



UNIVERSITI PUTRA MALAYSIA

***ECONOMIC VALUE AND DETERMINANTS OF EFFECTIVE
HOUSEHOLD SOLID WASTE COLLECTION SERVICES IN KANO,
NIGERIA***

HAMISU ALHAJI BASIRU

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By

HAMISU ALHAJI BASIRU

**Thesis submitted to the School of Graduate Studies, Universiti Putra Malaysia,
in Fulfillment of the Requirements for the Degree of Doctor of Philosophy**

November 2017

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DEDICATION

This thesis work is absolutely dedicated to my treasured late parents; Mallam Hassan Maikaji Jahun and Mallama Aishatu for their morality and spiritual trainings. May Allah (SWT) let Jannatil-Firdausi be your final abode. AminYaa Rabbih!!!



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in Fulfillment
of the requirement for the degree of Doctor of Philosophy

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November 2017

Chairman : Associate Professor Mohd Rusli Bin Yacob, PhD
Faculty : Environmental Studies

Solid waste management (SWM) in Kano metropolis is under the responsibility of urban authority, known as, Refuse Management and Sanitation Board (REMASAB). Waste management is a critical issue in the metropolis due to dwindling financial resources and population escalation. These problems result in poor control and handling SWM effectively and efficiently, giving rise to adverse threats on both environmental and public health. In a radical policy response to address this environmental problem, Kano State government proposed to privatize SWM services, via REMASAB, for improved collection services, as a better management option to ensure sustainability in SWM in Kano metropolis.

Thus, the aim of this study is to estimate the economic values and determinants of waste collection services and their potentials towards effective waste management in Kano metropolis. Choice Experiment (CE) and Contingent Valuation Methods (CVM) valuation techniques were employed in the study. In the CVM section, willingness to pay (WTP) elicitation format, dichotomous choice and a close ended question were employed. In the CE part, five categories of non-market values of waste collection services were defined including: collection frequency, storage facilities, disposal method, pre-collection services and collection value. A total of 400 respondents were interviewed in face-to-face format, using cluster random sampling method.

In the CVM section, logit model was defined based on dichotomous choice method for the estimation of the WTP off a specified bid amount to the hypothetical price for waste collection services. The logit model was used to drive marginal value and compensating surplus of the respondents to the attributes of non-market values of waste collection services.

The results of mean WTP was estimated using single bounded dichotomous choice contingent valuation (DC-CVM) format, however, the result demonstrated respondents positive WTP for improve waste collection services. The estimated mean WTP was ₦2202.03 (\$11.7) per household, and from the CE ₦2593.2 (\$13.2) per household respectively.

The households' statistics acquired from the 2006 Population Census data that Kano metropolis has a total number of 275,851 households. This implies an aggregate welfare gain worth ₦607, 432,177.53 (\$3, 08,412.06) monthly, or ₦7, 289,186,130.4(\$33,000,944.82) annually, for the CVM and ₦715, 336813.2 (\$3, 631151.3) monthly and annually ₦858,404, 1758, 4 (\$43, 573816) for the CE. Invariably, this study generate significant information on the practical potentials for improving waste collection services in Kano metropolis.

Generally, the results, in this research indicated that households placed high value on the collection services, and they are willing to pay for their waste collections in sustainable manner. These findings can be used for larger societal awareness about the waste collection services and the incurred benefits, including economic benefits. The results would also be beneficial to policy makers and PSPs to set priorities to ensure that the polluters' pay principal is observed accordingly for environmental sustainability.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**NILAI EKONOMI DAN PENENTU PERKHIDMATAN PENGUMPULAN
SISA PEPEJAL DALAM KALANGAN PENGGUNA ISI RUMAH DI
KANO, NIGERIA**

Oleh

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Pengurusan sisa pepejal di metropolis Kano di bawah tanggungjawab pihak berkuasa bandar, dikenali sebagai, Lembaga Pengurusan Sisa dan Sanitasi (REMASAB). Pengurusan sisa pepejal merupakan isu yang kritikal di metropolis disebabkan penyelewengan sumber kewangan dan eskalasi populasi. Oleh sebab itu, masalah tersebut menyebabkan ketidakkompetensian dalam pengawalseliaan dan pengendalian penghasilan sisa secara efektif dan berkesan, dan seterusnya menimbulkan ancaman buruk pada kedua-dua alam sekitar dan kesihatan orang ramai. Dalam respon polisi radikal bagi menangani masalah alam sekitar, kerajaan negeri Kano telah mencadangkan untuk menswastakan perkhidmatan pengurusan sisa pepejal, melalui REMASAB, bagi memperbaiki perkhidmatan pengumpulan bagi mengelakkan risiko berkaitan dengan indiskriminasi longgokan sisa dan proliferasi ancaman kesihatan berkaitan dengan alam sekitar yang kotor, sebagai pilihan pengurusan yang lebih baik bagi memastikan kemampuan dalam pengurusan sisa pepejal di metropolis Kano .

Oleh itu, tujuan kajian ini adalah untuk menganggarkan nilai ekonomi dan determinan perkhidmatan pengumpulan sisa dan potensi mereka terhadap pengurusan sisa yang efektif di metropolis Kano. Teknik penilaian Eksperimen Pilihan (CE) dan Kaedah Penilaian Kontigen (CVM) telah digunakan dalam kajian ini. Dalam bahagian CVM, format elisitasi kesediaan untuk membayar (WTP) , pilihan dikotomi dan soalan tertutup telah digunakan. Dalam bahagian CE, lima kategori nilai bukan pasaran perkhidmatan pengumpulan sisa telah dihalusi, termasuk: kekerapan pengumpulan, kemudahan penyimpanan, kaedah disposal, perkhidmatan prapengumpulan, dan nilai pengumpulan. Sebanyak 400 responden telah ditemu duga dalam format bersemuka, menggunakan kaedah persampelan kluster. Di samping itu, teknik persampelan rawak

kluster pelbagai peringkat telah digunakan yang memerlukan tiga urutan persampelan untuk diguna pakai. Oleh itu, tiga peringkat telah digunakan untuk memilih kejiranan kajian:

Peringkat 1: Tiga majlis kerajaan tempatan (LGC) telah dipilih secara rawak. Mereka ialah Perbandaran Kano (KMC), Gwale, dan Nassarawa, daripada enam LGC di metropolis tersebut. Nama semua majlis kerajaan tempatan telah ditulis di atas sekeping kertas dan kemudian dimasukkan ke dalam sebuah bekas, kemudian digoncang, dan daripadanya tiga telah dipilih secara rawak dari bekas tersebut ($1 \times 3 = 3$).

