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FACTORS INFLUENCING RESIDENTS' WILLINGNESS TO PAY FOR IMPROVED HOUSEHOLD SOLID WASTE MANAGEMENT: A COMPARATIVE STUDY

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ABSTRACT

Solid waste management is a major environmental challenge facing most developing countries. The goal of this study is to identify the factors that influence residents' willingness to pay (WTP) for improved solid waste management in Shah Alam city, Malaysia and Ibadan city, Nigeria. A total of 440 residents were randomly selected across residential neigbourhoods in the two cities. The contingent valuation method (CVM) involving two hypothetical improved service scenarios in waste management were used to estimate WTP. Binary logit regression analysis technique was employed to determine factors that influence residents' WTP. Findings from the study revealed that on average, residents from Shah Alam city are willing to pay RM58.47 (USD$12.2) for the proposed service improvement in waste management, while Ibadan city residents are willing to pay ₦4,796 (USD$ 3.4). In terms of factors that influence WTP for improved SWM, results

showed that income, household size, and educational qualifications have significant influence on WTP for improved SWM in both cities.

Keyword: *Willingness to pay, Ibadan city, Shah Alam city, Contingent valuation method, Solid waste management*

INTRODUCTION

Rapid growth in human population, urban development, industrial growth, and economic progress have led to the generation of large volume of solid waste in residential areas globally, with a particular emphasis on the rapidly expanding cities of developing nations (Afroz & Masud, 2011). Household solid waste management remains one of the environmental challenges confronting cities around the world, especially in the rapidly growing urban centres of developing nations (Guerrero et al., 2013). The high population growth experienced in the last five decades in most developing countries, coupled with increased household income, have increased the quantity of solid waste generation (Chakrabarti and Sarkhel, 2003; Samah et al, 2013), which surpasses the management capacity of most Local Authorities in the developing countries (Akhtar et al., 2017). The large volume of solid waste generated daily in urban centres has made the management of solid waste a serious environmental problem for poor developing countries (Bahauddin & Uddin, 2012; Manuel, et.al. 2017; Chinh et.al. 2021). In most low income developing countries, about 90% of solid waste is often disposed in unregulated dumpsites or are openly burnt (World Bank, 2022), and this has implication on human health and the environment (Wiedinmyer et al., 2014).

The huge amount spent in solid waste management in most developing countries does not necessarily translate to improvement in the quality of service delivery (Ike et.al.,2018). This is due to lack of proper Municipal Solid Waste Management (MSWM) system, which involves collecting, transferring, treating, recycling, recovering and disposal of solid waste (Sarpong and Alarussi, 2022). The essence of MSWM is usually to reduce the quantity of waste going to the landfills, thereby reducing cost of collection and transportation (Hilburn, 2015). The present waste challenges being experienced in most developing countries is because solid waste generation exceeds collection capacity (Sarpong and Alarussi, 2022). The problem is further compounded by lack of necessary facilities for proper

solid waste management and poor programme articulation and design (Zhu et al., 2008).

According to the World Bank 2018 report, Nigeria generated at least 32 million tonnes of solid waste annually, and this number is projected to rise to about 107 million tonnes by 2050. However, only about 30% of the wastes generated in Nigeria is efficiently collected and disposed in an environmentally friendly manner. The reason being that two-thirds of urban households in high-density low-income neighbourhoods in Nigeria, lack formal waste management services, compared to low and medium density high-income neighbourhoods, where waste management is organized (Agbo, 2023). The volume of waste generated in Nigeria cities is beyond the capacity of the municipal waste management authorities to handle (Uwadiegwu and Chukwu, 2013). The inability of the municipal waste management authority to function effectively in Nigeria is exacerbated by lack of urban planning, policy summersault, lack of modern waste management equipment/tool, and high rate of urbanization (Onukogu, 2018). The problem of municipal solid waste management in Nigeria cut across concerns for human health, water, air and land pollution (Abila, and Kantola, 2013). For example, in the coastal cities such as Lagos and Port Harcourt, indiscriminate dumping of wastes has led to contamination of water bodies (Ike et.al., 2018).

In Malaysia, alterations in the prevailing business landscape impact both the private and public sectors, with solid waste management (SWM) being one of the areas affected. According to Section 72 of the Local Government Act 1972, local governments are mandated to provide SWM services. However, the rise in population, urbanization, industrialization, and economic growth over the years has led to a significant rise in the volume of solid waste being disposed of daily in residential areas. This has resulted in detrimental effects on human health and has caused adverse economic, environmental, and biological consequences (Che Pak et.al.2023). The rapid increase in population in Malaysia, has notably contributed to the surge in solid waste generation, reaching 38,427 metric tonnes per day in 2021 and escalating to 14 million metric tonnes per annum in 2022 (MIDA, 2022).

Sustainable development has been a central focus of Malaysia's development strategy since the 1970s, prioritizing the elimination of poverty, enhancing the welfare of its citizens, ensuring equal access to education, and

fostering environmental sustainability (Saadatian et al., 2012). Sarpong and Alarussi, (2022) noted that despite the well thought out need for sustainable development in Malaysia, it has been hard attaining these objectives for a country of about 33 million people. According to Yusop and Othman (2019), the environmental challenges facing the country is quite huge. Malaysia is battling how to manage the creeping trend of plastic and other solid wastes dumped in the country from the developed nations (Sarpong, 2020). About 38,000 metric tons of wastes is being generated daily in Malaysia, out of which 24% is recycled while the rest (76%) goes to the landfill (Lim, 2018). The current situation is such that large volume of wastes continue to end up in Malaysian landfills where space is running out (Sarpong and Alarussi, 2022).

