and management of solid waste services. Community members and local leaders in urban communities play different roles in solid waste management in different parts of cities. However, Juerg (2002) contends that, the management of hazardous chemicals is not only a matter of technology and legislation, but also of enforcement, funding and financial instruments.

Revenue raising instruments include the various kinds of user charges (levies or taxes) for the provision of collection, transportation and final disposal services. These are directed at "internalizing" the externalities associated with the production, transportation and disposal of waste. The revenue raised from such charges may then be earmarked for solving the specific problem from which the charge was levied. There are many examples of charges and taxes that fall under the category of revenue raising economic instruments. These instruments, which include deposit-refund programmes, combine the incentive effects of charges (when a good is purchased and the deposit is made) and subsidies (when the good is returned or otherwise handled properly and the deposit is refunded) for the management of solid waste. Other incentive-creating policies can include property rights-based instruments as well as legal /information based instruments. These charges include; monthly waste management charges, pay-as–you dump fees or a collection charge as part

of a monthly service fee or annual municipal rates. For commercial waste, public containers are used and collected at a charge. With respect to human waste, the economic instruments that have been used include; a connection fee for sewage systems and a monthly charge. A frequently used instrument is user charges for the collection, transfer and disposal of solid wastes. At least in countries like Bolivia, Brazil, Chile, Colombia, Ecuador, Jamaica, Mexico and Venezuela, there is experience with this instrument.

For residential waste, however, it is usual for these charges to be fixed and payable periodically, unrelated to the volume, weight or type of waste being disposed of. In this case, the economic instrument is being directed exclusively to the achievement of cost recovery and not towards the reduction of generated wastes. For example, in the urban municipalities of Greater Santiago, where this instrument has been used for many years and is considered a success, recovery is about 55 per cent of service cost. The essential problem is that it is not possible to exclude from service those who do not pay, which makes it impossible to recover the total cost. The use of charges through territorial taxes has the inconvenience that collection costs are high, as they usually involve the use of legal mechanisms and, therefore, have a high non-payment rate. However, Bamukwesha (1998) pointed out that, in Uganda, there is already an outcry about high taxes and doubted if the introduction of waste taxes would be a lasting solution. This study however disagrees with this observation because the success of a waste tax depends on the approach used to introduce and enforce it.

Mushabe (2002) observed that, in the absence of the official waste taxes in Uganda, it is already evident that some sections of the urban population have already started incurring costs to meet their demands on solid waste. Rwamushaija (2000) observed that, despite in adequacy of the existing solid waste management facilities in Malukhu Squatter Settlement, the Municipality is also short of funds to purchase more equipment. The residents are also short of funds hence they cannot afford to pay for private garbage collection services to supplement the Municipal collection which has proved to be in efficient. Arua Municipality at the moment manages all the solid waste through the Division Councils, which are still very far from the satisfaction of the people in the Municipality. This study will assess the effect of funding on solid waste management in Arua Municipality. This involves the need for consultation between the stakeholders, following which there is a trade-off between what people want and what an institution is prepared and/or able to supply.

Commitment may depend on the awareness of health, social and economic benefits of improved services and a willingness to contribute to the development and maintenance of the facilities (Badiul, 1998). People may be happy to pay for services if they feel that they have a direct say in decision making and contribution is also perceived as a declaration of equality in status. There is also a role for the agency in being willing to encourage communities to make these improvements. In recent years, Community-based solid waste management is a reality in many cities in developing countries, although it may take different forms. Given the continuing lack of means and regardless of the type of waste management, community-based SWM will be an important option for Cities in developing countries to keep their environment clean. To translate the concept into reality, the

conscious citizens must take the required initiatives (BCAS, 2005). Arua Municipality should earmark a sustainable funding source and allocate a specific percentage for solid waste management out of her annual budgets.

Population Behavior and Solid Management

As noted earlier, waste can be loosely defined as any material that is considered to be of no further use to the owner and is, hence, discarded. However, most discarded waste can be reused or recycled. What may be of no further use to one person and regarded as waste to be dumped, may be of use to the next person, and is the basis of the rag picking trade, the sifting through refuse at landfills for recovery and resale (Allen, 2001). Ecaat (2003) maintains that, whereas it is true that the problem of urban waste manifests itself as an environmental concern requiring putting in place sound environmental practices, it is also true that, the waste problem to an extent is a function of irresponsible behavioral tendencies associated with an urban population. Mugenyi (2007) puts the blame on traditional feeding habits of the local communities that emphasize eating of food stuffs such as bananas with high potential to generate wastes (peelings) which are partly responsible for the high volume of organic wastes generated.