Peringkat 2: Lima belas jiran dari majlis kerajaan tempatan tersebut (KMC, Nassarawa dan Gwale) telah dikenal pasti berdasarkan prosedur persampelan yang diguna pakai dari tiga majlis kerajaan tempatan, menjadikan lima jiran daripada setiap kerajaan tempatan. Daripada ini, sebuah jiran telah dipilih secara rawak. Mereka termasuk Gandu dari Majlis Kerajaan Tempatan Kano (KMC). Dorayi dari Gwale dan Hotoro dari Nassarawa melalui prosedur yang sama seperti peringkat pertama di atas ($1 \times 3 = 3$).

Dalam bahagian CVM, model logit telah digunakan berdasarkan pilihan dikotomi bagi penganggaran jumlah tawaran spesifik terhadap harga hipotetikal bagi perkhidmatan pengumpulan sisa pepejal. Model logit tersarang telah digunakan untuk mendapatkan nilai marginal dan lebihan kompensasi responden terhadap atribut nilai bukan pasaran bagi perkhidmatan pengumpulan sisa.

Dapatan min WTP telah dianggar menggunakan format penilaian Kontigen Pilihan Dikotomi Terikat Tunggal (DC-CVM), walau bagaimanapun, dapatan memperlihatkan respon terhadap WTP adalah positif bagi memperbaiki perkhidmatan pengumpulan sisa. Min anggaran masing-masing ialah WTP ₦2202.03 (\$11.7) per isi rumah, dan dari CE ialah ₦2490 (\$12.6) per isi rumah.

Oleh sebab itu, berdasarkan statistik isi rumah yang diperoleh dari data Banci Penduduk 2006 daripada Suruhanjaya Penduduk Nasional (NPC, 2006), metropolis Kano mempunyai keseluruhannya sebanyak 275,851 isi rumah. Perkara ini menandakan agregat keuntungan kebajikan bernilai ₦607,432,177.53 (\$3,08,412.06) setiap bulan, atau ₦7,289,186,130.4 (\$33,000,944.82) setiap tahun. Sesungguhnya, kajian ini menjana maklumat yang signifikan mengenai potensi praktikal bagi memperbaiki perkhidmatan pengumpulan sisa di metropolis Kano.

Umumnya, dapatan kajian ini memperlihatkan bahawa isi rumah tangga meletakkan nilai yang tinggi terhadap perkhidmatan pengumpulan, dan mereka bersedia untuk membayar bagi pengumpulan sisa mereka dalam bentuk yang mampan. Oleh itu,

dapatan ini dapat digunakan bagi kesedaran kemasyarakatan yang lebih luas mengenai perkhidmatan pengumpulan sisa dan faedah tertanggung yang diperoleh, termasuk faedah ekonomi. Di samping itu, dapatan kajian ini bermanfaat kepada penggubal polisi dan PSP untuk menentukan prioriti bagi memastikan bayaran prinsipal pencemar dikesan sewajarnya bagi memastikan kemampanan alam sekitar di Metropolis Kano.

Oleh itu, pembangunan mungkin menyumbang kepada keadaan kebersihan alam sekitar. Walau bagaimanapun, sumber semula jadi termasuk alam sekitar yang bersih merupakan bahagian pembangunan yang integral. Jadi, sekiranya kenaikan dalam faedah agregat melebihi kenaikan dalam kos agregat, pemuliharaan alam sekitar dapat diterjemahkan sewajarnya dari perspektif masyarakat umum. Namun, ini dikenali sebagai “pareto improvement” yang bermaksud bahawa faedah sepatutnya adalah besar yang secara prinsipalnya, bermaksud, setiap orang boleh menjadi lebih baik atau alternatifnya sesetengahnya boleh menjadi lebih baik tanpa seorang pun yang terkebelakang.

Kesimpulannya, analisis kajian telah menjana banyak maklumat untuk implikasi polisi bagi membimbing pelbagai pemegang taruh dalam sektor SWM, kedua-dua penggubal polisi dan penyedia perkhidmatan swasta.

Penggubal Polisi

Tahap peduli isi rumah yang sederhana terhadap kelestarian alam sekitar memerlukan lebih kepekaan dan pencerahan bagi mempromosikan dan mempertingkatkan kelestarian terhadap SWC di metropolis. Oleh sebab itu, isi rumah sebagai pengguna memerlukan kepekaan yang progresif dan positif bagi menyokong nilai kepedulian terhadap pencemaran. Pengkomputeran DAII menunjukkan bahawa terdapat prioriti dari segi pengurusan sisa terdekat yang memerlukan tindakan dan pelan persekitaran segera, seperti yang dinyatakan oleh penggabungan atribut perkhidmatan pengurusan sisa pepejal yang diharapkan oleh pengguna isi rumah dalam tinjauan tersebut.

Kajian ini telah berjaya memperlihatkan aspek permintaan penambahbaikan dalam kekerapan pengumpulan sisa. Oleh sebab itu, penambahbaikan dalam SWC merupakan proses kompleks yang memerlukan strategi yang dirancang dengan teliti. Hasil model bagi anggaran WTP menunjukkan hasil positif yang menyebabkan pengguna isi rumah bersedia untuk membayar. Oleh sebab itu, dapatan kajian memberikan suatu tanggapan untuk REMASAB bagi mengenal pasti sebarang ketidakpadanan antara apa yang sebenarnya isi rumah sanggup untuk membayar dan kemampuan REMASAB untuk menyediakan perkhidmatan tersebut.

Penyedia Perkhidmatan Swasta

Kajian ini menunjukkan atribut perkhidmatan paling diutamakan yang diharapkan oleh pengguna isi rumah berdasarkan kepentingan relatif teranggap mereka. Oleh sebab itu, sebelum melaksanakan pelaburan oleh sebarang penyedia perkhidmatan swasta yang berminat (PSP) untuk terlibat, sektor SWM perlu menentukan faktor atau atribut bagi segmen pasaran sisa pepejal yang dapat diakses sebelum pembelian peralatan dan mesin yang relevan disebabkan prioritisasi teralih bagi atribut perkhidmatan merentas segmen pasaran.

Kajian juga menunjukkan bahawa terdapat potensi bagi perkhidmatan pengumpulan sisa untuk memperbaiki kekerapannya. Ini merupakan salah satu cara untuk menghapuskan proliferasi tapak buangan haram serta memastikan persekitaran yang lebih bersih. Oleh sebab itu, firma baharu yang berminat dalam perkhidmatan pengumpulan di metropolis Kano patut mengambil kira manfaat ini. Dengan itu, pelabur prospektif patut melabur dalam kedua-dua trisikal bermotor dan truk penyedat yang dapat membantu dalam usaha perkhidmatan pengumpulan sisa. Hasil WTP dapat digunakan sebagai indikator berguna untuk menentukan kepentingan relatif perkhidmatan dan barangan yang sewajarnya dihargai oleh orang ramai.

