

## **DETERMINANTS OF HOUSEHOLDS' CHOICE OF WASTE MANAGEMENT IN THE BUEA MUNICIPALITY: AN ECONOMETRIC ANALYSIS**

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### **Abstract**

Waste management has been found to be not only a local problem, but rather global, affecting the environment and leading to climate change. Therefore, making the environment a priority starts at home, reason why this paper examines the attitude and behaviour of households towards waste management in the Buea Municipality in 2015. To achieve this, the survey research design was employed with the use of a questionnaire. 397 households were drawn using a simple random sampling technique. Descriptive statistics and the multinomial logit model were used for the analysis. The paper reveals that a majority of households still dispose their wastes in unauthorized sites. The empirical analyses also show that, household education, age, household headship, frequency of emptying trash bins, participation in Keep Buea Clean and accessibility of HYSACAM are the major determinants of household attitudes and behaviours towards waste management in the study area. On the basis of these findings, it is recommended that educational program should be organised and continuous policies enhanced so as to improve favourable waste management practice. Also, implement strict monitoring policies and motivating factors for proper disposal through education and continuous waste management campaigns.

**Keywords:** waste management, multinomial logit model

## 1. INTRODUCTION

All human activities result in the generation of waste which causes changes to the environment, which cause harm to animals, plants and the ecosystems. It had been projected that the world's waste generation could reach up to 27 billion tons by 2050, and the quantity of Municipal Solid Waste (MSW) generated worldwide was estimated between 1.7 – 1.9 billion metric tons (UNEP, 2010) a third of which could be generated in Asia, with a significant percentage of that being produced in China. In 2011 the world generated 2 billion tons of municipal solid waste of which Europe's share was approximately 265 million tons of MSW. Recently, Canada is known to be the highest municipal waste generator (above 800kg) as compared to other developed countries (Avagyan, 2013).

These increasing amounts of waste generated worldwide is the result of the rapid increase in population, urbanization, industrialization, changing consumption patterns, standards of living, technology, abundance and type of nations natural resource, and diversification of different types of solid waste generated (Dickerson, 1999). All these have instead led to a consequence of life for both developed and developing countries. A recently published 2010 human development report (UNDP, 2010) showed that the percentage of populations living on degraded land is increasing to an average that exceeds 15%. Hence, the consequence of unplanned urbanization growth has definitely lead to huge problems on governments especially for meeting the increasing demand for proper and healthy municipal services. The growth has rather resulted in increase in the quantity and complexity of the generated wastes and overburdens, including solid wastes, and in particular municipal solid waste (MSW). Such MSW is considered a problem that has impacted negatively on the environment.

Although lots of significant efforts have been carried out in the last few decades in many developing countries supported technically and financially by developed countries and international organizations, substantial reforms in the management of MSW are still not attained. The reasons for this backwardness have been has been due to the lack of adequate administrative and financial resources, absent of effective and comprehensive legislative frameworks governing the solid waste sector and the inadequate enforcement mechanisms, which are no less important than the legislations themselves, the availability of the significant amount of accurate background data and information on the status of solid waste, including MSW (Khatib, 2011 & Nthambi 2013).

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Given the aforementioned, developing countries have still not prioritized waste management as a fundamental problem plaguing their environment (Uwaegbelun, 2004). This is supported by the fact that when the governments of African countries were required by the World Health Organization (WHO) to rank their environmental health problems, the results showed that solid waste management wasn't on the lead (Senkoro, 2003).

Recently, waste management has become one of the most crucial health and environmental problems facing governments of African countries today with Cameroon inclusive. This is because even though these countries are using 20-50% of their budget on waste management, only 20-80 % of the waste is collected. The uncollected or illegally dumped wastes constitute a disaster for human health and environmental degradation (Achankeng, 2003).