Mwesigye (2003) also observed that, the volume of garbage generated per house hold is the highest in the region largely because of the nature of food consumed in these homesteads like banana, sweet potatoes, cassava and maize and all these food items have a tendency of leaving behind huge amounts of residue when being prepared for consumption. This means that, big volume of solid waste in developing countries' towns and Uganda in particular is largely dependent on their traditional eating habits where by a lot of food stuffs are acquired in markets in their un processed form as opposed to processed food stuffs consumed in developed countries' cities (Mushabe, 2002). Rwamushaija (2000) in agreement with the above scholars affirms that, people's culture affects solid waste management because it determines the amount and composition of the wastes in Malukhu Squatter Settlement. He pointed out that, Malukhu is mainly composed of Itesots and Bagishu with the latter out numbering the former. The Bagishu mainly produce organic residues because they eat bananas as their staple food. Bananas produce a lot of wastes because 2/3 of the bananas are consumed and 1/3 is thrown away as waste. The Itesots on the other hand mainly eat cereals such as millet, rice which produce less waste than bananas. The brewing of local beer known as "*malwa"* by both communities also affects solid waste management because this brew is cheaper than beer and its dregs are a problem since they are disposed of carelessly after the "malwa" has been consumed. However, Pandy (1997) in contrast pointed out that, house holds' solid materials vary from one urban area to another due to different population sizes and consumption habits.

The foregoing review shows that; indeed, waste is generated universally and is a direct consequence of all human activities. Wastes are generally classified into solid, liquid and gaseous. Gaseous waste is normally vented to the atmosphere, either with or without treatment depending on composition and the specific regulations of the country involved (Nyepon, 2007). Liquid wastes are commonly discharged into sewers or rivers, which in many countries is subject to legislation governing treatment before discharge. In many parts of the world, such legislation either does not exist or is not sufficiently implemented,

and liquid wastes are carelessly discharged into water bodies or allowed to infiltrate into the ground (Arefin, 1993). With households, household waste represents waste generated in the home and collected by municipal waste collection services. Municipal solid waste (MSW) includes shop and office waste, food waste from restaurants, markets etc., collected by municipal waste collection systems, plus waste derived from street cleaning, and green waste generated in parks and gardens (Horst, 2001). This suggests that, households form the largest category of stakeholders in waste generation. They have a multi-faceted relationship to waste management activities: waste generators, waste service clients, receivers of information and participants in mobilization for waste management. Important roles of households in waste management are to store garbage, set out the garbage at the agreed place and time, use the official disposal sites and maintain private waste facilities. The community leadership in turn, has to look into the heterogeneity composition of the community to have better participation and to support households in playing their expected roles (BCAS, 2005). This implies that, there is a need for genuine commitment at the household and community level for improved services in solid waste disposal.

In Bangladesh, households prepare their garbage in such a way that it can be collected by micro- and small enterprises, the local authority or a private company, or by waste pickers, or bought by itinerant buyers (Abdus & Kamaleswar, 2005). In developing countries, Sustainable Solid Waste Management (SSWM) and sanitary environment remain the greatest challenge and threat to public health, growth, poverty reduction and social transformation (Thando, 2003). Together, these factors threaten life, liberty and the pursuit of happiness. They are human rights, which ought to be protected by the law because they stall fundamental liberties and potential human growth. In Liberia, over 80 percent of the population has no organized waste collection service, while less than 10 per cent have municipal water lookup, including municipal sewerage or pour-flush toilets with septic system (Nyepon, 2007). The majority of Liberians use pit latrines and other unsanitary methods as the only means of excreta management, while children walk barefoot through rotten garbage to makeshift dumpsite that contains hazardous medical waste such as used syringes and bloodied bandages to access a toilet site. For instance, these primitive forms of excreta disposal have created a dangerous unsanitary environment throughout the city, while the lack of efficient facilities continues to contribute to accumulation of wastes in the urban centre thereby, increasing diseases, such as gastroenteritis and bilharzias, which cause widespread morbidity (Nyepon, 2007).

The indiscriminate disposal of solid waste in public places therefore causes serious environmental hazards and health risks. Mubarak (1993) affirms that rotten and decomposed garbage make neighborhoods filthy, foul smelling and unhealthy. Flies, cockroaches and rodents thrive in such filth, and they are the known sources of many diseases. Uncontrolled and open dumping also clog the urban drainage system, cause frequent floods and threaten the contamination of water supply. Thus, the growing problem of solid waste in cities is posing increasing threats to the health and wellbeing of its residents (Badiul, 1998). Much of the solid waste generated by individuals consists of organic food remains, accounting for between 80% and 85% of the total. Other types of wastes include paper, plastics, clothes, glasses, metals and construction materials. Despite some minor variance, there appears to be a great deal of similarity in the composition of

solid wastes generated in residential and commercial areas (Shukur& Paul, 1993). Faced with an unsatisfactory and inadequate system of solid waste management, some groups of people in urban centres in countries like Bangladesh are coming forward to deal with the problem. Some community groups are taking initiatives themselves to manage the burgeoning challenge of waste (Badiul, 1998).