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APPROVAL

I certify that a Thesis Examination Committee has met on 15 November 2017 to conduct the final examination of Hamisu Alhaji Basiru on his thesis entitled "Economic Value and Determinants of Effective Household Solid Waste Collection Services in Kano, Nigeria" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

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LIST OF ABBREVIATIONS

ABC	Averting Cost Behaviour
CD	Compensation Demand
CE	Choice Experiment
CF	Collection Frequency
CM	Choice Modelling
CVM	Contingent Valuation Method
DARII	Design Attribute Relative Importance Index
DCE	Dichotomous Choice Experiment
DM	Disposal Method
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
GHG	Greenhouse Gas
GRA	Government Reserved Area
HPM	Hedonic Pricing Method
IIA	Independence of Irrelevant Attribute
IID	Independence of Identically Distributed
IP	Implicit Price
LCM	Latent Class Model
LL	Log Likelihood
MC	Monthly Charges
MLE	Maximum Likelihood Estimator
MNL	Multinomial Logit
MRS	Marginal Rate of Substitution
MSW	Municipal Solid Waste

MSWM	Municipal Solid Waste Management
NOAA	National Oceanic and Atmospheric Administration
OLS	Ordinary Least of Square
PCS	Pre-Collection Service
PSP	Private Service Providers
REMASAB	Refuse Management and Environmental Sanitation Board
RP	Reveal Preference
SD	Standard Deviation
SF	Storage Facility
SP	Stated Preference
SSE	Sum of Square
SW	Solid Waste
SWC	Solid Waste Collection
SWC	Solid Waste Collection
SWM	Solid Waste Management
TCM	Travel Cost Method
TIOLI	Take-It or Live-It
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UNDB	United Nations Development Programme
WTA	Willingness To Accept
WTP	Willingness To Pay

CHAPTER 1

GENERAL INRODUCTION

1.1 Study Background

Solid waste (SW) refers to the valueless material to the individual who generates it, usually sourced from domestic, commercial, industrial, healthcare, agricultural and mining activities and dumped in streets and public places (Puri et al., 2008). The term 'garbage,' 'trash,' 'refuses' or 'rubbish' are often to be used interchangeably refer to some forms of households' solid wastes. According to Tchobanoglous, et al., (1993), SW is the wastes that source from the activities of human and animals which are discarded as useless or unwanted broadly refer as solid waste, which includes sewage slug, demolition wastes and mining residues, municipal garbage, wastes of agricultural and animal husbandry, as well commercial and industrial wastes.

While, Solid Waste Management (SWM) is defined as those practices which involve processing, and waste disposal in accordance with the best practices of public health, legal, environmental, economic and financial, engineering, as well as the administrative considerations, regarding waste control, generation, storage, collection, transfer and transport of wastes materials (Othman, 2002). Thus, municipal solid waste (MSW) denotes SW generated by households, commercial units (with exception of industrial units) and institutions. Such wastes are usually heterogeneous often been influenced by socio-geographical factors.

Hoornweg and Bhada-Tata (2012), reported that annually about 1.3 billion tons on the estimate of solid waste are collected globally, contributing about 5% emission of greenhouse gas (GHGs) of the organic component of the solid waste decayed, which gives rise to global warming. Solid waste generation in the world is expected to significantly increase to about 2.2 billion tons by 2025. However, inefficient waste management which consists of a poor collection system and ineffective disposal method results in pollutions of air, water, and land. Which eventually attribute to the contamination of drinking water sources, thus, spreading waterborne diseases and causing infections to the dwellers. As denoted by Nabegu, (2008), Nigeria produces about 25 million metric tons of solid waste per year, and 0.49 kg per capita per day. While, in Kano metropolis shows per capita generation of waste ranges from 0.75 kg/day in the suburban area, and 1.2 to 1.7kg/day in the city and government reserved areas (GRAs) respectively, perhaps due to variations in the socio-economic status of the residential zones. Nabegu, (2010) studied municipal solid waste and estimated that Kano Metropolis generates about 3085 metric tons daily or 1, 080, 5000 tons annually of solid waste. On projection, it implies that by 2025 the amount would probably raise up to 1,825,000 tons per annum, or 5000 tons daily.

Solid waste management in Kano Metropolis has a long history. Dated back from the colonial era to independence, waste management has been under the control of the local authorities – with Wakilin Tsafta as the counselor in-charge. During that time, there was a decentralized waste management- East, West, South and Northern areas of the metropolis. In the mid-1970s to 1990s, it shifted to several ministries and various special task forces to handle waste management in the metropolis. With the beginning of civil rule in 1990 management of solid waste became an integral issue for parties' campaign to seek for an election in Kano state, therefore, it ends in the establishing the present Refuse Management and Sanitation Board (REMASAB) in 2003. Thus, the function of municipal solid waste management (MSWM) in Kano Metropolis was given intermittently to fourteen (14) different agencies as that can be seen from the table as below:

Table 1.1 : Transition of Responsibility for MSWM in Urban Kano from 1960 to Date

S/NO	Name of Agency Responsible for Waste Management	Period
1	Kano Native Authority	1960-1969
2	Local Government Authority	1969-1971
3	Kano Metropolitan Planning Board	1971-1973
4	Ministry of Health	1973-1976
5	Kano Municipal Local Government	1976-1982
6	Ministry of Housing and Environment	1982-1983
7	Ministry for Local Government and community Dev't	1983-1984
8	Kano Municipal Council	1984-1985
9	Metropolitan Environmental Sanitation Task Force	1986-1988
10	Kano State Environmental Planning and Protection Agency	1989-1994
11	Refuse Disposal Agency (REDA)	1994-1997
12	Waste Disposal Company (WASCO)	1997-1999
13	Ministry of Environment	1999-2003
14	Refuse Management and Sanitation Board (REMASAB)	2003-Date

(Source: Sustainable Kano Project, 2004)