Cameroon, witness an annual urbanization growth rates of 4% and population growth of 2.7 % (World Bank, 2002) which resulted to waste generation rates between 0.5 kg to 0.8 kg per capita per day and collection rates which ranged from almost zero per cent in 1990 to more than 50%. These improvements were witnessed as a result of the provisions of Agenda 21 of the UNCED Conference in Rio de Janeiro (1992) which triggered an avalanche of environment-related institutional innovations in the 1990s and the World Commission on Environment and Development (WCED, 1987) in the Brundtland Report which aimed for 'Sustainable Development', the recent Millennium Development Goals (MDG) in 2000 which advocates for environmental sustainability and the 2002 Johannesburg World Summit on Sustainable Development which called for the development of a 10-year framework of programmes to promote sustainable consumption and production patterns (OECD 2008).

These conferences led to the creation of The Ministry of Environment and Forests and the subsequent promulgation of Law No. 96/12 of 5th August 1996 providing the legal framework for environmental management in Cameroon, Article 76 sub-section 1. As outlined by (Achere, 2012), other ministries assigned to this effect include: Ministry of Territorial Administration and Decentralization (MINTAD), Ministry of Mines Industries and Technological development (MINMITD), Ministry of Economy and Finance (MINEFI), Ministry of Urban Development and Housing (MINDUH), Ministry of Environment and Nature Protection (MINENP), and the Ministry of Public Health (MINPH). The highest body responsible for municipal solid waste management is the Inter-Ministerial Commission for

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Municipal Waste Management (ICMWM), created under the direction of the Prime Minister Decree No. 95/230/PM of 31/04/95 which is charged with formulation and policy development for appropriate municipal solid waste management strategies (Lawrence et al., 2012).

More so, the National Environmental Management Plan (NEMP) was also framed for municipal councils in the management of municipal solid waste. This plan was developed to govern municipal solid waste activities like street sweeping, collection, transportation and disposal of household wastes, as well as the management of all public spaces and infrastructure and most of all increase public sensitization on waste management issues (Manga et al., 2007).

Recently, the Ministry of Environment and Sustainable Development has also incorporated the concept of sustainable development in its waste management strategy document. As pointed out by Ymele (2012) this official strategy is clearly structured around three priorities; the first is to prevent and reduce the production and harmfulness of waste by developing clean and more resource- efficient technologies, the second priority is to ensure that more waste is recovered and recycled, and the third is to dispose of non-valuable waste in a sustainable way.

HYSACAM, a waste management company is helping to drive this process forward with initiatives that include projects for capturing and processing the biogas generated by decomposing domestic waste at its waste facilities; for example, the company has established Central Africa's first biogas processing plant at the waste facility in Nkolfoulou, a suburb of Yaoundé using the Kyoto Clean Development Mechanism (CDM) and its collection rates of up to 80-90% operating in about 14 towns and cities in the country (Ymele, 2012), reach harder-to-access neighbourhoods, HYSACAM has developed pre-collection agreements with community based organizations that gather the waste from the inaccessible areas and transfer it to the company's collection bins (Ps-Eau & PDM, 2003). However, the Cameroon's waste management system is still faced with great challenges despite government efforts to create and implement legislation related to sustainable waste management in Cameroon. It is based on the above that this paper sought to give answers to the following questions:

- i. How do households in the Buea Municipality behave towards waste management?

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- ii. What are the determinants of households' choice of waste management?

### **1.1. OBJECTIVES OF THE STUDY**

The main objective of this paper is to investigate households' choice of waste management in the Buea municipality of Cameroon. As a result, the specific objectives include:

- i. Assessing households' behaviours towards waste management.
- ii. Determining factors that affect households' choice of waste management.

Many studies have been carried out within this domain of household waste management such as the works of Adenso-Díaz (2005), Tadesse (2000), Omran (2011), Awah Manga (2012) who found out that longer distances and accessibility to skips encourages illegal dumping. On the other hand, Jenkins, et al, 2000; Joël Sotamenou (2005), Kamara, 2006; Mbeng, et al, (2009); Bizatu & Negga, 2010; Ashenafi, 2011 and Banga (2011), Zarrintaj *et al* (2013) found out that education and age are major factors influencing waste management. Also, Fauziah et al 2009; Afroz & Masud, 2011 indicated that the lack of separation of households was due to absence of mandatory recycling practice.