There have been challenges in managing humongous solid waste being generated in Malaysia by Local Government and City councils (Ebekozien et.al.2022). One of the major issues hindering solid waste management in Malaysia is the residents' attitude and perception that waste management is a government problem (Agamuthu and Fauziah 2011; Fadhullah et al. 2022). Environmental management including solid waste management is capital intensive, which involves cost of collection, transportation, recycling and disposal (Subhan et.al. 2014). Currently, household waste management in Malaysia is handled by private collectors. The local authorities set tariff rate after consultations with private waste collectors. The households are charged based on location and house type. The payment for waste collection is made indirectly via annual house or building assessment (Othman, 2007). Assessment is a system of property tax local authorities collect from property owners for the provision of services like waste and sewage management. The amount charged is based on the classification of property and it varies from one state to another. In most of the states in Malaysia, the assessment tax is calculated based on a given percentage of annual property value (Afroz and Masud, 2011). Solid waste management in Malaysia is highly subsidized by the local authorities, thus the amount charged property owners/ households does not reflect the true amount private waste collectors charge the government.

Studies have been conducted on willingness to pay (WTP) for improved service in SWM in Malaysia (Othman, 2007; Afroz and Masud, 2011; Haron et.al. 2023). In these studies, improved service in waste

management centred around provision of additional bin to encourage waste separation at source (recycling and waste separation mandatory) (Afroz and Masud, 2011), increasing waste collection frequency (Haron et.al. 2023), disposal method from control tipping to sanitary landfill and improved transportation from a mixture of compactor and covered trucks (Othman, 2007). The present study deviates from earlier studies, by conceptualizing improved service in SWM to mean integration of fourth industrial revolution (4IR) smart technology (steel ultrasonic detector waste bins) into SWM system in Shah Alam city. Therefore, this study examines residents' WTP for improved service in waste management for two developing country cities - Shah Alam city, Malaysia and Ibadan city, Nigeria, with different level of economic development and solid waste management system.

Aim of the Study

The aim of this study is to identify the factors that influence residents' willingness to pay (WTP) for improved solid waste management in Shah Alam city, Malaysia and Ibadan city, Nigeria.

METHOD

CVM Questionnaire Design and Administration

The major benefit of the CVM is that it gives the investigator the opportunity to obtain households' stated preference for improved product or service quality (Alberini and Cooper, 2000). The willingness to pay (WTP) question in the CVM allows households to say how much they are willing to pay for the improvement in solid waste management. Studies have been conducted using CVM to examine households' WTP for improved SWM (Afroz and Masud, 2011; Mulat et al., 2019; Kayamo, 2022). Since the present study was conducted in two cities (Ibadan city, Nigeria and Shah Alam city, Malaysia) with different level of economic development, waste management system, and socio-cultural settings, some slight variations exist in the CVM questionnaire. The questionnaire describes the existing solid waste management system in the two cities and the proposed (hypothetical) improved service and the payment methods to elicit households' (respondents) WTP for the services.

The adoption of fourth industrial revolution (4IR) smart technology tool called ultrasonic detector in Shah Alam city's waste management will enhance efficiency and environmental sustainability. Switching from the traditional plastic bins (status quo) to steel bins with ultrasonic detector will allow waste managers to remotely monitor the waste bins from computers in their offices without necessarily depending on their clients (households) to alert or inform them. This kind of improvement in service can only be offered if the respondent agrees for an upward review of the monthly charge for waste collection. In order to identify the initial bid, a pilot study involving 10 respondents was conducted. After explaining how the ultrasonic detector bins work to the respondents, they were asked how much they are willing to pay for this improvement in SWM in Shah Alam city. Summing up the total amount respondents were willing to pay and dividing by 10 gives the average WTP (Malaysian Ringgit (RM) 50) as initial bid. The respondents were presented with three possible costs (RM 50, RM 70, RM90), to derive benefit (utility) from the improved service in waste management in the questionnaire. Currently in Ibadan city, waste contractors come once or twice a month depending on the area for waste collection. Also, households do not separate organic and inorganic (recyclables) waste before dropping them into the waste bins. These developments require an increment in number of times waste is being collected to four times monthly and provision of additional bin for households to drop their inorganic wastes (recyclables). This kind of improvement in service which involves increase in waste collection frequency and provision of additional bin for waste separation, can only be offered if the residents agree for an upward review of waste collection fee.

The first bid was obtained after sampling the opinion of 15 residents through a pilot study, on how much they are willing to pay for the proposed improvement in service. Again, taking their average WTP (Naira (₦) 4,500) as the initial or first bid. The WTP for improved SWM depends on the expected benefits residents of Ibadan city think they will gain from increase in frequency of waste collection and provision of additional bin for recyclable wastes. On the other hand, WTP for improved service in waste management in Shah Alam city Malaysia (ie switching from traditional plastic bins to steel ultrasonic detector waste bins (4IR)), depends on the expected benefits residents think they could gain.