Accordingly, solid wastes collection (SWC) is identified as one of the SWM problems in most cities of developing countries in recent decade, this is as a result of high population growth, rapid urbanization, change in lifestyle and rising standard of people in Metropolis, these, however, influences the volume and diversity of wastes generated, eventually its generation becomes faster than they are collected, transported and disposed (Nguyen, 2003). Thus, one of the important aspects in households' solid waste collection concern is addressing the problem of municipal solid waste management, for which its generation has significantly increased beyond proper control and effective management capacity of urban authorities over the years. Invariably, households' solid waste collection system in Kano Metropolis is not sustainable and poses a lot of threats to the public health and the environment. However, Adeyinka, et. al., (2005) reported that collection, transportation, and disposal of households' solid waste are largely capital intensive and require much

labour, which revealed about 70% to 80% of the total cost of the agencies for SWM in the country accounts for transportation including both machinery and labour. Despite that, agencies responsible for MSWM (indeed in most cities in Nigeria), charges no fees is imposed to individuals for its operations. Thus, waste management services in Kano Metropolis by the state are provided freely. Therefore, the cost for waste disposal are virtually not reflected in the prices households pay for daily activities, eventually, this trend would tend to generate more waste compared to payment for waste generated based on the health, social and environmental marginal cost (Linderhof, et al., 2001). However, Coffey and Coad, (2010) showed that SWM services in the urban centers as a source of public revenue is seriously depleting globally, the depletion account for 20% to 40% of urban revenue. Nabegu, (2010) observed that wastes collection in Kano Metropolis is slower compared to its generation which exceeds the current government's provisions for proper and effective SWM. The United Nations Centre for Human Settlements reported that only between 25% and 55% of all wastes generated in urban centers are usually collected by urban authorities. While, the United Nations Development Programme (UNDP) has estimated that more than five million people die yearly due to diseases related to poor and ineffective waste collection system (Srinivas, 2002). It is, therefore, necessary for individuals and communities to actively participate in decisions making and payment for waste management services (Kassim, & Ali, 2006).

In Kano Metropolis, large heaps of uncollected wastes are common; roads and streets are littered, drainages, streams, as well as gutters, are blocked with heaps. Dumpsites within the neighborhoods posed serious health threats to the surrounding residents. Thus, uncollected heaps of waste appears to be beyond the control of the urban authorities and is against the principles of sustainable development, (Ali, 2012). Invariably, these scenarios significantly causes flooding, transmitting and spreading of gastrointestinal diseases, such as dysenteries, typhoid fever, cholera, yellow fever, and plague among others, also, serve as a niche for breeding insects-pest such as flies, mosquitoes, cockroaches and rodent vectors, like rats, squirrel and so on, also it produces unpleasant odour which pollutes the atmospheric air.

Like in many other developing countries, waste collection, transportation and disposal is a sole function and responsibilities of urban and local government authorities for environmental protection in Nigeria, (Ogwueleka, 2009). Likewise, in Kano metropolis, waste collection, treatment, transfer, resource recovery, recycling, and disposal is a whole responsibility of the urban authority, that is, Refuse Management and Sanitation Board (REMASAB).

Conversely, waste collection by REMASAB in Kano Metropolis was found to be inadequate, insufficient and ineffective as observed by some studies, for example, Sha'Ato, et al., (2007), reported that less than 40% of households' wastes are collected, and less than 30% is properly disposed of. Waste collection services by the urban authority-REMASAB are ultimately insufficient and inadequate. The operation is only confined within a limited domain of the Government Reserved Areas (G.R.As) and some wealthy domains, (Ali, 2012). Moreover, Nabegu, (2008) shows the

collection coverage of solid waste by REMASAB, indicated that about 7% of the households receive 50% coverage collection, 23% of the people receive 30% of coverage collection and bulk of the residents about 70% have only 20% collection coverage, invariably, this trend hold the belief that households' waste generation in the metropolitan Kano is inversely proportional to the collection capability and capacity of the urban agency, as supported in a different study by Medina, (2003) revealed that households' waste collection services in cities of developing nations is beyond the capacity of the responsible urban authorities.

Consequently, SWM services in Kano Metropolis is always assessed based on the activities and performances of the service provider (REMASAB), which is just one side i.e. the "supply" and ignoring the other side i.e. the "demand" side. Contrary to the situations in the urban centers of advanced countries, private sector operations in waste management are well organized and regulated. In the case of Kano Metropolis in particular and in Nigeria as a whole, such private operators are often not to be closely monitored, most of them were not fully registered neither they were regulated properly to attain sustainability in waste management (Mukhtar, 2008).

The involvement of households who generate substantial amount of waste and often to be the potential victims of the threat posed by uncollected heaps of waste, should be an integral part to actively participate in the decision-making regarding policies on effective and efficient solid waste management, perhaps, this trend would allow private service providers in waste management stream to understand the willingness of the households "to pay" and actively participate. Hence, the important question is that; are the households willing to pay and how much are they willing to pay for an effective and efficient solid waste collection services for them?

According to the National Bureau of Statistics, (2012), Nigeria has an estimated population of about 163 million people of its thirty-six states including federal capital territory, Abuja. Nigeria like most developing countries has the issue of municipal solid management as one of the serious challenges facing her major cities including Kano Metropolis. These urban centers have suffered an unprecedented increase in a waste generation with escalating population figure, as such waste collection has become a serious problem to urban authorities, especially in Kano metropolis.

Furthermore, Kano region over the years has been witnessing substantial population growth due to its Agricultural, Commercial, and Industrial Activities, for instance, the population figure of Kano region was given at about 5.945 million people, the population figure increased in 1991 to about 8.686 million population, with current estimates of over 12 million population (Olofin et al., 2008). Recorded a 2.9% growth rate and has declined in mortality rate and a rapidly increased fertility rate in the region. In addition, the rate of population growth also increased from 2.51% per annum in 1960's to 3.3% in 1980's, and currently at the rate of 4.5% per annum and with annual growth rate of 5.5% (Gabriel & Abraham, 2011). These high population and rapid urbanization in the recent time posed a serious problem and confounded

wastes collections and disposals problems in the city. Its huge population, therefore, provide potentials for high households' waste generation, (Thanh, et al., 2011). While high concentration of population in the region is largely found in the Metropolis with about 275,851 households and about 2.83 million people National Population Commission, (N.P.C, 2006).

Thus, waste generation has substantially increased in the municipality over the years due to high population growth and rapid urbanization since early independence in 1960, Nabegu, (2008), shows the waste generation and distribution pattern of solid waste in the metropolis in which households significantly contributes with more than 63%, followed by the commercial sector, 27%, institutional 6%, industrial 3% and others 2% as represented in figure 1.1 below.

