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Household Knowledge, Attitudes and Practices in Solid Waste Segregation and Recycling: The Case of Urban Kampala

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This article investigates households' knowledge, attitudes and practices on the separation and recycling of solid waste in Kampala, Uganda. A survey was administered to 500 households randomly sampled from Kampala. The results indicate that, although the public is aware of solid waste separation and recycling practices, it has not participated in such initiatives. The results also indicate that participation in solid waste separation activities depends on the level of awareness of recycling activities in the area, household income, educational level and gender. It is, therefore, argued that increasing accessibility to recycling facilities is the best means of promoting positive attitudes to solid waste separation activities. One of the effective strategies identified by households that can be initiated by policymakers in government and urban authorities to increase the rate of participation in separation activities and eventually encourage them to participate in recycling activities is to provide easily accessible recyclable collection centres in all residential areas in urban Kampala.

1. Introduction[1]

Solid waste is a by-product of human and animal activities. These can be classified in terms of their original use (such as packaging waste), the material (glass, paper, or plastics), their physical properties (combustible or biodegradable), their origin (domestic, commercial, industrial or agricultural), and the safety parameters (hazardous or radioactive). Although human and animal excreta often end up in the solid waste stream the term, solid waste, does not generally include such waste material (White et al., 1999). The high rate of urbanisation, the rising standard of living and rapid development accompanied by population growth have resulted in the increased generation of solid waste in urban areas in Uganda. Unfortunately, this has not been accompanied by an equivalent increase in the capacity of the relevant urban authorities to deal with the problems. This has, as a result, become one of the most pressing and challenging environmental problem in Uganda (National Environmental Management Authority (NEMA), 2004).

Urban local government authorities in Uganda are responsible for solid waste management services. They, however, lack adequate infrastructure, operate in an inefficient institutional set-up, and have limited financial and technical resources. This has led to an inadequate level of provision of services. Yet the rate of waste generation is increasing each day. According to the mayor of Kampala about 1,580 tonnes of solid waste are generated per day. But only 40% of it is collected. A significant amount of solid waste is either burnt on the streets or ends up in drainage channels, marshy areas and empty plots[2].

It is estimated that 84% of the solid waste generated in Kampala is organic matter (Ssemwanga, 2006). Much of this waste comes from residential areas. It is further estimated that residential areas (the residential source) contribute about 53% of the total solid waste generated (Banga, 2008). The composition of the municipal solid waste in Kampala is shown in Figure 1.
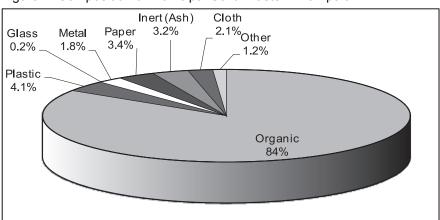
Figure 1: Composition of Municipal Solid Waste in Kampala

Source: Ssemwanga (2006).

Given the current composition of solid waste, with over 80% of it being organic and Uganda being an agricultural country, the best option to deal with the disposal of the solid waste is compositing at both a small and commercial scale. Other non-biodegradable materials such as metal and glass could be gathered, sorted and reused or recycled while the rest can be land filled. Land filling all the waste that is generated in Kampala is throwing away gold. It neglects a potential source of income and productive activity.

Attempts to improve solid waste management in Uganda have focused on the technical aspects: These are the different means of collection and disposal of solid waste. Examples of these are the procurement of waste collection vehicles, the privatizing of waste collection services and the maintenance of the landfill. It is estimated that over 35% of the Kampala City Council (KCC) budget is devoted to such waste management activities, but the problem of the disposal of solid waste still persists (KCC, 2003/2004).

In many countries, recycling activities have gained increasing attention as a means of protecting the environment. It has been argued that it offers one of the most sensible solutions both economically and ecologically for managing solid waste disposal (Omran et.al., 2009; Rabinson, 1986). The enhancement of waste recycling activities saves resources and foreign exchange by reducing on the purchase of raw materials, lowers the costs of the final disposal of the residues, produces cheaper goods that help low-income households, and creates new jobs (Cointreau et.al., 1984). Despite these advantages, recycling activities have not become a major way of managing solid waste disposal in urban Uganda.