For the questionnaire administration, the respondents' (household heads') WTP was elicited through iterative bid method. Through this approach, the household head was presented with the first bid (Gd) and was requested to say whether he/she will be willing to pay this amount for the improvement in solid waste management, taking into consideration average monthly income and other related expenses. If a household head says 'yes' to the initial bid, a higher bid (Gk) was presented, and lower (Gl) to the household head that says 'no' to initial bid. In general, the respondents (household heads) were offered three categories of cost options (Gd, Gk, and Gl) to generate utility (UI) from improvement in service (increase in number of times wastes are collected and additional bin for recyclable wastes in Ibadan city, Nigeria and deployment of smart technology (steel ultrasonic detector waste bins) in Shah Alam City, Malaysia). The current waste management practices (status quo) in the two cities (U0) does not produce the required environmental quality. Thus, four scenarios arise in deriving the WTP: both answers are 'no', one answers 'yes' and the other 'no', one answers 'no' the other 'yes' and both answers 'yes'. Adopting Hanemann, (1991) approach, the probabilities obtained are:

pY =0, when willingness to pay < G d→ (no – no)
pY =1 when willingness to pay ≤ Gd < G k → (yes-no)
pY =2 when willingness to pay ≤Gk < G l→ (no-yes)
pY =3 when willingness to pay ≤ Gl < G +∞ → (yes-yes)

In Ibadan city, 290 respondents were administered the questionnaire while 150 were administered in Shah Alam.

Analytical Technique

Concerning the analytical technique for CVM, there is no general consensus among researchers. However, several studies (Afroz and Masud, 2011; Ndau and Tilley, 2018; Kayamo, 2022; Haron et.al. 2023) have adopted logistic regression analysis in examining improved SWM . In this study, to identify the factors that influence or determine households' WTP for improved SWM, logit regression was adopted. The logit model is presented:

Log Wi/(1 - Wi) = Li =β0 + βiXi + e

Whereby,

Wi = 1 if the respondent is willing to pay for improved waste management;

Wi = 0 for otherwise;
Xi = independent variables;
$\beta 0$ = constant term;
βi = coefficient of independent variables;
e = the error or disturbance term;
i = 1,2,3, . . .,n.

The independent variables in this model are monthly income of household head, educational qualification, family size, age, gender, occupation, marital status and location of house.

RESULTS

The socio-economic attributes of respondents surveyed in the two cities are presented in Table 1. More than half of respondents in Shah Alam (52%) city and Ibadan city (51.4%) are male while the rest (48% and 48.6% respectively) are female. About two-third of respondents in both cities are in their working age (25-54). In terms of marital status, results in Table 1 indicate that about 61.3% and 64.1% of respondents in Shah Alam and Ibadan city respectively are married, while 18.7 and 22.8% are single (unmarried). There is variation in occupational distribution among respondents in the two cities. In Shah Alam city, about two-fifth (40.7%) of respondents are government employees, while in Ibadan city, only about one-fifth (20.3%) are government employees. About 41.3% of respondents in Ibadan city are self-employed, while in Shah Alam less than ten percent (8.7%) are self-employed. The high percentage of respondents in Ibadan city who are self-employed reflects the national employment statistics in Nigeria. According to Nigeria Bureau of Statistics (NBS) 2023 report, about 73.1% of Nigerians are self-employed who operate their own businesses or engage in farming activities. Results indicate that 10% and 22.4% of respondents in Shah Alam and Ibadan city respectively obtained high school (secondary education) certificate. About 32% and 29% of respondents in Shah Alam and Ibadan city respective have degree certificate, while 23.3% and 13.4% obtained other post-graduate qualifications. For income distribution, results in Table 1 indicate that almost half (49.3%) of respondents earned between RM 3001-5000 monthly (Malaysian Ringgit (RM) local currency), 22% earned above RM5000, 21.3% earned between RM 1501-3000, and 7.3% earned between RM 1200-1500. In Ibadan city, 48.6% earned between

₦151-300, 000 (Naira (₦) local currency in Nigeria) monthly, 25.9% earned between ₦100-150, 000, while 7.6% earned above ₦300,000. More than half of households in the two cities have between 4-6 persons.

Table 1. Socio-economic Characteristics of Respondents

Shah Alam City, Malaysia			Ibadan City, Nigeria		
Gender	Frequency	Percent	Gender	Frequency	Percent
Male	72	48.00	Male	141	48.60
Female	78	52.00	Female	149	51.40
Age					
18-24	17	11.30	18-24	25	8.60
25-34	32	21.30	25-34	102	35.20
35-44	30	20.00	35-44	118	40.70
45-54	48	32.00	45-54	29	10.00
55 and above	23	15.30	55 and above	16	5.50
Total	150	100.00	Total	290	100.00
Marital status					
Single	28	18.70	Single	66	22.80
Married	92	61.30	Married	186	64.10
Single parent	9	6.00	Single parent	15	5.20
Widow/ widower	11	7.30	Separated	4	1.40
Separated	10	6.70	Widow/ widower	19	6.60
Total	150	100.00	Total	290	100.00
Occupation					
Government	61	40.70	Government	59	20.30
Private sector	20	13.30	Private sector	31	10.70
Self employed	13	8.70	Self employed	121	41.30
Retiree	16	10.70	Retiree	25	8.60
Housewife	21	14.00	Housewife	30	10.30
Unemployed	19	12.70	Unemployed	24	8.30
Total	150	100.00	Total	290	100.00
Education					
High school	15	10.00	No education	9	3.10
Diploma	52	34.70	Primary	26	9.00
Degree	48	32.00	High school	65	22.40
Postgraduate	35	23.30	ND/NCE	67	23.10
			BSc/HND	84	29.00