In many regions, centralized waste disposal has historically occurred by land filling, wherein local quarries and gravel pits have been filled with waste because, in many cases, they simply constituted an appropriately sized hole in the ground. Such locations typically offered little protection against contamination of adjacent groundwater supplies. Legislation, designed to protect usable groundwater, has helped to reduce the incidence of this practice in many high to middle income countries (Allen, 2001). Modern waste management practices involve disposal of waste in specially sited and engineered sites known as sanitary landfills. Waste accepted in municipal waste landfills in developed countries would normally consist of municipal solid wastes, plus commercial and non-hazardous industrial wastes, and construction and demolition (C&D) waste. There is a tendency in many countries for C&D waste, usually regarded as inert, to be buried on the construction site where it is generated (Allen, 2001). Due to the lack of regular garbage collection, irregular excreta management combined with careless disposal of garbage, most of the people in developing countries perform unsafe hygiene practices due to lack of public health education and environmental awareness. Many do not wash their hands before handling food, before eating, after a toilet visit, after household chores such as cleaning and garbage collection (Anomanyo, 2004). Others do not wash food before eating, especially fruits.

Additionally, many men for instance, do not wash their hands after urinating; and they urinate in open spaces (e.g. behind the house, next to cars, near streets and railways). Furthermore, many of the poor perceive safe hygienic practices as rich people's affair, as authorities reinforce this myth by employing a "One- size -fits- all" approach to social change, which presents a problem because it has no specificity, and does not fit and address local conditions and concern. This lack of adequate resources to provide environmental sanitation and sustainable waste management exposes the population to pollution, contamination, deadly disease carrying vectors and public health hazards (Nyepon, 2007). It is through this lens that the researcher in the current study view human behavior to be responsible for municipal failure to manage waste in their localities as a prerequisite to social transformation, better living standards and sustainable poverty reduction. The current waste management practice in Arua Municipality is contracting out to a private firm who collects, transports and disposes the waste to the land fill which is consequently disposed and recycled. The key challenges are frequent breakdown vehicles and inadequate funding for solid waste management.

Solid Waste Management

Serageldin et al, (1995) observed that, despite heavy municipal spending on waste management, most cities fail to provide efficient, reliable and Universal collection, or environmentally safe disposal. Achankeng (2003) pointed out that, Municipal Solid Waste management constitutes one of the most crucial health and environmental problems facing

Governments of African cities. This is because even though these cities are using 20 – 50 percent of their budget on solid waste management, only 20 – 80 percent of the waste is collected. The uncollected or illegally dumped waste constitutes a disaster for human health and environmental degradation. Nyakaana (1997) and NEMA (1998) pointed out that, in the Ugandan Capital City Kampala, 70 – 80 percent of the solid waste produced remains uncollected. Although Municipal Governments spend between 20 – 50 percent of their available operating budgets for solid waste services, typically only half of the urban households benefit from collection services. Bartone et.al (1994), point out that, inadequate collection of household garbage is a persistent problem facing Local Governments. This study will assess the effectiveness of solid waste collection in Arua Municipality in order to address the solid waste dilemma.

According to NEMA (2005), almost 80 percent of the households are not served by Kampala City Council because they are hardly accessed by KCC's waste collection facility due to a combination of bad roads and absence of vehicle pass way. Ecaat (2003) in agreement with NEMA (2005) observes that, the challenge related to poor collection and transportation is related to several causes that include; inefficient transportation systems (inadequacy of trucks) and poor coverage of collection services due to poor roads and inaccessibility of some areas. NEMA (1998) pointed out that, handling of solid waste from the point of disposal in other urban areas involves several different methods which range from waste delivery trucks to hand driven carts of different types and sizes. Gombya & Mukunya (2004) pointed out that, many sources of waste management can only be reached by roads or alleys, which might be inaccessible to certain method of transport because of their width, slope and congestion or surface. This is especially critical in unplanned settlements such as slums or low-income areas and thus largely affects the selection equipment. This study will assess the appropriateness of solid waste transportation in Arua Municipality in order to address the solid waste crisis.