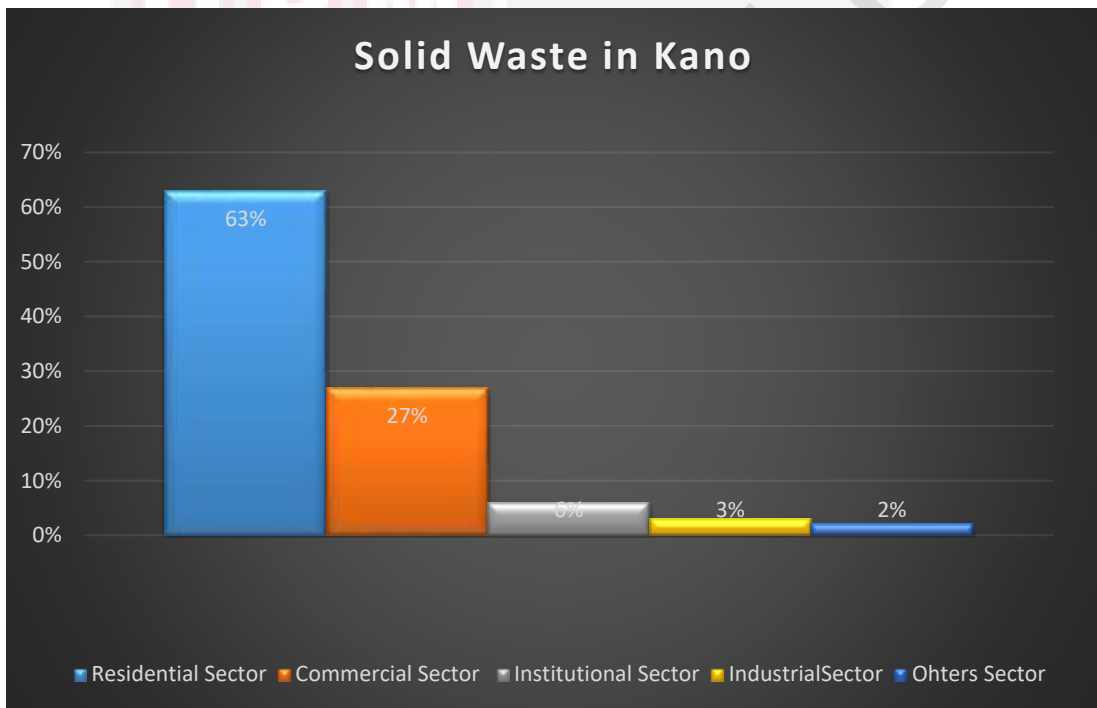


Figure 1.1 : Solid Waste Generation in Kano; Modified Raw Data from Nabegu, 2010

Poor households' waste collection is contributing elements for degrading the environmental quality and human health UNDESA, (2005), in Behzad, et al., (2011). Waste collections used to be the responsibility of municipal authorities in the past (Yusuf, et al., 2007), it is one of the services for which local governments are responsible for, precisely, it is a constitutional responsibility of the local governments in Nigeria (Adepoju, et al., 2013). This obligation is not mutually exclusive, because, none of the local governments in the country that meets the expense of the gigantic financial, technical, administrative and human resource requirements to efficiently carry out this constitutional obligation (Alabi, 2004). Although, government attached

importance to the health and environmental issues a priority in their development objectives, however, their ability to address the problems of waste collection depreciates with time, due to increase in capital costs for plant, equipment, operation and maintenance costs. Bearing in mind the rapid population and spatial growth of most urban areas and cities with increasing level of waste generation and decreasing coverage levels, confronted by ever increasing public demand for improved solid waste collection services (Sule, 1979; Solomon, 2009; Oyeniyi, 2011), thus, there is need for the involvement of the private service providers in the provision of municipal solids waste services among households in Kano Metropolis. It is worth noting, however, there are many informal operators as private service providers in SWM or informal refuse collectors such as cart pushers. Therefore, it is deemed feasible to evaluate the household willingness to pay (WTP) for improved solid waste collection services in Kano metropolis. As such, the study examined the general features of the existing solid waste management practices, it estimates the households' willingness potential to pay for solid waste collection services improvement, and determinants influencing households' WTP for improved solid waste collection services were identified.

1.1.1 Geography of Kano Metropolis

The Metropolitan Kano is the capital of Kano State, it is located between longitude 8° and 9° East and latitude 10° and 12° North, it covers an area of about 600 km^2 . It has been observed that, far back to during the time of colonial masters in early 20th century, what constituted Kano city was contained within 17.55 km^2 . Now it has greatly expanded and declared urban area based on the 1978, land use Act, it contained within 60 km^2 , while the built-up metropolitan Kano is contained within 48 km^2 (Marafa, 2012). Indeed, these spatial spread has tremendous increased today undoubtedly. Hence, the location of Kano metropolis is depicted as shown in figure 1.2 below.