The emphasis on recycling activities as a sustainable waste management strategy has represented a shift in paradigm from the conventional collection and waste disposal practices. Most recent studies recommend the re-use and recycling of solid waste (Ekere et. al., 2009; Banga, 2008; Pokhrel and Viraqraghavan, 2005, and Omran et. al., 2009). However, for any recycling activity to take place, the waste has to be separated. One of the problems in waste management is the absence of a culture of sorting waste by type at the generation points. This results in the mixing of all kinds of waste. Recycling may demand other special solutions, but the separation of solid waste at the source is the starting point. Ehrampoush (2005) recommends that successful recycling programmes should be designed in such a way as to increase society's environmental knowledge, its attitudes as well as its behavior towards recycling. A first step in the design process is to establish the prior knowledge of the public on recycling activities. This should cover the level of knowledge, its sources and everyday application (Palmer, 1995; Tucker et al., 1998) and the attitudes and current practices of the public (Ballantyne and Packer, 1996; Ballantyne, 1998).

The purpose of this article is to examine the knowledge, attitudes and practices of households in waste separation and recycling activities. We look at household characteristics that are related to waste separation activities and suggest policies that would increase people's participation. The article is organised as follows: section 1 discusses the issues of solid waste management and recycling. We look at the data and methods in section 2. We present and discuss the results in section 3. Finally section 4 gives policy implications and concludes the article.

2. Data and Methods

The study area is Kampala, the capital city of Uganda. The city covers an area of approximately 195 square kilometres. It is surrounded by Wakiso District. The resident population of the city is estimated to be 2 million people (projected from 2002 National Census). The city has a daily transient population of about 2.3 million people (Uganda Bureau of Statistics, 2005). Politically, the city is a decentralized district administered under the Local Government Act (1997). It is divided into a hierarchical structure of Local Councils (LCs). At the top is the district government (Local Council 5 (LC5)). The district is further divided into divisions (Local Council 3 (LC3)). Below the divisions are parishes [3] (LC2). At the bottom

are zones (LC1), equivalent to villages in rural areas. The local levels at which legislative as well as administrative decisions are made are the LC5, LC3 and LC1 levels (Government of Uganda, 1997). Divisions enjoy corporate status and are directly responsible for planning and overseeing service delivery in their areas of jurisdiction. They enjoy substantial autonomy from the district (LC5) (Government of Uganda, 1997). The KCC constitutes the headquarters under which are the five administrative units (Divisions). These are Kampala Central, Kawempe, Nakawa, Makindye and Rubaga.

The data for the study was collected from 500 households in Kampala. Each of the five administrative divisions of the city was represented by one parish. From each parish, five local council (LC1) zones were randomly sampled. Since each LC1 zone has a mixture of low, medium and high income households, stratified random sampling was used to select the 20 households from each of the selected LC1 zones. In total, 100 households were sampled from each parish to take part in the survey. The socio-economic variables and other household characteristics were obtained through direct interviews using a structured questionnaire. The enumerators were instructed to interview the household heads. In cases where the household head was not available, the spouse was interviewed. In other words, the respondent was one who was involved in decision-making in the home or one with knowledge about household expenditures and commitments.

People's knowledge, attitudes and practices were analysed using descriptive statistics, while the characteristics associated with household's participation in waste separation were analysed using a binary outcome model. A household is assumed to make a decision whether to separate or not based on the perceived costs and benefits accruing from it (Park et al., 2002; Oskamp et al., 1991). Factors which are expected to influence waste separation were modelled as a function of socio-economic and demographic characteristics.

The logistic model used can be explicitly specified as:

$$ln\left(\frac{P_i}{1-P_i}\right) = \sum B_i X_i$$

Where P_i is the probability that the respondent separates waste, B_i's are the coefficients of the explanatory variables (X_i). The explanatory variables, their definitions and expected signs are shown in Table 1.