The rest of this paper is divided into five sections: the first section provides the conceptual framework; the second describes the methodology that includes a description of the sampling technique and data collection as well as analytical procedures. The empirical results are presented in the third section; section four provides the discussion of the results obtained and finally section five presents the conclusion and recommendations.

## **2. CONCEPTUAL FRAMEWORK**

The conceptual framework for this study is based on the waste management hierarchy which shows the extent to which waste management is practiced. Below is a typical model of waste management in Cameroon.

**Fig 1: Cameroon's waste management hierarchy**



*Adapted from Tapong, 2002*

Reuse is carried out at a very low rate in Cameroon. Traditionally, only glass beer bottles are reused. Often, glycerine bottles are also being reused but on a very small scale through people going round and buying these bottles from households. An insignificant portion of recyclable waste generated is actually being recycled such as Plastic Coca- Cola, Sprite, Fanta and Pamplamous bottles from Brasseries du Cameroon and Union Camerounaise de Brasseries, Supermont and Tangui bottles from Supermont and Tangui companies, Fruit juice containers from Frutas; plastic containers from yoghurt companies e.g. Camlait, plastic vegetable oil containers from Oilio and Diamoar companies, Polythene bags from Metropolitan plastics; paper and cardboard, metallic tins etc. Aluminium sheets are also recycled though on a minimal scale. Local pot manufacturers, who melt the sheets and then use the liquid aluminium for the manufacturing pots, do this. Such people always scavenge on landfill sites in search of old aluminium sheets, or move around and buy the old sheets.

Composting of biodegradable materials is carried out in a small scale and is restricted to the local areas where people use the compost manure for agriculture, and also where there is available land space. In the urban areas where people rely on the local markets for all their foodstuffs, composting is rare, partly due to the unavailability of land space. Another contributing factor is insufficient land space due to increase in population. On the other hand, landfills are the most widely practiced method of waste disposal in Cameroon. It can be private, used by a particular person, or communal, where small groups of people or a large community use a particular landfill. The landfills are always in the vicinity of living areas, and this has led to so many problems such as an increase in the incidence of vector borne

diseases e.g. malaria and typhoid fever. The landfills serve as a fertile breeding ground for these vectors. Bad odours from decomposing food remain in the garbage heaps.

### 3. METHODOLOGY AND DATA ANALYSIS

This paper made use of a cross-sectional data collected in the Buea Municipality in 2015 with the use of a structured questionnaire. The data collection was made by means of preliminary field investigation, self-administered questionnaires and interviews so as to ensure that the respondents better understood the essence of the study and ask questions where they were unsure about the reason for the study. Given the large population of more than 50,000 inhabitants in the Buea Municipality and the difficulties in reaching to all individuals, a simple random sampling technique with the aid of the Slovin's formula was employed to select the respondents. The Reliability of the questionnaire was tested with the application of the Cronbach's alpha which gave a value of 0.72.

The multinomial logit model by Nerlove and Press (1973) was adapted and modified to analyse the choices of household waste management. This is because the dependent variable has multiple categories that cannot be ordered i.e. it takes three categories (dumping, burning, reuse). One category (dumping) of the dependent variable is considered as the base category and the relationship of independent variables to all other categories are compared with the base.

#### 3.1 PRESENTATION OF RESULTS

**Table 1: Descriptive statistics**

Variables	N	Minimum	Mean	SD
Waste management option	320	1.00	1.8250	.59306
Age	320	1.00	2.1313	1.04520
Marital status	320	1.00	1.6437	.72004
Educational status	320	1.00	3.2812	1.08666
Number of persons in the household	320	1.00	4.3875	2.16118
Monthly net-income	320	1.00	3.8750	2.65757
Sex	320	1.00	1.4469	.49795
Head of your household	320	1.00	1.5156	.50054

Computed by Author with Excel 2010, 2015 survey

The above table shows that the mean for waste management option in the Buea municipality is 1.825 with a standard deviation of 0.593 and the lowest waste management option is 1 meaning that on average, individuals prefer to burn their waste than reuse. The average age range of our respondent is 29-39 with a standard deviation of 0.59. Looking at the educational status, our findings show that on average more of our respondents had attained the university. The mean value for sex is 1.44 with a standard deviation of 0.49 showing that on average, more females answered our questionnaires.