			Postgraduate	39	13.40
Total	150	100.00	Total	290	100.00
Monthy Income					
RM 1200-1,500	11	7.30	Less ₦100,000	52	17.9 0
RM 1501-3000	32	21.30	₦100-150,000	75	25.90
RM 3001-5000	74	49.30	₦151-200,000	56	19.30
Above RM5000	33	22.00	₦201-250,000	42	14.50
			₦251-300,000	43	14.80
			>₦300,000	22	7.60
Total	150	100.00	Total	290	100.00
Household size					
1-3	46	30.70	1-3	60	20.70
4-6	99	66.00	4-6	148	51.00
7 and above	5	3.30	7 and above	82	28.30
Total	150	100.00	Total	290	100.00

Source: Author

Table 2 provides an overview of the frequency of waste collection and level of residents' satisfaction in the two cities. Majority of respondents in Shah Alam city (74.5%) confirmed that waste is being collected from their homes by private waste collectors three times a week, 22% said twice a week, 2.7% once a week, while 0.9% said that waste collection is inconsistent. In Ibadan city, about 42.4% of respondents said that waste collection by private waste contractors is inconsistent, 33.4% said that waste is being collected from their homes twice in a month and 24.1% said once a month.

In terms of level of respondents' satisfaction with the current waste collection frequency (status quo), results in Table 2 indicate that majority (72%) are very satisfied in Shah Alam city, while majority (68.6%) are not satisfied (dissatisfied) in Ibadan city. Relatedly, more than half (62%) of residents in Shah Alam city are very satisfied with the current waste collection system in terms of trucks used by the waste contractors and the time waste is being collected, while only one-quarter (24.5%) of respondents are very satisfied with the current waste collection system in Ibadan city. The high number of respondents in Ibadan city, who are dissatisfied with the waste collection method, in terms of frequency of collection, reflects

the poor solid waste management system in most Nigerian cities where heaps of uncollected wastes pile in front of residential buildings for weeks.

Table 2. Waste Collection Frequency and Residents Level of Satisfaction

Shah Alam City, Malaysia			Ibadan City, Nigeria		
	Frequency	Percent		Frequency	Percent
Frequency of waste collection			Frequency of waste collection		
Inconsistent	3	.90	Once a month	70	24.10
Once a week	4	2.70	Twice a month	97	33.40
Twice a week	33	22.00	Inconsistent	123	42.40
Three a week	110	74.50			
Total	150	100.00	Total	290	100.00
Level of satisfaction with current waste collection frequency			Level of satisfaction with current waste collection frequency		
Very Satisfied	108	72.00	Very Satisfied	42	14.50
Neutral	11	7.30	Neutral	49	16.90
Not satisfied	31	20.70	Not satisfied	199	68.60
Total	150	100.00	Total	290	100.00
Level of satisfaction with current waste collection method			Level of satisfaction with current waste collection method		
Very Satisfied	93	62.00	Very Satisfied	71	24.50
Neutral	31	20.70	Neutral	55	19.00
Not satisfied	26	17.30	Not satisfied	164	56.60
Total	150	100.00	Total	290	100.00

Source: Author

Table 3 presents the summary results of respondents' WTP for improved service in waste management in Ibadan city. About 30.3% rejected both the first and second bids/offers. Three-quarter of the respondents (76.2%) accepted the first bid and rejected the higher bid. About 19.3% rejected the initial bid and accepted the higher bid, while 4.5% accepted both the initial bid offered and the higher bid. Adopting the Honu (2007) formula, the mean WTP of Ibadan city residents for improved SWM was calculated: multiplying the percentage of the counts in the third column by average WTP for each class and adding the total gives the mean WTP.

Thus, mean WTP for No-No =₦0, Yes-No =₦ 4,500, No-Yes =₦5,500, Yes-Yes = ₦7000. Against this background, the mean WTP was calculated as follows: (0. 303 x ₦0) + (0.762 x ₦4,500) + (0.193 x ₦5,500) + (0.045x

₦7,000) =₦4,796 (current exchange rate USD$ 3.4). What this implies, is that Ibadan city residents are WTP USD $3.4 for increment in frequency of waste collection from twice a month to four times and provision of additional bin for waste separation.

For Shah Alam city, results in Table 3 indicate that 12% of the respondents rejected both the first and second bids offered them. About 36.7% accepted the initial bid and refused the higher bid, while 30.7% rejected the initial bid and accepted the higher bid. About 20.7% accepted both the initial and the higher bid offered. The mean WTP was calculated as follows: (0.12 x RM 0)+ (0.367x RM50) + (0.307x RM70) + (0.207xRM90) =RM58.47 (current exchange rate USD$12.2). This implies that residents in Shah Alam city Malaysia are willing to pay USD$12.2 for improvement in service (switching from the traditional plastic bins to steel ultrasonic detector waste bins (ie adoption of 4IR smart technology).