The methods of solid waste disposal have been handled differently worldwide. Some standard waste disposal methods that can be applied in combination to produce a waste management system include: Recycling, compositing, incineration, land fill and ordinary burning and each is reviewed below. According to Environmental Protection Agency EPA (2001), Recycling of solid waste in Denmark has been boosted by the introduction of waste taxes. Ramesh et al. (1993) pointed out that, recycling of solid waste reduces the pressure on the collection, disposal and handling systems of waste and at the same time, it creates further economic benefits such as employment creation and income generation. Mawanda (1997) and Mugisha (1995) pointed out that, recycling of solid waste is still very limited in Uganda's urban areas but admitted that, the potential exists.

In Kampala, it's the poor at times who engage in scavenging of the waste discarded by the affluent group (Mawanda, 1997). Similarly, in Kabale Municipality, some waste has been put to profitable use such as converting some waste to manure and animal feed in the farming sector (Mugisha, 1995). According to Mushabe (2002), only 32 percent of the people opted for compositing because of low-income levels. Casey (1999) noted that increased use of compositing in Denmark was between 1987 and 1997 whereby after the introduction of the waste tax, compositing increased from 86,000 tonnes in 1990 to 500,000

tonnes in 1994. Bamukwesha (1998) indicated that, it is being practiced in those areas where solid waste collection services have not reached and those homesteads that have big compounds. Achankeng (2003) observed that, the organic content of solid waste in African cities is identified to be as high as 70 percent. This suggests that, compositing could be a very viable recovery alternative. However, according to Gombya & Mukunya (2004), compositing is reported to be in very limited use in Uganda, for instance, in Kampala, little effort has been put to convert large amounts of organic waste into compost. However, the above studies did not clearly indicate how best compositing can work. This study will come up with an approach that can lead to the successful use of compositing as a solid waste source reduction method in Arua Municipality.

According to EPA (2001), Municipal solid waste incineration plants tend to be among the most expensive solid waste management options as they require highly skilled personnel and careful maintenance. For these reasons, it tends to be a good choice only when other, simpler and less expensive choices are not available (Rand, Haukohl & Marxen, 2000). Gombya and Mukunya (2004) point out that, incineration appears to be an extremely attractive option, however, with occasional exceptions; it is an inappropriate technology for developing countries and requires high financial start up and operational capital. Achankeng (2003) points out that Incineration remains a low option for Africa. This is because the high organic and water content of the waste stream makes incinerators energy consumers rather than energy producers, in addition, they are also very expensive to construct and run. Rand, et al (2000) showed that, because MSW plants are capital intensive and require high maintenance costs and comparatively higher technically trained operators, they are commonly adopted by developed countries. According to EPA (2001), though recycling, composting and incineration can divert large portions of Municipal solid waste from disposal, some waste still must be placed in landfills.

EPA (2001) points out that, a landfill operates under some federal standards namely: Location restrictions liners, operation practices, around water monitoring, closure and post – closure care, corrective action and financial assurance. Pandy (1997) reported that, in USA, 94 percent of the sites have been unacceptable and represent a disease potential and threat of pollution. According to World Bank (2000), selecting a site on which to develop a landfill is one of the most important decisions to be made by a Municipality in developing and implementing its waste management plan. This is because making the wrong decision will be expensive and may also cause long term problems resulting from public opposition. Gombya & Mukunya (2004) point out that, dumping of solid waste in landfills is probably the oldest and definitely the most prevalent form of ultimate garbage disposal. Mushabe (2002) noted that, because standards for maintenance of landfills are difficult and have as such failed many urban centres worldwide, the population has been resisting their locations in their planned areas. In Uganda, most urban local authorities operate dump sites, which are hazardous in nature and the urban residents are never contented with their locations (Mushabe, 2002). This study will assess the situation for Arua Municipality in order to address the problems surrounding the dumping site. According to EPA (2001), Local Governments or private operators can implement controlled burning process called combustion. Burning of solid waste was seriously practiced in Denmark between 1987 and 1997 following the introduction of waste taxes.

Bamukwesha (1998) observes that, the burning of solid waste in Kampala (Uganda) is done on small scale at household level as a way of reducing the amounts of garbage produced and this is common in dry season and where the cities' collection services are insufficient. Refuse is at times burnt from collection sites and worse still, in the skips. Burning also takes place at the landfill. Through the provision of a comprehensive and thorough review of the literature, a detailed analysis of the challenges to solid waste management in urban local authorities with reference to Arua Municipality propelled the researcher to undertake this study. From the foregoing review, the challenges facing Urban Local Authorities in Solid Waste Management were articulated and elaborated as reported by different Scholars. Available literature was reviewed on urban population growth, Funding and Urban population behavior and how they influence solid waste management. A number of approaches have been attempted to address the problem in different parts of the world and the experience for developing countries' towns including those in Uganda have been portrayed. Several studies carried out on Solid waste management around the world and in some Urban Local Authorities such as Kampala City Council (Bamukwesha, 1998, Mawanda,1997), Kabale Municipality (Mugisha,1995), Mbarara Municipality (Mushabe,2002), Jinja Municipality (Fahad,2000) and Malukhu Squatter Settlement in Mbale Municipality (Rwamushaija, 2000), indicated that Solid waste management is one of the pressing challenges facing urban areas namely; inadequate funding, indiscriminate waste disposal, frequent breakdown of equipment and incapacitated private sector service providers.