3.   Results and Discussion

General Characteristics of the Respondents

The study sampled 500 households. However, not all households completed the questionnaire. Only 468 households had complete information. This is about 94% of the total households in the sample. The sample characteristics are given in Table 1. First, the majority of the respondents were females. These are estimated at 66.2%. This can be attributed to the fact that female members of the households

were the ones found at home at the time of the survey. Furthermore, husbands preferred their wives to be interviewed claiming that they are the ones concerned with the handling of waste.

The average age of the respondents was 36.7 years. The average family size was 6 people. In respect of the education level of the respondents, only 6.9% of the households reported not having had any formal education, 30.5% had primary level education, 43.8% attained secondary level education and 17.5% had attained tertiary level education. The average monthly income per household was Ushs 541,563.80[4] Most households stayed in independent houses. These are estimated at 51.2%. The rest were staying in tenements (Mizigo) and in other types of dwellings (such as a garage). These are estimated at 45.7% and 3.1% respectively. About 41% of the houses had backyards. Households who stay in houses with backyards have alternative ways of disposing waste such as dumping it in pits and burning it.

Table 1: Descriptive statistics, variable definition and expected signs

Variables	Description	Expected Sign	Mean	Std Dev*
AGE	Age of household head/spouse	[+/-]	36.73	13.50
HHSIZE	Number of adults and children feeding from same source	[-]	5.92	2.76
Education level of household head/spouse				
EDUC1	1 if respondent has primary or no formal education, zero otherwise	[+/-]	0.37	0.48
EDUC2	1 if respondent has secondary education, zero otherwise	[+/-]	0.44	0.49
EDUC3	1 if respondent has tertiary education, zero otherwise	[+/-]	0.18	0.38
INCOME	Monthly household expenditure**	[-]	541,564	457,120
GENDER	1 if respondent is male, zero otherwise	[-]	0.34	0.47
PAY	1 if respondent paying for waste collection service in any form, zero otherwise	[-]	0.46	0.50
YARD	1 if house has a backyard, zero otherwise	[+/-]	0.41	0.49
MAID	1 if a household has a Maid, zero otherwise	+	0.31	0.45
RECYCLE	1 if household is aware of recycling activities in the area, zero otherwise	+	071	0.81

Notes:

* Standard deviation

** in million Ugandan shillings

Source: Author's computation from survey data.

Knowledge and Attitudes

Households were asked if they had ever heard of the segregation of solid waste. Sixty percent of the households said that they had heard about it. They gave examples of what is segregated into plastic bags, glasses, peelings (banana and

potatoes) and metal. Others gave an example of waste separation that takes place at the landfill. When asked from whom they got their information on waste segregation, 39% of the households that had heard of solid waste segregation said they had learnt about it from friends and relatives, 30% from the itinerant buyers, 27% from newspapers and magazines and 4% said they had learnt about it at school.

Households were also asked what they thought about solid waste separation in their homes. Forty percent said it was a good idea while 60% said they did not support it because it is time wasting and a dirty job. This, therefore, should be done at the collection points or at the landfill.

When asked whether or not they had ever heard about recycling, 81.6% of the respondents indicated that they had heard about it. The main source of information was scrap (metal, plastics, paper, polythene and glass) dealers. These are estimated at 39.3% of the respondents that had heard about recycling. This is followed by relatives and friends, radio, newspapers and magazines. This is estimated at 32.8%, 15.1% and 6.4% respectively. Only 6.4% had heard about recycling from school.