Table 3. Summary of Household Heads'

WTP in Ibadan City			
Responses	WTP	Count	Percent
No- No	0	88	30.30
Yes- No	₦4,500	154	76.20
No-Yes	₦5,500	39	19.30
Yes-Yes	₦7,000	9	4.50
Total		290	100.00
WTP in Shah Alam City			
No- No	0	18	12.0 0
Yes- No	RM50	55	36.70
No-Yes	RM70	46	30.70
Yes-Yes	RM90	31	20.70
Total		150	100.00

Source: Author

Factors that Influence WTP for Improved Solid Waste Management

The study examines the factors that influence households' willingness to pay for improved waste management using binary choice model (logit regression model). The parameters in the model were estimated using the

Maximum Likelihood (ML) method. The likelihood ratio index measures the goodness of fit for logit regression model. The dependent variable is measured as dichotomous whereby yes = 1, otherwise 0. Meaning that if a respondent says yes that he/she is willing to pay for improved solid waste management in the study area, it was coded as 1 in the computer, but when respondent says no, it was coded as 0.

The summary of the binary logit regression in Table 5 indicate that there is a strong association between the dependent variable (WTP for SWM in both cities) and the socio-demographic attributes of respondents (independent variables). The Nagelkerke R Square which accounts for the explanatory power of the model is high (Shah Alam City Nagelkerke R Square =.726, Ibadan city Nagelkerke R Square =.520). Similarly, the Omnibus test of the model coefficients which shows Chi-square statistic test for testing the null hypothesis that all coefficients of the independent variables (predictors) are equal to zero (0) is $\chi 2 = 85.608$ (df)8, $p<0.005$ (Shah Alam City) and $\chi 2 = 53.562$ (df)8, $p<0.005$. This shows that the dependent variable is related to each specified independent or explanatory variable in the model.

In logit regression, the effect of the predictors on the outcome (dependent variable) is obtained by exponentiating the coefficients and interpreting them as odd ratios (Exp(B) . Thus, results for each socio-demographic attribute was interpreted based on p value and the odd ratios (Exp(B) . Results in Table 5 indicate that occupation significantly influence willingness to pay for improvement in SWM in Shah Alam City (e .422 = 1.525 (Exp(B), $p<0.05$). Occupation in this study was coded as dummy whereby 1 = government employee, otherwise 0. What this result implies is that government employees in Shah Alam city are two times more willing to pay for improvement in SWM via adoption of 4IR smart technology (ie use of ultrasonic detector waste bins instead of the traditional plastic bins) than other occupational groups (self-employed, retiree, private sector employee).

Results equally show that monthly household head income significantly influence willingness to pay for improved SWM in both cities (Shah Alam: e 1.122 = 3.071 (Exp(B), $p<0.05$, Ibadan city: e .493 = 1.637 (Exp(B), $p<0.05$). Based on the odd ratio results in Table 5, it could be said that households with higher income in Shah Alam city are three times

more likely to pay for improved service in waste management compared to low-income households. In Ibadan city, higher income households are two times more likely to pay for improved service in waste management compared to low-income households. From the results of the study, it could be said that increase in income brings about willingness to accept the initial and higher bid value increases. The findings re-echo past studies that have identified income as one of the socio-demographic attributes that influence household WTP for improved SWM (Afroz and Masud, 2011; Awunyo-Vitor et al. 2013; Boateng et.al. 2016; Patrick et al., 2017; Kayamo, 2022).

Relatedly, household size has a significant effect on willingness to pay for improved waste management in both Shah Alam (e 2.640 = 14.014 (Exp(B), $p<0.05$) and Ibadan city (e -.864 = .421 (Exp(B), $p<0.05$). What this result implies is that larger households in Shah Alam city are more likely to pay for improved service in SWM. Kayamo (2022) noted the reason behind households with larger number of people willing to accept initial bid and the higher bid is because they generate a larger volume of waste; thus they are WTP for improvement in SWM. In Ibadan city, results indicate that households with fewer number of people were willing to accept the initial and higher bid. This is premised on the fact that a negative coefficient (e-) value was obtained in the results for household size (Table 5). In other words, there is an inverse relationship between WTP for SWM in Ibadan city and household size. One reason that may be adduced to this, is the fact that in African society, Nigeria inclusive, most high-income households are educated, with small family size of between 2- 6, live in low-density planned neighbourhods and thus, will be willing to accept initial bid and higher bid offer for improved SWM.

Educational qualification of respondents is another socio-demographic attribute that significantly influence WTP for SWM in both Shah Alam city (e 2.640 = 8.786 (Exp(B), $p<0.05$) and Ibadan city (e 432 = 1.541 (Exp(B), $p<0.05$). Meaning that household heads with higher educational qualification are eight times more likely to pay for improved service in SWM in Shah Alam city and two times more likely to pay for same in Ibadan City. The findings demonstrate that level of education affects WTP for improved SWM in both cities. Boateng et.al. (2016), noted that people with higher educational qualification (tertiary education) are likely to have good paying jobs to pay for waste disposal services compared to those with

lower educational qualification. Studies have shown that level of education play significant role in residents' WTP for enhance and better solid waste management (Aggrey & Douglason, 2010; Banga, et.al. 2011; Addai & Danso-Abbeam, 2014; Song, et.al. 2016).