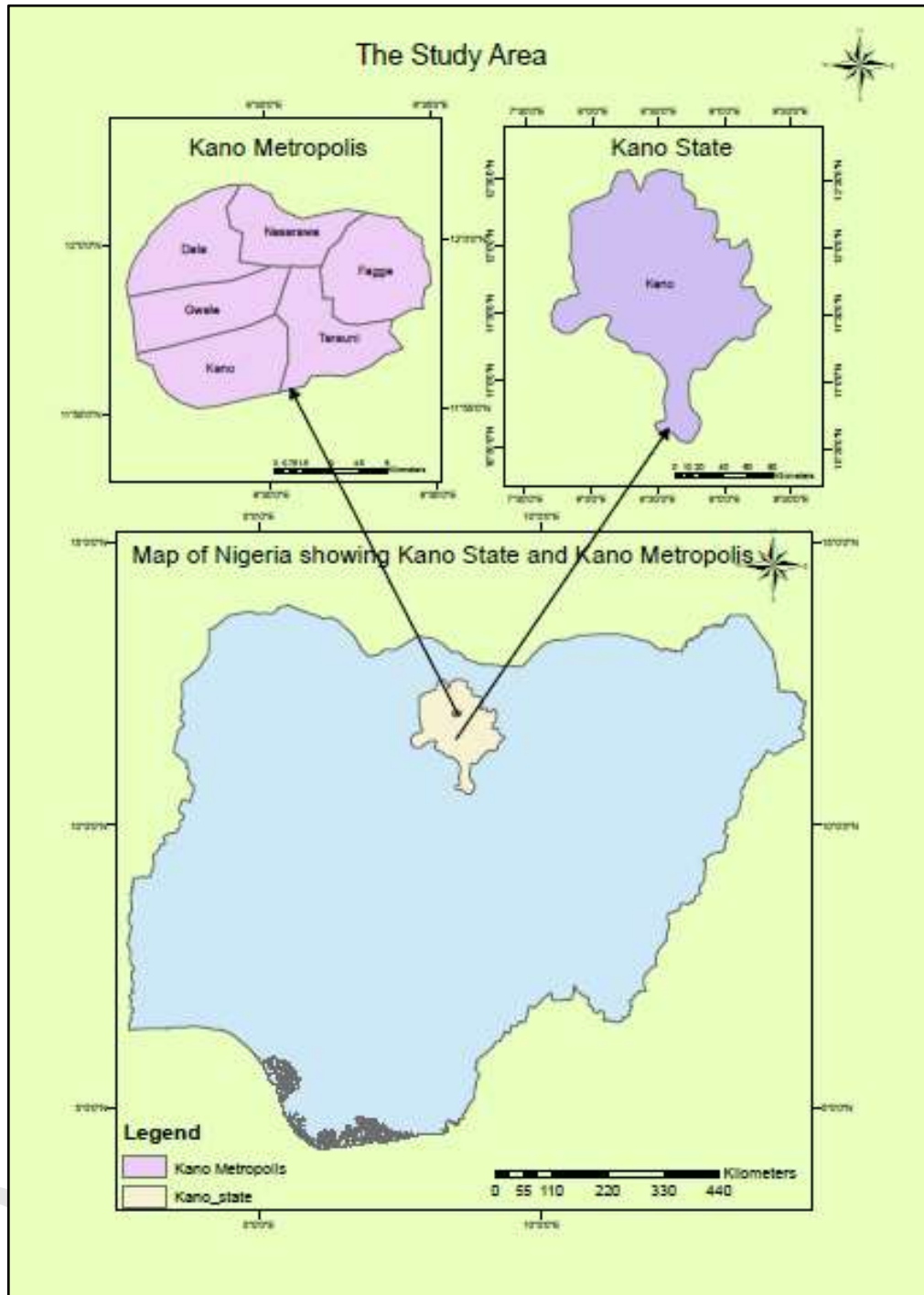


Figure 1.2 : Map of the Study Area (Source: Conceived by the Researcher, 2015)

Kano has been a center of trade and a popular hub of sub-Saharan trade and a rich agricultural region. Presently, the city is a major commercial, industrial, administrative, and religious center (Muhammad & Bichi, 2014). Kano metropolis is the largest city in the Northern part of the country, Nigeria, and ranked third (3rd) among Nigerian cities after Lagos and Ibadan. Kano city consists of Six Metropolitan

Local Government Areas and two dove-tailed out of forty-four Local Government areas in the state including; Municipal, Dala, Gwale, Nassarawa, Tarauni, and Fagge, while, Kumbotso and Ungogo are the dove-tailed Local Governments. Based on the National Population Commission (N.P.C 2006) national population census, Kano state was ranked the most populous state in the country with about 9,384,682 population, while the city itself has a population of about 2, 828, 861 (30.14% of the state population). The population growth, however, results from an influx of people from different places both from within and outside Nigeria due to its commercial and industrial activities. Thus, population growth in the city means an increase in the demand for infrastructural facilities, which seemed to be unattended by the local authorities (Muhammad & Bichi, 2014). The native tribes of the area are Hausa/Fulani, while, non-indigenous tribes were from other parts of the country. For example, non-indigenous tribes from the southern parts of the country include Igbos and Yorubas, while those from the northern parts were Kanuri, Nufe, Igbira, and Mangawa. These tribes in the city have engaged in various economic activities to support their families.

Demographically, metropolitan Kano is significantly influenced by its political development and economic growth, with an estimated population of about 4 million, the growth rate is at 3.9% per annum (Lynch et al., 2001). According to Ahmed and Ali, (2004), urban population expansion certainly puts more pressure on the existing urban infrastructures and services, hence, most of them have been dilapidated and very few were expanded to meet the rapid urban population sprawl.

Furthermore, inadequate housing provisions in Kano metropolis to accommodate for the increasing urban population is an integral issue of its own. Subsequently, development of slums and squalor settlements emerged with no adequate proper planning and mostly inaccessible for an emergency situation. Perhaps, such settlements considerably account for so many urban populace in Kano metropolis. Additionally, such settlements are commonly characterized by congestion, poor sanitation and indiscriminate dumping of refuse as well as general degradation of environmental quality (Ali, 2012).

1.1.2 Household Solid Waste Management Challenges

Medina, (2003); Nabegu, (2010); and Aliu et al., (2014), Observed that solid waste management is a great issue of concern facing developing and even the developed nations of the world, because of its adverse effects on human health and environmental quality. Equally, Nigeria is also battling with the issue of solid waste management like most developing nations, these challenges, however, ranges from poor collection coverage; inadequate transportation system; indiscriminate dumping of refuse and open burning; inadequate funding and institutional problems. Hence, these bottlenecks hamper with an effective and sustainable waste management systems and development.

According to Achankeng, (2003), about 20% to 50% of the annual budget of many urban areas spent on solid waste management, hence, collection is still low. SWM is poor and below standard in most developing nations, it is associated with poor waste storage and collection coverage, lack of accurate data on waste management, indiscriminate waste disposal. Ineffective and inefficient waste management significantly contributed to pollutions of air, water and land, and contaminate sources of water (WHO/UNICEF, 2012).

Urbanization largely due to population growth in Kano region, like in most urban cities of developing nations stand as bottleneck for the urban authorities in providing effective and efficient waste management services (Olanrewaju and Ilemobade, 2009). In which population expansion directly affects land uses pattern eventually if this scenario has not been checked it may lead to the advent of illegal structures creating slums within the neighborhoods and squalor settlements. Hence, it upsets the initial urban plan and eventually hinders effective and efficient waste collection services and brings about indiscriminate dumping of refuse. Such open illegal dumps gradually accumulate and become heap of mountain, releasing unpleasant odour, and serve as a niche for breeding insects and rodent pests. Moreover, illegal open dumps pose serious threat to human health, environmental quality, and contaminate sources of water through leaching from the dumpsites (Karunakaran et al., 2009).

Nabegu, (2010) denoted that waste generation and composition is influenced significantly by social behavior, income, population, season, economic growth, and climate. In Kano metropolis solid waste consists of heterogeneous compositions and mixed of both bio- degradable, and non-biodegradables materials, as well as hazardous and non-hazardous materials, therefore, waste segregation from the source is absolutely absent or during collection for final disposals.

Generally, the magnitude and diversity of solid waste generation and composition is significantly influenced by some factors in developing countries and even the developed ones, such as population expansion, change in consumption styles, and industrialization, climate, culture, seasonal variation and economic growth, Medina, (2003); Lau, (2004); Nhamo, et al., (2009). Comparably, however, solid waste generated per person is lower in developing countries as compared to that of developed countries due to population density, indeed, urban areas significantly differs in the characteristics and composition of waste, however, more developed nations comparably produce less organic waste than developing nations in the urban areas, bio- degradable waste consists of animal and human waste, (Ogwueleka, 2009; Nabegu, 2010).