Gaps in Literature

Despite the fact that a number of studies have been conducted on Solid waste management around the world and in some Urban Local Authorities in Uganda, there is no mention of Arua Municipality in the Literature. This study will fill the existing gap left by previous literature.

3.0 MATERIALS AND METHODS

Research Design

A case study design was used. Case studies involve in-depth, contextual analysis of similar situations in organizations, where the nature and definition of the problem happen to be the same as experienced in the current situation (Sekaran, 2003). The case study helped to bring about an understanding of complex issues on solid waste management through previous studies undertaken in some urban local authorities in Uganda. Both quantitative and qualitative approaches were used. Quantitative approach was used in order to investigate relationships while qualitative approach was used because it is considered more useful to the diversity of multiple realities one finds in the complex field situations (Amin, 2005). The study also employed both probabilistic and non-probabilistic sampling designs because it allows use of statistics, tests hypotheses, and eliminates bias while non probabilistic sampling design was used because it is useful for quick and inexpensive studies (Amin, 2005).

Location of the Study

The study was carried out in Arua Municipality, one of the thirteen Municipalities in the Country. It has two Divisions namely Arua Hill and River Oli. The Municipality was chosen as the area of study because the increasing solid waste generated was not accompanied with its adequate management. Being one of the oldest Municipalities in Uganda, Arua Municipality is likely to have similar solid waste management problems like other Municipalities as such the findings of this study will be relevant to them as well.

Study Population

The study population consisted of the Heads of Households, Business operators, Elected Leaders, Heads of Departments and Solid Waste Collectors as shown in Table 1.

Table 1: Distribution of Respondents in Arua Municipality

Category of respondents	Target population	Sample size	Percentage	Sampling technique
Heads of households	7,443	287	3.9	Systematic sampling
Business operators	360	72	20	Systematic sampling
Elected leaders	48	12	25	Purposive
Heads of departments	20	10	50	Purposive
Solid waste collectors	10	10	100	Purposive
Total	**7,881**	**391**	**4.9**	

Source: (UBOS, 2007, Arua Municipal Council, 2007)

Sampling Techniques and Procedure

A sample size of 391 out of 7,881 was selected. These included; 287 Heads of Households,72 Business operators,12 Elected Leaders, I0 Heads of Departments and 10 Garbage Collectors. Purposive sampling was used to identify subjects among Elected leaders, Heads of Departments and Solid waste Collectors. The above categories of respondents were expected to be more knowledgeable on issues on solid waste management and therefore major source of information. Using purposive sampling, Twelve Elected leaders were selected from both the Municipal Council and the two Division Executive Committees. Ten technical officers were selected namely; the Town Clerk, the two Division Senior Assistant Town Clerks, Town Health Inspector, Environment Officer, Engineer, Chief Finance Officer, Health Educator, Education Officer and Community Development Officer.

Ten Garbage Collectors were selected. Business Registration Records from Arua Municipal Council Finance Department indicated that, 360 operational shops do exist in the Municipality. Systematic sampling was used to select Business operators. The sampling interval was determined by calculating N/n where N=360 and n= 72. The sampling interval was 360/ 72=5 the first respondent was number 5 and next number was 10 and this continued until all the 72 respondents were selected. According to the 2002 National Housing and Population Census, Arua Municipal Council has 7,443 Households (UBOS, 2007). Systematic sampling was used to select 287 households based on the census data

(Household list). The sampling interval was determined by calculating N/n where N=7,443 and n=287.The sampling interval was 7,443/287=26.The first respondent was number 26 and the next was number 52 until all the 287 households were selected. The Heads of the selected households were the respondents. Systematic sampling was used because it is a good procedure for sampling from a large population (Amin, 2005).

Data Collection Methods

The data collection methods that were employed in this study included the following:

Questionnaire

A questionnaire is a pre formulated written set of questions to which respondents record their answers, usually within rather closely defined alternatives (Sekaran, 2003). Questionnaires are completed at the respondents' convenience hence increasing chances of getting valid information. They also offer greater assurance of anonymity (Sarantakos, 1998, Amin, 2005).

Interviews

An Interview is an oral questionnaire where the investigator gathers data through direct verbal interaction with participants (Amin, 2005). Interviews provide in-depth data, are more flexible and yield more information by using probing questions (Mugenda & Mugenda, 1999). They also provide opportunity to observe non-verbal behaviour and to record spontaneous answers (Sarantakos, 1998).