Furthermore, results indicate that marital status (e 1.122 = 3.070 (Exp(B), $p<0.05$) and house location (e .851= 2.342 (Exp(B), $p<0.05$) have significant relationship with WTP for improved waste management in Ibadan city while they do not in Shah Alam city. In the analysis, marital status was coded as dummy variable whereby married = 1 otherwise 0. What the result suggests therefore, is that household heads that are married are three times more likely to pay for improved service in SWM in Ibadan city. Again, house location was coded as dummy in the analysis whereby low density neighbourhood =1, otherwise 0. Based on the results obtained in Table 5, it could be said that residents in the low-density high income neighbourhoods of Ibadan city are two times more likely to pay for improved service in SWM compared to those residing in the medium and high density low-income neighbourhoods. In most African cities, neighbourhood location affects the spatial-distribution of basic amenities and services like waste collection. In their study in Ghana on WTP for SWM, Boateng et.al. (2016) reported that respondents in the new sites (low-density planned neighbourhoods) have stronger economic background, thus they are able to pay for solid waste disposal services compared to those residing in high-density neighbourhoods (old sites). Results indicate that in both cities, gender does not have any significant effect on WTP for improved service in waste management ($p>0.05$). This corroborates past studies that have reported gender as having no significant effect on WTP for SWM (Chinh et,al. 2021; Afroz and Masud, 2011).

Table 5. Independent Variable Coefficients

	Logistic Regression for Shah Alam					Logistic Regression for Ibadan				
Variable	B (e)	S.E.	Wald	Sig.	Exp (B)	B (e)	S.E.	Wald	Sig.	Exp (B)
Age	.513	.326	2.468	.116	1.670	- .179	.157	1.300	.254	.836
Occupation	.422	.214	3.873	.049*	1.525	.021	.082	.063	.802	1.021
Income	1.122	.400	7.859	.005*	3.071	.493	.115	18.456	.000*	1.637
House size	2.640	.954	7.656	.006*	14.014	-.864	.224	14.840	.000*	.421
Education	2.173	.598	13.203	.000*	8.786	.432	.109	15.835	.000*	1.541
Marital status	.421	.390	1.161	.281	1.523	1.122	.303	13.667	.000*	3.070

Gender	1.014	.859	1.391	.238	2.755	.161	.292	.305	.581	1.175
House location	.568	.579	.964	.326	1.765	.851	.275	9.607	.002*	2.342
Constant	-12.530	3.174	15.586	.000	.000	-.375	.893	.176	.675	.688
Cox & Snell R Square = .431, Nagelkerke R Square = .726, -2 Log likelihood = 50.594a						Cox & Snell R Square = .328, Nagelkerke R Square = .520, -2 Log likelihood = 285.887a				

Source: Author

CONCLUSION

Proper solid waste management has been a major environmental challenge in most urban centres in the developing countries. Waste management is a capital intensive venture, both material and financial resources are required in order to effectively manage the large volume of wastes being generated daily by households in urban centres. To this end, households are expected to make some financial commitments in the form of levies or tax to assist government in SWM. This study assessed willingness of residents from two developing countries – Shah Alam city, Malaysia and Ibadan city, Nigeria to pay for improved service in waste management. The CVM was employed to evaluate residents' WTP for improved services in solid waste management. While an appreciable progress has been made in SWM in Shah Alam city, in terms of provision of solid waste infrastructure, the reverse is the case for Ibadan city were most residents in high-density unplanned neighbourhoods and some medium-density neighourhoods do not have access to solid waste infrastructure.

Majority (70%) of residents in Ibadan city stated that waste is being collected from their homes once monthly while 33.4% said twice. In Shah Alam city, about 74.5% of residents stated that waste collection from their homes is thrice weekly, 22% twice and 2.7% once. About 56.6% of residents from Ibadan city are not satisfied with the current waste collection method, in contrast, 62% of residents in Shah Alam city are satisfied with the current waste collection method. Findings from the study also showed that on average, residents from Shah Alam city are willing to pay RM58.47 (USD$12.2) for the proposed improvement in waste management (ie switching from plastic bins to steel ultrasonic detector bins - smart technology), while Ibadan city residents are willing to pay ₦4,796 (USD$ 3.4) for the proposed service improvement in terms of increase in frequency of waste collection from twice to four times monthly, and provision of

additional bin for waste separation.

The study also identified factors that influence WTP for improved service in waste management in the two cities through binary logit regression. Results showed that income of household head, household size, and educational qualifications have significant influence on WTP for improved SWM in Shah Alam and Ibadan city. Based on coefficient values obtained for each of the three variables, larger household size (>6) influenced WTP in Shah Alam city (positive relationship), while smaller household size (negative relationship) influenced WTP in Ibadan city. House location and marital status were found to have significant influence on WTP for improved SWM in Ibadan city, while in Shah Alam city, their effect were insignificant. In both cities, gender does not have any significant effect on WTP for improved service in waste management.

The findings of the study has some policy implications. First, residents of Ibadan city are not satisfied with the current state of waste collection method, in terms of number of times government licensed waste contractors come for waste collection. Most of the waste bins in front of residential homes are always overflowing with wastes and their surroundings littered. During the pilot survey interview with residents, they were sceptical on the proposed improvement in SWM. In this regard, the Local Government Authorities and State Ministry of Environment that have the responsibility of hiring private waste contractors should step-up their monitoring to ensure that quality service is delivered. Again, house location influenced WTP in Ibadan city. Based on the logit regression results, residents in low-density planned neighbourhood are WTP for improved service in waste management. The high-density and majority of low-density neighbourhoods are not planned, lacked access road for compactor or waste trucks. Thus, residents in these neighbourhoods dump their wastes in vacant plots, river banks, streets and drainages. Most of the residents in the high and medium density neighbourhood still perceive SWM as purely government business. There is need for dialogue and engagement from government to convince them to participate in SWM via payment for waste collection. During the pilot study interview in Shah Alam city, it was observed that residents are conversant (ie comfortable) with the traditional waste collection method through plastic waste bins. Switching to the fourth industrial revolution (4IR) smart technology, via ultrasonic detector bins which makes waste

collection efficient and environmentally sustainable is something new or alien to some residents.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

Abila, B., & Kantola, J. (2013). Municipal solid waste management problems in Nigeria: Evolving knowledge management solutions.