On average more of our respondents are head of households with a mean of 1.51 and a standard deviation of 0.5005. In the same light, the average number of persons in a household in the Buea Municipality is 4 indicating a mean of 4.38 with a corresponding standard deviation of 2.16.

For our monthly income, the statistics (3.87) show that the mean income of our respondent is between 126000 – 176,000 francs. Concerning marital status our mean figure stands at 1.64 with a standard deviation of 0.72 meaning that on average our respondents in the study were married.

**Table 2: Multinomial logit results**

	<b>Base group = Dumping</b>	
<b>Variables</b>	<b>Coefficients for Burning</b>	<b>Coefficients for Reuse</b>
<b>Household socioeconomic factors</b>		
Age	-.0191935 (0.906)	.5554109 (0.014)**
Sex1	-.1264636 (0.645)	.3963652 (0.330)
House1	-.5958861 (0.060)***	.2133586 (0.681)
Marital	.1775654 (0.573)	-.2864042 (0.530)
Educ	-.0605566 (0.641)	.3396618 (0.095)***
No_persons	-.0313355 (0.655)	-.0753495 (0.475)
Income	.0578285 (0.288)	-.043694 (0.602)
<b>Institutional factors</b>		
No trash	-.2750323 (0.059)***	-.0188294 (0.935)
Distance	-.0049574 (0.969)	-.0972979 (0.606)
Will1	-.7696911 (0.102)	-.9843277 (0.132)

Part1	.9010078 (0.003)*	.7139096 (0.094) ***
Hysac1	.2789059 (0.509)	2.067074 (0.059)***
Cons	.1735172 (0.873)	-5.104665 (0.009)*

*Note: The coefficients in parentheses indicate the levels of significance of the P-value at 1% (\*), 5% (\*\*) and 10% (\*\*\*).*

Computed by Author with SPSS 20, 2015 Survey

As observed on the table above, the results of the socioeconomic variables for burning relative to dumping shows a negative coefficient for age indicating that an increase in age makes it less likely to choose burning as opposed to dumping. Implying that if an individual's age were to increase by one year, the log-odds for burning relative to dumping would be expected to decrease by 0.02 units all things being equal. Also, the coefficient for females relative to males is -0.13. This indicates that females are less likely to burn than dump as compared to males i.e. females prefer to dump waste while males prefer to burn. The log odd coefficient for marriage is 0.18. This indicates that individuals who are married are more likely to choose burning to dumping as opposed to being single, divorced or co-habiting.

The coefficient for household headship is -0.59 at 10% level of significance, this indicates that individuals who head households are less likely to choose burning as opposed to those who aren't head of households i.e. head of households in the Buea municipality prefer to dump while burning is preferred by those not heading households. For the number of persons in the household, the coefficient is -0.031 meaning that as the number of individuals in the household increases, the lower the likelihood of burning relative to dumping. This means households with more persons will prefer to dump their waste. Given the coefficient for the educational level of the individual, it is negative (-0,06) implying that if the educational level of an individual were to increase by one level, the log-odds of burning relative to dumping would be expected to decrease by 0.06. This means as an individual's level of education increase, they will prefer to dump waste than to burn. The coefficient for income is positive (0.06), implying that the multinomial log-odds of burning relative to dumping will be expected to increase when there is a franc increase in income, all things being equal.