Households were further asked if they knew or had ever seen products from recycled materials. The majority knew about recycled products from metal (charcoal stoves), candles (tadooba), building equipment, and domestic utensils (such as ladles and saucepans), old tyres (ropes and sandals) and straws (mats and bags). Households reported that the recycled products from metal were very useful to them but expressed fear about the re-use of the plastic bottles. For example, they complained that the re-use of plastic bottles for juice could result into disease outbreaks, such as cholera because they are dirty. They reported that recycling of metals is very important because products from recycled metals are cheaper than the items produced from new materials. This is what one of the respondents had to say:

> *I don't know what we would be using if these men (local artisans) were not making these products for us. We cannot afford to buy cookers and other items from shops. In fact some of these products are not found in shops. For example, I have never seen a charcoal stove in the shop. These products are cheap and yet very strong. (Respondent from Kawempe Division)*

Waste Separation and Recycling Practices

We also looked at the behaviour of households on waste separation at source. This is shown in Table 2. We found that 59.4% of the households separate some of their waste. They gave various reasons for doing so. The majority of the households separated waste because they earned an income from the separated waste. These are estimated at 70.1%. The other households separated the waste because they wanted it disposed of efficiently and in order to make manure from the separated waste. These represented 22.8% and 7.2% of the households. Households reported that what were mostly separated are banana and potato

peelings (81.7%), broken and whole bottles (18.3%), and plastic bags (17.6%). The bottles do not include beverage bottles (beer and soda) because households do not consider them as waste. The banana and potato peelings are either sold to urban farmers, or given out in exchange for taking away the solid waste. The peelings are also sometimes fed to their own animals. Only 4.7% of the households put the peelings in a pit. The separation of peelings and making good use of them is a sign that with time there will be no peelings in the waste stream. This will reduce the amount of waste which is disposed at the landfill.

Table 2: Households' Reasons for Separating Solid Waste

Reason	Number	Percentage
Get some income	195	70.1
Dispose of waste efficiently	63	22.7
To get manure	20	7.2
Total responses	278	100

Source: Author's computation from survey data.

Most of the households who practised waste separation reported that they separate the waste into different types before they dispose it in different garbage bags (some of the separated solid waste is put in different corners not necessarily in plastic bags or containers). They do not separate waste after mixing it up. They reported that the items which they think can be re-used or recycled are not mixed with the rest of the garbage. However, those households who have adequate space in their yards normally throw waste in the backyard and remove plastics when the garbage is dry.

This is what one of the respondents who separate solid waste had to say:

> *Separation of waste is not time consuming because I do not have to set aside time for separating. All I need is to have separate containers in which to dispose the different types. In most cases I separate plastic bags and biodegradables. (Respondent from Makindye Division)*

The broken bottles are normally thrown in pit latrines. Whole bottles are sold. Plastic bags are burnt. Less than 1% of the households reported selling broken bottles. The main reasons for this are that the quantities are too small to be traded and households do not know where to sell them. The deposit refund system for bottles appears to have worked effectively. All households reported that they never throw away the glass beverage bottles. They also said that the bottles have a ready market as itinerant buyers take them. Prices vary with the size of the bottles. Thus no empty glass bottles (beer and soda bottles) are mixed with the waste stream. Other empty bottles of varying sizes are often re-used for packaging locally processed syrups, drinks or other liquids.

Households reported that they do not throw away paper because they use it for

lighting charcoal stoves and for 'sanitary' purposes. With plastic materials - such as broken jerry cans, some households reuse them as flowerpots, charcoal containers, and animal and poultry feeders. However, the majority of the households burn them. The plastic bags are separated and burnt. There is thus a reuse of such materials among households. However, some of the separated waste is still disposed of inefficiently through burning and burying. It therefore appears that there is need for community sensitization on the impact of this activity on the environment.

This is what one of the respondents had to say:

> *I always remove anything plastic from the waste because the plastics do not rot and thus they spoil our land. I remove them and burn them. I know it is not right to burn the plastics but it is better than leaving them to spoil the land. (Respondent from Kawempe Division)*

Households were asked if they were aware of where they can take their recyclable waste for sale or of any recycling centres in the area. Seventy percent of the households were aware of these centres. Indeed, 65% of those aware of the centres had sold recyclable materials to the centres. Households were also asked whether they participated in waste recycling activities in their homes. None of the households participated in waste recycling. The reason they were not participating in recycling activities being that they did not know how to do it. Some households reported that they separate the organic matter and throw it in a pit but they did not know how manure is made from the waste.