International Journal of Environmental and Ecological Engineering, 7(6), 303–308.

Afroz, R., Masud, M.M., (2011). Using a contingent valuation approach for improved solid waste management facility: evidence from Kuala Lumpur, Malaysia. *Waste Manag. 31,* 800–808.

Agamuthu, P., & Fauziah, S. H. (2011). Challenges and issues in moving towards sustainable landfilling in a transitory country: Malaysia. W*aste Management & Research, 29*, 13–29. https://doi.org/10.1177/0734242X10383080.

Agbo, M. (2023). *The problem with solid waste management in Nigeria's low-income neighbourhoods.* Earth.Org. https://earth.org/the-problem-with-solid-waste-management-in-nigerias-low-income-neighbourhoods/

Aggrey, N., & Douglason, O. G. (2010). Determinants of willingness to pay for solid waste management in Kampala City. Current Research *Journal of Economic Theory, 2*, 119–122.

Akhtar, S., Ahmad, A., Qureshi, M., Shahraz, S. (2017). Households willingness to pay for improved solid waste management. *Global J. Environ. Sci. Manag. 3*, 143–152.

Alberini, A., & Cooper, J. (2000). *Applications of the contingent valuation method in developing countries: A survey.* Food and Agriculture Organization of the United Nations.

Awunyo-Vitor, D., Shaibu, I., & Jasaw, G. S. (2013). Urban households' willingness to pay for improved solid waste disposal services in Kumasi Metropolis, Ghana. *Urban Studies Research, 2013,* Article 659425. https://doi.org/10.1155/2013/659425

Bahauddin, K. M., & Uddin, M. H. (2012). Prospect of solid waste situation and an approach of environmental management measure (EMM) model for sustainable solid waste management: Case study of Dhaka City. *Journal of Environmental Science and Natural Resources, 5*(1), 99–111.

Banga, M., Razack, B. L., & Adolf, F. M. (2011). Households' willingness to pay for improved solid waste collection services in Kampala City, Uganda. *Environment and Development, 20*(4), 53–62.

Carson, R.T., Flores, N.E., Martin, K.M., Wright, J.L. (1996). Contingent valuation and revealed preference methodologies: comparing the estimates for quasi-public goods. *Land Economics. 72*, 80–99.

Chakrabarti, S., Sarkhel, P. (2003). *Economics of solid waste management: a survey of existing literature.* Economic Res. Unit Indian Stat. Institute. 30, 1–9.

Che Pak, N.A.H, Ismail, S., Mohd Alwi, N. (2023). Translation of the management control system in a privatized solid waste management network. *Journal of Accounting & Organizational Change.* 1832-5912 DOI 10.1108/JAOC-08-2021-0100.

Chinh, P.C., Hung, N.T.Q., Minh Ky, N., Thi Le Ai, N., Tam, N.Y. (2021). Willingness to Pay for Improving Household Solid Waste Management in Vietnam. *App. Envi. Res. 43*(2): 1-14

Chung, W. & Yeung, I.M.H. (2019). Analysis of residents' choice of waste charge methods and willingness to pay amount for solid waste management in Hong Kong. *Waste Management. 96*, 136–148.

Ebekozien, A., Samsurijan, M. S., Aigbavboa, C., & Malek, N. M. (2023). Malaysia's low-cost housing solid waste management in the era of COVID-19: The role of fourth industrial revolution technologies. Management of Environmental Quality: *An International Journal, 34*(1), 80–98. https://doi.org/10.1108/MEQ-01-2022-0017

Fadhullah, W., Imran, N. I. N., Ismail, S. N. S., Jaafar, H. M., & Abdullah, H. (2022). Household solid waste management practices and perceptions among residents in the East Coast of Malaysia. *BMC Public Health, 22*(1), 1–15. https://doi.org/10.1186/s12889-021-12274-7

Guerrero, L.A., Maas, G. & Hogland, W. (2013). Solid waste management challenges for cities in developing countries. *Waste Manag. 33,* 220–232.

Hanemann, M.W., (1991). Willingness to pay and willingness to accept: how much can they differ? *American Economic Review, 81*, 635–647.

Haron, N. F., Kamaludin, M., Mahmood, S., & Amirah, N. A. (2023). Analysis of households' willingness to pay for solid waste management services in Kuala Nerus, Terengganu. *Journal of Sustainability Science and Management, 18*(10), 35–48.

Hilburn, A. M. (2015). Participatory risk mapping of garbage-related issues in a rural Mexican municipality. *Geographical Review, 105*(1), 41–60.