1.1.3 Households Solid Waste Management Practices

Waste management in Kano metropolis is indeed unsustainable, perhaps it could be link to the inability and incapability of the urban authorities to handle, manage and regulate the dumps of wastes effectively and properly. Despite that curbside (trash

bins) were allocated in some designated points, and along the major streets and roadsides by urban authorities, yet wastes is commonly been dumped openly near houses, in public places, and near river sides, while some are being dumped directly into the near-by rivers or ponds especially in the city and the surrounding suburban areas this may be detrimental not only to the aquatic organisms, also the public health by contaminating the water table (Ogwueleka, 2009; Nabegu, 2010). It revealed that about two-third of the urban residents do not utilize official dumpsites for dumping their waste. Perhaps due to inaccessibility nature of some areas for waste collection because they are unplanned, even in the planned urban areas, waste collection is not immediate and frequent Nabegu, (2008).

1.1.4 Households Waste Collection and Transportation

A major cost in households' SWM services is the collection and transportation issues. Although, waste collection involves primary and secondary waste collections, thus; waste collection from households to the designated neighborhoods collection sites and from these points to the final disposal sites and landfills respectively by the urban authority. Though, there are some private operators in waste management, mainly operates on demand and therefore charges some fees, while, the urban authority handling SWM (REMASAB) operates freely, therefore, charges no fees from the households. Thus, in some place of their operations private operators collect waste from house-to-house on weekly basis, while, in most areas of their operations there is no consistency in waste collection services. Noticeable, among waste collectors, is the informal waste collectors who operate also on the house-to-house basis and scavenging for re-use and recyclable materials, however, scavenging in solid waste may pose a serious threat to the health condition of these scavengers (Chung and Poon, 2001). Informal waste collectors and Scavengers often to litter streets in an attempt to search and sort for some recyclable items from the waste collection containers, and this may lead to poor environmental sanitation and possibly may be a threat to public health (Yuan et al., 2006).

1.1.5 Households Waste Separation and Recycling

Source separation of waste materials reduces the solid waste quantity and ease recycling, it also minimizes the total cost of disposal. However, in Kano region, Nigeria, there is total absence of waste separation among the households from the source of generation, mostly generated waste are mixed off inside one single container, thus, source-separated materials among the household for collection is uncommon practice in Nigeria, particularly in Kano metropolis, Nabegu, (2008), Ogwueleka, (2009). Unlike in advanced nations where solid waste generated are usually separated and collected in a labeled and different containers of different colors, for example, papers, metals, plastics etc. are collected separately, (Chung and Poon, 2001; Yuan and Wang, 2006).

Waste recycling on the other hand, for the technologically advanced nations such as America, Japan, and Germany, because of their sophisticated technology have a tremendous utilization of generated solid waste into recycling, hence, in developing countries such as Nigeria, especially in Kano metropolis, there is a very few recycling rate due to low level in recycling technology, as solid waste recycling is observed to be highly labour and capital intensive, likewise, absent of recycling bins in most urban cities in developing nation like Nigeria prompt residents to dispose of their waste without prior source-separation of generated solid waste, also, re-used materials has low patronage by individuals, as such inadequate market for recyclable materials make recycling of waste materials little worth (Yuan et al., 2006).

Table 1.2 : Waste Generation in Some Urban Cities in Nigeria

City	Population	Agency	Tonnage/month	Density (kg/m ³)	Kg/capita/day
Kano	9,383,534	Refuse Management and Sanitation Board	626,704	1,160	0.56
Lagos	8,029,200	Lagos state management authority	255,556	294	0.63
Ibadan	307,840	Oyo state environmental protection commission	135,391	330	0.51
Kaduna	1,458,900	Kaduna state environmental protection agency	114,443	330	0.51
Port Harcourt	1,053,900	Rivers state environmental protection agency	117,825	300	0.60
Makurdi	249,00	Urban development board	24,242	340	0.48
Onitsha	509,500	Anambra state environmental protection agency	84,137	310	0.53
Nsukka	100,700	Enugu state environmental protection agency	12,000	370	0.48
Abuja	159,900	Abuja environmental protection agency	14,785	280	0.66

(Source: Ogwueleka, 2009).

1.2 Problem Statement

Solid waste generation and its management basically are the two major ways in handling solid waste (Coffey & Coad, 2010). The main focus in dealing with solid waste in Kano Metropolis was vehemently on the management of waste after it has been generated (Nabegu, 2010; Oke, 2008; Babayemi & Dauda, 2009; Agunwamba, 1998). Thus, solid waste management was basically on mere collection and disposal

operational model. Hence, the necessity to properly handle the increasing amount of solid waste generation globally and Kano inclusive, prompt the use of a more strategic and comprehensive approach referred to as integrated solid waste management- the ISWM (UNEP, 2009; Niaura, 2013; Tonglet, et al., 2004). The current SWM strategy in Kano Metropolis of collection and disposal approach causes three major impacts which include public health effects, environmental effects and shortening landfills' lifespan. Thus, it has exposed the city to some environmental threats such as public health problem, loss of aesthetic glory, bio-diversity threatening, an increase in land requirements, and a general reduction in the environmental quality. Consequently, individuals do not take into consideration how much waste they produce. Because the external cost of waste generation such as pollutions to the environment (land, water, and air) are often to be ignored by individuals and accordingly more waste is been generated and disposed of (Ferrara, 2003; Jenkins et al., 2003; Hong, 1999). Indeed, in Kano Metropolis and in some of the urban cities in Nigeria, individuals don't pay a penny for their disposed of wastes, it is perceived as a social responsibility for the government to deal with it. So, costs for waste management are not incurred or reflected in the households' price for a daily activities and thus would generate more waste than if cost was incurred for additional waste generated as in line with its social, health or environmental marginal costs (Zurbrügg and Ahmed, 2003; Linderhof et al., 2001). It is highly noticeable in Kano Metropolis a high competitive land uses (commercial, residential, industrial, administrative etc.) due to its high population growth (Nabegu, 2010).

Rapid population growth and urbanization in the metropolis influences generation of more wastes in the city, for instance, Kano Metropolis generates about 3085 metric tons daily or 1, 080, 5000 tons annually of solid waste. However, on a projection by 2025 this amount would probably raise up to 1,825,000 tons per annum, or 5000 tons daily, hence, more than 60% of municipal solid waste is generated by households (Nabegu, 2010).