Observation

Observation is a method of data collection that employs vision as its means of data collection (Sarantakos, 1998, Amin, 2005). This method approaches events in its natural structure and studies events as they evolve. It also offers first-hand information without relying on the report of others (Sarantakos, 1998, Amin, 2005). Observation was used to supplement the responses got from the respondents in a bid to get more factual data.

Documentary Review

This method involves delivering information by carefully studying documents, or visual information from sources called documents (Amin, 2005). Documents are useful in that, they are quick and easily accessible, spontaneous, retrospective, cheap and yield high quality information (Sarantakos, 1998).

Reliability and Validity of Research Instruments

Validity

Validity is the ability to produce findings that are in agreement with theoretical or conceptual values, or to produce accurate results and to measure what is supposed to be measured (Amin, 2005). Copies of the questionnaire and the objectives of the study were given to two judges to find out whether the instrument measured what it was meant to measure and also check on the phrasing, understanding and wording of the statements. Content validity index was used to establish whether the questionnaire measured what it was to measure. Content Validity is the degree to which the test actually measures or is specifically related to the traits for which it was designed (Amin, 2005). Following the

feedback from the two judges, amendments were made to simplify the questioning approach and some rearrangement of question sequence took place. The content validity index was found by considering the number of items declared relevant divided by total number of items presented. Overall, the questionnaire had a CVI index of .833 which was above 0.7, thus it was acceptable as valid (Amin, 2005: 288).

Reliability

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated results (Mugenda and Mugenda, 1999). In this study, quality control was done by carrying out a pre-test of the research instruments to test the reliability. This helped to eliminate questions that were vague, leading and ambiguous. The researcher pre tested questionnaires on seventeen purposively selected respondents. This was done in order to assess the reliability of the questionnaire. The responses from the piloted instruments were then entered into the SPSS programme to compute the reliability coefficient. This was determined using Cronbach's alpha coefficient which gives the average correlation of items in the instrument given. Table 2 shows the results of the computations for both the dependent and the independent variables.

Table 2: Reliability Coefficients of Independent Variables and Dependent Variable

Variables	Cronbach's Alpha
Urban population growth	.881
Funding	.702
Urban population behaviour	.768
Solid waste management	.754

Source: Primary Data (2008)

Table 2 above shows the reliability coefficients of the independent and dependent variables under study. From the table, the reliability coefficients of the variables were urban population growth .881, funding .702, urban population behaviour .768, and solid waste management .754. These reliability coefficients were based on an alpha Cronbach test of more than 0.7 which is a measure of internal consistency of the items on each scale. It tests whether the items for each variable hang together as a set.

Data Analysis

Quantitative Data Analysis

Quantitative data was collected using closed ended type of questions. The researcher ensured that, data was properly coded. Data was presented inform of frequency tables and graphs with their respective percentages. A computer statistical package, Statistical Package for Social Scientists (SPSS) was used. Subsequently, data was analyzed using a linear regression in order to establish whether management of solid waste was significantly dependent on the independent variables. Regression is a method that allows Social Scientists to make predictions about the value of one variable if another variable is known (Sarantakos, 1998).

Qualitative Data Analysis

Qualitative data was analyzed by arranging the data in to different themes and by source of information. Data was then coded to generate a description of the setting as well as categories of themes for analysis (Amin, 2005). An interpretation of the data was made in accordance with the study variables and study objectives. Where necessary, direct quotes were used to strengthen the interpretation.

4.0 FINDINGS

Urban Population Growth and Solid Waste Management

The null hypothesis stated: *"Urban population growth has no significant effect on solid waste management in Arua Municipality."* The results of the analysis are shown in Table 3.

Table 3: Effect of Urban Population Growth on Solid Waste Management [a, b]

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig.
(Constant)	108.968	2.124		51.308	.000
Urban Population growth	-1.872	.160	-.546	-11.726	.000

[a] Dependent Variable: solid waste management.   [b] R Square =.298

In Table 3, the coefficient of urban population growth is given by a value of -1.872. This coefficient being negative implies that population growth has an inverse relationship with solid waste management and makes it difficult to effectively manage solid wastes in the municipality. The p-value for the t-statistic was significant (.000<.05) implying that solid waste management is significantly affected by increase in urban population. In other words, as urban population increases, it becomes hard for municipal authorities to effectively manage the overwhelming increase in the garbage because increase in population increases the volume of solid waste generation. The R-squared value of .298 shows that, about 29.8 percent of the municipality's failure to effectively manage solid wastes in Arua Municipality is accounted for by the increase in the population in relation to the facilities available to collect, transport, and dispose the accumulated garbage in the Municipality. The above phenomenon was as a result of lack of segregation of solid waste. While it is a known fact that, the waste generated in urban centers contain different forms of wastes with different characteristics some of which are dangerous, it is also true that, urban wastes contain other materials that could be reused. However, the study showed that in Arua Municipality, waste segregation is a management strategy yet to be realised. With wastes disposed off without sorting, opportunities for possible reuse of some of the valuable and re-useable waste items are squandered. This poses challenge to solid waste management in Arua Municipal.