Honu, B. (2007). *Contingent Valuation Method for General Practitioners: a Cookbook Approach.*

Ike, C. C., Ezeibe, C. C., Anijiofor, S. C., & Nik Daud, N. N. (2018). Solid waste management in Nigeria: Problems, prospects, and policies. *Journal of Solid Waste Technology and Management, 44*(2).

Kayamo S.E. (2022). Willingness to pay for solid waste management improvement in Hawassa city, Ethiopia. *Journal of Environmental Management, 302,* 113973.

Lim, R. (2018). *Green Ways to Manage Waste,* The Star, 9 September, available at: https://www.thestar. com.my/news/nation/2018/09/09/ green-ways-to-manage-waste-swcorp-goes-for-greentechnology- and-educating-the-young (accessed 17 feb 2024).

Manuel, S.C., Juan, C.R.R., Alberto, L.T., Rafael, A.J. (2017). Stakeholder analysis of municipal solid waste companies - A first step towards successful corporate social responsibility. *Journal of Environmental Science and Management, 20*(2), 40–53.

MIDA. (2022). *Waste to Energy for A Sustainable Future.* available at: www.mida.gov.my/waste-toenergy- for-a-sustainable-future (accessed 24 February 2024).

Abu Eusuf, M. et. al. (2011). Solid Waste Generation Characteristics: The Malaysian Local Authorities's Outlook. *Journal of the Malaysian Institute of Planners*. IX, 51-76.

Mulat, S., Worku, W., Minyihun, A. (2019). *Willingness to pay for improved solid waste management and associated factors among households in Injibara town, Northwest Ethiopia*. BMC Res. Notes 12, 1–6.

Ndau, H. & Tilley, E. (2023). Willingness to Pay for Improved Household Solid Waste Collection in Blantyre, Malawi. *Economies, 6*, 54; doi:10.3390/economies6040054.

Onukogu, H.F. (2018). *Willingness To Pay for Improved Solid Waste Collection Services In A Commercial Centre in Sango, Nigeria.* Thesis Submitted to Universiti Putra Malaysia (UPM).

Othman, J. (2007). Economic Valuation of Household Preference for Solid Waste Management in Malaysia: A Choice Modeling Approach, *IJMS 14* (1), 189-212.

Patrick, I.M.V., Okon, U.E., Solomon, U.U. (2017). Households' willingness to pay for improved solid waste management in Uyo Metropolis, Akwa ibom state, Nigeria. Am. J. Environ. *Protect. 5,* 68–72.

Saadatian, O., Haw, L. C., Mat, S. B., & Sopian, K. (2012). Perspective of sustainable development in Malaysia. *International Journal of Energy and Environment, 2*(6), 260–267.

Samah, M.A.A., Manaf, L.A., Ahsan, A., Sulaiman, W.N.A., P. Agamuthu, D'Silva, J.L. (2013). Household Solid Waste Composition in Balakong City, Malaysia: Trend and Management. *Polish Journal of Environmental Studies, 22* (6), 1807–1816.

Sarpong, S., & Alarussi, A. S. (2022). Waste to wealth: Enhancing circularities in the Malaysian economy. *Technological Sustainability, 1*(2), 145–159. https://doi.org/10.1108/TECHS-01-2022-0001.

Sarpong, S. (2020). Counting the cost: Malaysia's push-back begins over overseas waste dumping. *Society, 57,* 77–84.

Boateng, S., Amoako, P., Appiah, A. F., Garsonu, E. K., & Poku, P. (2016). Household willingness to pay for solid waste disposal services in urban Ghana: The Kumasi Metropolis situation. *Ghana Journal of Geography, 8*(2), 1–17.

Song, Q., Wang, Z., & Li, J. (2016). Residents' attitudes and willingness to pay for solid waste management in Macau. *Procedia Environmental Sciences, 31,* 635–643.

Subhan, M., Abdul Ghani, A. B., & Raihan Joarder, M. H. (2014). Urban community willingness to pay for improved solid waste management in Malaysian municipality: A choice modelling approach. *Asian Social Science, 10*(18).

Uwadiegwu, B. & Chukwu, K. (2013). Strategies For Effective Urban Solid Waste Management in Nigeria. *European Scientific Journal, 9*(8), 296-308.

Wafaurahman Wafa, et. al. (2023), Urban Development and Waste Management Planning in Kabu New City, Afghanistan: A Case Study. *Journal of the Malaysian Institute of Planners. 21* (5). 96-109.

Wiedinmyer, C., Yokelson, R. J., & Gullett, B. K. (2014). Global emissions of trace gases, particulate matter, and hazardous air pollutants from open burning of domestic waste. *Environmental Science & Technology, 48*(16), 9525–9530. https://doi.org/10.1021/es502250z

World Bank. (2018). *A global snapshot of solid waste management to 2050.* World Bank. https://hdl.handle.net/10986/30317

World Bank. (2022). *Solid Waste Management*. available at: https://www.worldbank.org/en/topic/ urbandevelopment/brief/solid-waste-management (accessed 7 February 2024).

Yusop, Y. M., & Othman, N. (2019). Linking Malaysia's solid waste management policy instruments with household recycling behaviour. *International Journal of Academic Research in Progressive Education and Development, 8*(4), 474–488.

Zhu, D., Asnani, P.U., Zurbr€ugg, C., Anapolsky, S. & Mani, S. (2008), *Improving Municipal Solid Waste Management in India: A Sourcebook for Policy Makers and Practitioners,* World Bank, Washington, DC.