This scenario makes it much more a herculean task for REMASAB to properly and effectively deal with heaps of wastes dumped indiscriminately on the major streets and open dumping sites. Thus, SWM in the metropolis is beyond the current capacity of REMESAB to collect the wastes effectively and properly, (Nabegu, 2010; Medina, 2003). However, over the years, inadequate infrastructural facilities, insufficient institutional system, inadequate financial and technical arrangement, have resulted in the inadequate and insufficient level of service provisions in the solid waste collection (SWC) at various communities. This is perhaps due to disparities with the growing rate of waste generation and poor awareness, and perception levels, as well as lack of proper attitude and participation levels among households towards sustainable SWM services in the metropolis. Hence, these, in turn, affects the environment in several ways ranging from drainage blockage, floods, the spread of environmentally related diseases such as Diarrhea, Cholera, Dysentery among others, as well as human displacement and loss of human lives and properties. For example, more than 10,000 cholera epidemic cases were recorded in 2010 alone in West African sub-region, and out of which 550 of them were in Kano metropolis largely associated due to a poor waste collection system (Hutin et al., 2003). Therefore, to address the problem of the

poor waste collection in Kano Metropolis, privatization of SWM market sector was initiated in 1999, basically aimed at attaining an efficient and integrated management system to system for enhancing and improving environmental quality by incorporating private service providers (PSP). Another serious concern is connected to the consumer demand (WTP) with the type of services characteristics along sides with the waste collection options for proper disposal to be offered by the PSPs.

Conceivably, based on the welfare theory, households would support any environmental change conditionally if they were not made worse-off. Thus, this is achievable through solid waste collection services improvement options that could add to a household and it is expected to have an increase in the societal net utility through pollution reduction (air, water and land), avoidance of environmental eyesores, emissions of greenhouse gases (GHGs emissions) from the dumpsites and landfills, requirements for landfills areas, etc. (Eshet et al., 2005).

Part of the important benefits of SWM policy improvement in Kano Metropolis is the big market opportunity for SWM service providers to incorporate PSPs in the provision of SWC services. It is obvious from the proliferation of informal waste collectors in the streets and markets place in the Metropolis. Thus, the existence of potentials for societal benefits is good enough to settle the additional costs accrued as a result of policy change (Morrison, 2000). This is, however, based on Kaldor-Hicks' compensation principle potentially on the interpersonal compensation of utility. In spite of welfare lost to losers due to policy change, hence, this principle states that policy could be 'welfare improving' only if it increases societal benefits where gainers compensate the losers (Kaldor, 1939; Hicks, 1939).

Hence, welfare impact assessment on SWC services produces non-market benefits, has to be computed using economic valuation of non-market benefits (Mitchell and Carson, 1989). Also, designing informed policies on waste collection services which have several potentials non-market service attributes needs understanding on the marginal rate of substitution (MRS) among service attributes (Agimass & Mekonnen, 2011). It would guide policymakers on alternative policies toward SWC services and their respective costs. Additionally, if the welfare gain from SWC services is known, it will give an input in the costs-benefits analysis (CBA) needed to evaluate the feasibility of service options improvement on SWC in the metropolis. This could be done by comparing aggregated welfare gain to the various stakeholders in SWM such as PSPs, REMASAB or other parties and policy-designated managers of MSWM services.

1.3 Research Questions

- i. What is the level of households' awareness, attitudes, perceptions, and participation towards solid waste collection?
- ii. What are the utmost important service attributes of solid waste collection services favored by the households in Kano metropolis?
- iii. Are the households willing to pay for improved SWC services, and what is their mean willingness-to-pay (WTP) for improved SWC services?
- iv. What are the households' preferences on SWC service improvement options to facilitate SWM practices?

1.4 General Objective

The general objective of this study is to estimate economic values and determinants of solid waste collection services among households in Kano Metropolis, Nigeria under the guide of the following specific objectives;

1.5 Specific Objectives

1. To describe households' levels of awareness, attitudes, perceptions, and participation towards sustainable solid waste collection services in Kano Metropolis.
2. To determine the most relevant choice influencing set of service attributes for solid waste collection services among households in Kano Metropolis.
3. To estimate households' mean willingness-to-pay (WTP) for improved solid waste collection services in Kano Metropolis.
4. To determine households' preferences for solid waste collection service improvement options to facilitate SWM practices in Kano Metropolis.

1.6 Significance of the Study

- The findings of this study provided baseline information on the aggregate benefits derivable from households' improved waste collections services not only to REMASAB but also to the prevailing and prospective private investors into the SWM.
- The information on the households' willingness to pay (WTP) provided by this research work unearthed the optimal and socially acceptable estimate of the economic value of households' solid waste collections in Kano metropolis.

- It served as guide to policy regulators for pro-active attitude on environment among the teeming urban populace towards solid waste pollution, attained via the investigation on households' level of awareness, attitudes, perceptions, and participation towards SWC, to guide decision/policy-makers on the possible segments to intervened and focused on its awareness and enlightens campaign and programs..
- It is significance for researchers as early information or as a reference point for future studies by providing a framework for the improvement of current policies and practices on SWC services among households in Kano metropolis.
- It will contribute to the existing micro level of literature on economic valuation of non-market cost/benefits related to SWM which might be applicable in Kano metropolis and similar urban cities elsewhere in developing countries.

1.7 Scope and Limitation of the Study

The research was conducted in Kano Metropolis, North-western, Nigeria, and assessed the economic values and determinants of SWC services among households, the study examined the households' level of awareness, attitude, perceptions, and participation towards sustainable SWC. This study also estimated the mean of household willingness to pay (WTP) for improved solid waste collection services. It also determined the preferences perceived by the households as the most favored ones, and also the households' marginal rate of substitution (MRS) among service attributes of SWC services was determined.

However, this work did not cover a detailed study on private sector participation in municipal SWM centrally due to time constraints and limited resources to cover such sector comprehensively and judiciously.

In this piece of work all bold and concerted efforts were made from the researcher's side to avoid as much as possible any political statement in an attempt to be objective, fair and unbiased, as one of the ethics and integral parts for empirical studies to conduct an objective research across the dimensions involves in a research.

1.8 Organization of the Thesis

This thesis is organized into five (5) chapters. Chapter 1 provides a global overview of solid waste management, and narrowed it down to some details on Nigeria, and then the case study of Kano region particularly the metropolis. It also discusses the problem statement, the objectives which outlined the specific aims of the study and finally, the contributions of the research were discussed under the significance of the study.

Chapter 2 presents the review of the literature on the methods adopted, thus, the stated preference (SP) approach using contingent valuation (CV) and choice experiment were reviewed.

Chapter 3 consists of the conceptual framework of the study, in addition to that, the survey design consisting the survey method, sampling method, sample size, questionnaire design, data collection as well as estimation methods were presented. Moreover, the pre-survey result was presented to address the first specific objective of the research, prior to the conduct of the main survey.

Chapter Four, in this chapter the results from the estimated models were reported, also the findings were discussed and interpreted. The final chapter, chapter five, consists of the summary of research results from the research in concise conclusion, along with the conclusion and implications for policy were also presented. On the whole, limitations of the study were highlighted, along with proposals for further studies.

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