Funding and Solid Waste Management

It was hypothesized that; "Funding has no significant effect on solid waste management in Arua Municipality". The results are presented in Table 4

Table 4: Effect of Funding on Solid Waste Management [(a, b)]

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	sig
(Constant)	58.007	4.118		14.087	.000
Funding	1.001	.153	.341	6.536	.000

[a] Dependent Variable: solid waste management.   [b] R Square =.117

Table 4 above summarises the results of the regression analysis and from this table, funding is positively related (1.001) with solid waste management. This implies that, holding other factors constant, increase in funds results into effective and efficient management of solid waste in the municipality. As seen in the table, the computed value of the t-statistic (6.536) for the coefficient of funding is significant ($p<0.05$). The results therefore show that, solid waste management is significantly dependent on funding. The computed value of R-squared being 0.117 suggests that, holding other factors constant, funding accounts for about 11.75 percent of the variations in urban solid management in Arua municipality. In adequate funding for solid waste management leads to inadequate provision of facilities and equipment such as refuse skips, trucks and refuse bins for solid waste management. This is because collection and transportation of waste to disposal sites require collection facilities and vehicles respectively. In addition, the Council lacks funds for expansion of the dumping site. In Arua Municipality the few solid waste transportation vehicles are not in good operational state hence no adequate routine services. This poses serious challenges to solid waste management in Arua Municipality.

Urban Population Behaviour and Solid Waste Management

The null hypothesis stated: "Urban population behaviour does not significantly affect solid waste management in Arua Municipality." The findings are presented in Table 5.

Table 5: Effect of Urban Population Behaviour on Solid Waste Management [(a, b)]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	sig
1	(Constant)	91.529	3.499		26.158	.000
	Urban population behaviour	-.414	.209	-.109	-1.979	.049

[a] Dependent Variable: Solid waste management.   [b] R Square =.012

The results in Table 5 above show a negative relationship between urban population behaviour and solid waste management. In particular, the careless dumping of waste, lack of sensitization/ awareness coupled with low education levels of some urban residents (50 percent of the respondents) and consumption habits of the people whereby, most of the food eaten have high potential of generating a lot of waste during their preparation and the like have a resultant negative effect on the management of waste in the municipality. From Table 5 above, the coefficient of urban population behaviour given by -.414 implies that holding other factors constant, poor urban population behaviour (as mentioned above) leads to a 0.414 significant (p<0.05) decline in solid waste management. Other factors constant, such behavioural tendencies make solid waste management difficult if they persist. Looking at the value of R-squared given by 0.012, the results suggest that about 1.2 percent of the failure to adequately manage solid waste in Arua municipality is accounted for by urban population behaviour. The problem of indiscriminate solid waste disposal has been aggrevated due to lack of legislations or bye-laws on solid waste management in Uganda. In addition, there are also enforcement challenges in the area of solid waste management in terms of personnel facilitation and working hours since most of the enforcement staff are off duty and solid waste is mostly disposed off at night.

Table 6: The Combined Effect of Urban Population Growth, Funding and Population Behaviour on Solid Waste Management

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	**Std. Error**	**Beta**	**t**	**sig**
(Constant)	113.878	5.735		2.420	.000
Urban population growth	-1.426	.171	-.224	-2.493	.009
Funding	1.305	.146	.044	.530	.005
Urban pupation Behaviour	-1.136	.376	-.073	-.812	.000

[a] Dependent Variable: Solid waste Management   [b] R square = .518

Table 6 above shows the combined effect of the independent variables on the dependent variable which is solid waste management. From the table, the independent variables are jointly regressed on the dependent variable which indicates the combined predictive strength of the independent variables on the dependent variable. From the study the R square is .518 which indicates that 51.8 percent of the variance has been explained by the independent variables. The Beta coefficient indicates the individual predictive strength. The bigger the magnitude, the higher the causal effect. Hence the greatest predictor of the variation in relation to the magnitude of the Beta coefficient is urban population growth. The study findings indicate that all the independent variables can predict 51.8 percent of the variance on solid waste management. This means that, there could be other factors for this occurrence. It could mean that, the remaining percentage is either explained by intervening variables or moderating variables.