Interpreting burning with respect to the institutional factors, the coefficient for frequency of emptying trash bins is negative (-0.28) and significant at 10% level, this implies that the multinomial log-odds of burning relative to dumping is expected to decrease when there is an additional day for disposal frequency of waste. The coefficient for distance is negative (-

0.004), this implies that an increase in distance makes it less likely to choose burning as opposed to dumping. Implying that if the distance were to increase by one kilometre, the log-odds for burning relative to dumping would be expected to decrease by 0.004 units all things being equal.

As concerns the willingness to participate towards proper waste management, the log odds coefficient for the willingness to participate is -0.77. This indicates that individuals who are willing to participate are less likely to choose burning as opposed to those who aren't willing. In terms of participating in Keep Buea Clean Campaign, the log odds coefficient is positive (0.901) and it is significant at 1% level. This implies that participants of this campaign are more likely to choose burning as opposed to those who don't. Lastly, the coefficient for HYSACAM's accessibility is positive (0.28). This shows that households who benefit from HYSACAM's services are more likely to prefer burning of their waste rather than dumping.

The coefficient for reuse relative to dumping for age indicates that the log of odds is 0.555. This implies that as an individual gets older the likelihood of preferring reuse will increase rather than dumping. The results precisely show that a year's increase in the age of an individual will result to a 0.555 increase in the likelihood to choose reuse as a method of waste management rather than dumping. This result is statistically significant at 5% level. The log of odds for being a female relative to male is 0.39. This implies that females are 0.39 times more likely to prefer reuse relative to males. The coefficient for household headship is 0.213 indicating that individuals who head households are more likely to prefer reuse as opposed to those who aren't head of households i.e. head of households prefer to reuse rather than dump. With respect to the number of persons in the household, the coefficient is -0.075 meaning that as the number of individuals in the household increases, the lower the likelihood of reusing relative to dumping. This means households with more persons will prefer to dump their waste rather than reuse.

In terms of education, the results show that individual's educational level has a positive coefficient (0.339) and statistically significant 10%. The implication is that as the level of education increases, the likelihood of reusing waste product as opposed to dumping increases. Specifically, if an individual's educational level increase by one level, the log-odds of preferring reuse as opposed to dumping is expected to increase by 0.339, holding other variables constant. This tells us that as the level of education for an individual in the Buea Municipality increases, it influences the likelihood to prefer reuse rather than dumping. The

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results further shows that a one franc increase in an individual's income will decrease the log-odds of reusing as opposed to dumping by 0.436 units, everything being equal. This indicates that as the income of individuals in the Buea municipality increases, they would prefer dumping than reuse. The coefficient for married relative to single (never married, divorced or widowed) is -0.286 units. This implies that married people have a higher preference for dumping than reusing relative to single.

Interpreting the coefficients for reuse with respect to the institutional factors, the coefficient for the frequency of emptying trash bins is negative (-0.0188), this implies that the log-odds of reuse relative to dumping is expected to decrease when a day is delayed in waste disposal. This means that households who pile their waste for longer days would prefer to dump than to reuse. The coefficient for distance is negative (-0.097), this implies that an increase in distance makes it less likely to choose reuse as opposed to dumping. Implying that if the distance were to increase by one kilometre, the log-odds for reuse relative to dumping would be expected to decrease by 0.097. With respect to the willingness to participate towards proper waste management, the log -odd coefficient for the willingness to participate is -0.98. This indicates that individuals who are willing to participate are more likely to choose dumping to reuse as opposed to those who aren't willing. In terms of participating in Keep Buea Clean Campaign, the log odds coefficient is positive (0.71) and it is significant at 10% level. This implies that participants of this campaign are more likely to choose reuse to dumping as opposed to those who don't. Lastly, the coefficient for HYSACAM's accessibility is positive (2.06). This shows that households who benefit from HYSACAM's services are more likely to prefer reuse of their waste rather than dumping.