Reasons for not Separating Solid Waste

The reasons cited by households for not participating in any form of waste separation activities are shown in table 3. These included: separation is time consuming (39.6%), lack of ready market for recyclable waste (38.7%), not being able to afford separate bins for separated waste (28.1%), they do not see the importance of separating since the waste is dumped together on the same truck or at the communal containers (8.1%), and lack of space (5.4%).

Table 3: Households' Reasons for not Separating Solid Waste

Reason	Number	Percentage*
Lack of space	10	5.4
Can't see importance of Separating	15	8.1
Cannot afford separate bins	53	28.1
Separation is time consuming	75	39.6
No ready market for recyclables	74	38.7
I pay for solid waste	17	8.9
Total respondents	190	100

Source: Author's computation from survey data.

* The total percentage is more than 100 because multiple answers were allowed.

Other households said they did not separate the solid waste because they were already paying for waste collection. They, therefore, did not see the reason why they should bother separating waste. This is what one of the non segregating respondents had to say:

> *At first we had a problem of where to dispose of the waste. We would therefore never mix broken glasses with the rest of the waste because of fear that it would injure whoever touches it especially the children. We used to dry peelings and burn them together with the plastics and the rest of the dry matter. However when we started paying for collection of waste, we do not see why we should bother removing glasses or any other things from the waste. We pay them to take the waste so we are already doing our part. (Respondent from Central Division)*

Households which were not separating solid waste were asked what would make them separate it before disposal. Fifty percent indicated that they can only separate waste if there is a market for what is separated, 47.8% said they can separate waste if they are facilitated by giving them containers where to put the separated waste and 2.2% said they can only separate if everyone else is separating the waste.

Determinants of Household Solid Waste Separation

We carried out a logistic regression to understand how various household characteristics explain household behavior in solid waste separation. The results from the logistic regression analysis show that gender, awareness of recycling activities in the area, household income, and education explain household waste separation behavior. The results are presented in Table 4.

The results show that gender is negatively and significantly related to solid waste separation at the 5% confidence level. This means that women are more likely to separate solid waste than men. This behavior is most probably because within the household, it is women who know and decide what is useful and what constitutes waste. Studies in Pakistan, Bangladesh and Ho Chi Minh City also found that women were more involved in source separation than men in the household (Beall, 1997; Du, 1995). Ekere et al (2009) also found similar results when they studied the separation of crop waste in Uganda.

The relationship between income and waste segregation is negative and significant at the 10% confidence level. This implies that households with high incomes are less likely to engage in separating waste. This is probably due to the fact that high income households can afford to pay for waste collection services. They, therefore, see no reason for segregating the waste before its disposal. Second, the majority of those who separate waste do it in order to get recyclables for sale and earn some income. This activity is not important for high income households. Ali (1997) and Furedy (1992) found out that low income households sell relatively more of their post-consumption household materials than affluent households. However, Ekere et al (2009) found a positive relationship between

income and the separation of crop waste in Uganda.

Table 4: Determinants of Household Solid Waste Separation

Variable	Coefficient	Z-Statistic	P-Value	Marginal effect
CONSTANT	2.725	1.29	0.195	
GENDER	-0.542	-1.99	0.047**	-0.133
EDUC1	0. 616	2.04	0.042**	0.144
EDUC2	0.405	1.51	0.132	0.097
INCOME	-0.283	-1.7	0.089*	-0.068
HOUSEHOLD SIZE	0.058	1.39	0.167	0.014
AGE	0.006	0.82	0.413	0.002
YARD	0.272	1.31	0.191	0.065
MAID	-0.15	-0.48	0.631	-0.036
RECYCLE	0.439	1.73	-0.084*	0.107
Number of observations: 466				
LR chi2 (9): 23.72				
Prob > chi2: 0.005				
Log likelihood: -302.403				
Pseudo R2: 0.038				

Source: Author's computation from survey data.