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this study was to assess the challenges to solid waste management in urban local authorities with specific reference to Arua Municipality in North Western Uganda. The researcher used questionnaires to collect data from Heads of households and business operators. Interview to elicit information from elected leaders, technical officers and garbage collectors, documentary review and observation were also used. The data was analyzed both quantitatively and qualitatively. It was presented in three parts namely: the socio-economic characteristics of respondents, the frequent counts of respondents' opinion per each of the items relating to a particular objective and study findings according to the hypothesis. The study findings showed that, the major challenges to solid waste management in Arua Municipality include: Lack of waste segregation, inadequate facilities and equipment for solid waste management, lack of legislations and bye-laws on solid waste management and in effective enforcement.

Conclusions

i. Urban population growth significantly affects solid waste management. Population growth poses the challenges of solid waste segregation since the waste is indiscriminately disposed off.

ii. Funding has a significant positive effect on solid waste management. Insufficient funding leads to inadequate provision of facilities and equipment for solid waste management.

iii. Urban population behavior significantly affects solid waste management. This was as a result of inadequate enforcement of public health legislations and solid waste management bye-laws.

Recommendations

Given the poor state of solid waste management in Arua municipality, the Local Officials, Community and Arua Municipal Council officials need to come together to address the problem. There is need to devise proper and appropriate strategies to mitigate the problem. Accordingly, the study made the following recommendations.

Solid waste Segregation/separation: A large proportion of the wastes generated in Arua Municipality is biodegradable and can be re-used hence an effort should be channeled towards putting these wastes to more productive use. It is therefore recommended that, segregation of waste be embarked upon in order to add value on the waste. Waste segregation should take place at the point of its generation such as at the residential and commercial premises levels. The sorting should be between bio-degradable and non-biodegradable waste. Biodegradable materials can be used to make compost to improve soil fertility or as animal feed especially the peelings of food stuff. The non-biodegradable wastes although less in composition than biodegradable wastes. Could also be re-used to reduce the quantity of wastes to be disposed for example, tins and bottles can be re-used as storage containers in homes for storing food or wastes.

Law Enforcement: Where as it is true that laws related to waste management do exist, more needs to be done in strengthening the enforcement capacity of Arua Municipality. Strict law enforcement is needed in the area of indiscriminate open dumping of waste on streets. The law enforcement personnel need to be availed with the necessary knowledge and skills and management support to enforce the law. In order for this to work effectively, Arua Municipal Council should be in position to enforce the laws as the situation demands.

Legislations: In order for any plan to work, it must be backed by legislative measures which will help to enforce the decisions that have been made. Bye-laws against littering should be enacted and enforced as the situation demands, for instance, culprits who litter the area with solid waste should be apprehended and fined. Arua Municipality should also advocate for a bye-law for privatization of solid waste management such that, private collection firms can come up to relieve the pressure on the Municipal authorities who have failed to adequately manage the solid waste.

Provision of adequate solid waste management facilities and equipment: In order to alleviate the problem of insufficient and inadequate solid waste management facilities and equipment, it is recommended that, the use of other collection systems and storage facilities be effected. In order to achieve the above, Arua Municipality should commit more funds to solid waste management. The study has shown that, there is need to put more funds to purchase more equipment and to facilitate collection and disposal of wastes. Funds could be raised levying of waste taxes, and fines imposed on residents caught dumping wastes illegally or by attracting donor agencies to come to their aid and finance solid waste management.

Training/Capacity Building Programmes on Solid Waste Management: In order to improve technical and managerial capacity for solid waste management in Arua Municipality, there is need to develop capacity to prepare action plans for waste management and monitoring, and to develop the ability to monitor, understand and adequately manage the solid waste production and disposal cycle. It is hoped that, once the capacity is built, it will set the basis upon which Arua Municipality will mainstream planning and resource allocation for waste management. It is also important that, capacity building for improved Municipal waste management should focus on assisting Arua Municipality to put in place deliberate policies and environment management action plans that integrate waste management as a component.

Contribution of the Study

The study has pointed out that, the population of Arua Municipality is heterogeneous since the residents are from mixed socio-cultural backgrounds. This implies that, their specific behaviour needs to be addressed hence behavioural change is a pre-requisite for effective solid waste management in urban local authorities. In addition, physical planning is an important aspect of solid waste management. The study revealed that poor physical planning leads to congested settlements which make accessibility of refuse collection trucks difficult. It also hampers location of refuse collection points. Therefore in order to ensure effective solid waste management proper physical planning is an important panacea. The study findings also indicate that, there are no legislations or bye-laws on solid waste management in Uganda that is Uganda has no policy on solid waste management.

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