#### **4. DISCUSSION OF RESULTS**

The results indicate that education, age, frequency of emptying trash, household headship, participation towards Keep Buea Clean and accessibility of HYSACAM are significant, on the other hand, the influence of marital status, sex, number of persons in the household, income, and the distance to skips are not statistically significant. These statistically insignificant results can be justified with the work of Chilinga (2013) who after using Bonferroni adjusted alpha ( $p$ ) to render these variables significant found out that public perception on solid waste management is not influenced by demographic factors. He suspected that if these demographic factors were used in combination with other circumstances they could be more consistent and significant.

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As willingness to participate towards proper waste management increases, households choose to burn their waste. This implies that households in an attempt to contribute towards proper waste management may decide to burn their solid waste in order to produce ash which they can use to increase the probability of being reused as manure to improve soil fertility. As concerns the frequency of emptying trash, as the number of days increase individuals choose to either dispose or reuse waste rather than burn. This brought about the accumulation of waste around the households which gives the opportunity for the breeding of flies and mosquitoes. Those who participate in keeping Buea clean prefer to reuse their waste. Increasing clean-up campaigns will create the awareness of the contents of the waste management regulations leading to increased solid waste reuse and hence sustainable solid waste management.

Also, as the level of education and age increases, individuals would opt for reuse as a best means of managing their waste. This means that households who are more educated have a higher probability of reusing solid waste because they are better placed in perceiving and conceptualizing the benefits that accrue from reducing waste build up through reuse. On the same base, we can say educated persons have ideas on sustainable development, climate change and rational use of resources. This is compatible with the waste management hierarchy theory which states that educational improvement could lead to households' awareness about the impact of inappropriate waste management on environment and human health. Environmental education in schools had important long-term effect on people's awareness and attitude towards environmental issues. To produce changes in basic environmental understanding, environmental education must start at the primary level and even at home. This implies that better educated households make reasonable waste management decisions as compared to the less educated. This is also in line with the works of (Jenkins, et al, 2000; Sotamenou (2005), Kamara, 2006; Lawrence, et al, (2009); Bizatu & Negga, 2010; Ashenafi, 2011 and Banga (2013)). Higher education has been found to lead to an increase in separation and recycling (Callan & Thomas, 1997; Duggal et al., 1991; Ferrara & Missios, 2005; Jenkins et al., 2003; Reschovsky & Stone, 1994).

As concerns age, it is evidence with the saying "wisdom comes with age". Yin (2002) also found out that people's attitudes and lifestyles are established at an early age. Middle-aged and older people are more likely to recycle (Meneses & Palacio, 2005; Nixon et al., 2006; Ebreo & Vining, 1990). Further research suggests that older people more often comply with social norms (Bruvoll & Nyborg, 2004; Berglund et al., 2009).

Accessibility of HYSACAM towards households is another variable of great influence. The more the accessibility of HYSACAM towards households, the better the waste management practice adopted by households i.e. individuals will choose to recycle their organic waste (use as manure) and/or dump their waste in HYSACAM's skips instead of burning or dumping them illegally as they have access to HYSACAM's services. This coincides with the work of (Manga, 2012; Tadesse , 2007; and the National Institute of Statistics (INS), 2011) who found out that accessibility of residential area negatively influences the probability of choosing management methods such as illegal dumping and because accessible area receives more municipal waste management services and the distance to communal containers positively influences the probability of managing household waste by methods such as organic recycling and illegal landfills.

## 5. CONCLUSION AND RECOMMENDATIONS

We therefore conclude that education, age, frequency of emptying trash, household headship, participation towards Keep Buea Clean, accessibility of HYSACAM, frequency of emptying trash, and willingness to participate towards proper waste management are the major factors which influence waste management in the Buea Municipality.

Given the above findings, it is therefore recommended that educational program should be organised and continuous policies enhanced so as to improve favourable waste management practice. The government can achieve this through the implementation of stringent penalties on disposal of waste in open areas and roadsides so as to reduce the external environmental costs resulting from illegal dumping. Also, the government should through the municipal council encourage households to also be fully involved by willingly paying for waste collection and disposal by HYSACAM in order to improve the waste management situation in this Municipality.

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