Notes: * and ** denotes statistical significance at the 10% and 5% confidence levels respectively.

We also looked at the level of education of the head of the household. We found that those in the lowest education category (no education and primary level education) were more likely to separate solid waste than those with tertiary education. The lower rate of participation in separation activities by those with more education could be because those with higher education are likely to be employed and have better jobs. Employment could give them higher incomes. Households with higher incomes are unlikely to look at recyclables in the solid waste stream to supplement their incomes. Furthermore, the education system in Uganda does not expose students to environmental issues. One has to gain appreciation of environmental issues through informal training and education. Ekere et al (2009) also did not find any relationship between education and the separation of crop waste in Uganda.

Finally, we found that the awareness of recycling activities is important in household behaviour toward solid waste separation. We found that the awareness of recycling activities in the area significantly influences the separation of solid waste in a household. This could be because people know that they will be able to get a ready market for their sorted waste. On the other hand, the results, show that having a yard, the age of respondent and household size have no significant effects on the household decision to separate solid waste or not.

4. Conclusion and Policy Implications

The article has shown that a considerable number (59.4%) of households in urban Kampala are engaged in some form of separation of solid waste. This is mostly done for a financial motive. Unfortunately some of the waste separated is either buried or burnt. This pollutes the environment and has severe health implications. It is very important for waste management programmes to discourage this polluting practice and highlight its health implications.

Households indicated that they did not separate solid waste because they could not afford separate bins for separated waste. If the KCC is to encourage waste separation activities at source, it would make good sense to start the waste reduction process by providing garbage bins to households. This would encourage them to separate waste. Furthermore, households did not composite their solid waste even when they separated degradable from non-degradable waste because they did not know how to do it. The Council, in partnership with other stakeholders (such as Non Government Organizations, Community Based Organizations and the private sector) should educate people on simple household compositing systems. The composited manure would help in household gardens. This would reduce the amount of solid waste that goes to the landfill. In order to promote household solid waste segregation and compositing activities, the Council should carry out educational campaigns. This should be supported by the selling of composite bins of various sizes to households at subsidized rates. The households would then sell the composited manure to urban farmers and peasants in the suburbs of the city.

Households with less education are more likely to separate solid waste because of the need to get an income. Perhaps, everyone would be separating waste if schools were exposed to environmental education through the school curriculum. The current education system does not include environmental education. There is need to emphasize the protection of the environment in the curriculum at all levels of the education system. The kindergarten could be the foundation for environmental education. Emphasis should also be placed on increasing environmental awareness and a sense of responsibility among students particularly in handling waste.

Policymakers could consider offering tax concessions to industries involved in developing reusable products that will reduce solid wastes intended for disposal. This would encourage informal recycling activities by giving recognition and facilities to recyclers. In Uganda, the itinerant buyers and local artisan groups provide an avenue for recycling of old and disposable items. They are involved in producing low cost household and farm tools which have a big market among the low income population. Their contribution in reducing waste cannot be ignored. The government should encourage and support these local artisans in their work by offering them educational programmes and financial assistance.

This article has used primary data to examine the knowledge, attitudes and practices of households in waste separation and recycling. It has analysed the determinants of waste separation in urban Uganda. The results of the study show that

waste separation is significantly related to household income, the gender of the respondent, the level of awareness of recycling activities in the area and the educational level of the respondent. Furthermore, the results show that people are aware and have a positive attitude towards both separation and recycling of solid waste. Households' participation in separation activities is not very high, but when promoted can result in great benefits. Attempts must be made by the Council to improve waste separation. To achieve this, the Council should concentrate first on awareness campaigns about the consequences of waste mishandling and the benefits of solid waste separation.

Notes:

1   The author acknowledges the financial support from the Swedish International Development Agency (Sida) through the Environment for Development (EfD) programme.

2   Personal communication with City Mayor, November 26, 2006.

3   A parish is the second lowest administrative unit in Uganda.

4   At the time of the survey 1US$ = UGSH 1,820.

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