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Factors Influencing Household Participation in Solid Waste Management: A Case of Muhanga City, Rwanda

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Abstract:- The goal of this research was to assess factors influencing participation of households in solid waste management in Muhanga city of southern province, Rwanda; more specifically, the research had the following specific objectives were to analyze factors influencing household participation in solid waste management in Muhanga City, to examine the solid waste management at household level in Muhanga city and to establish whether there is a significant effect of household participation in solid waste management in Muhanga city. The ANOVA tables proved better understandings of how the regression equation predicts the behaviors of the dependent against independent variables, and the model equation proved that the data are fit in the equation. The regression models predicted that the dependent variable was strongly significant as the data sample we have is fit. In the "sig." column, we find that the value of P is less than 0.005 that is P<0.005 (note that the value less than 0.005 is interpreted as 000 in the SPSS outputs). From that point, **regression analysis revealed a positive relationship (R = 975). The R coefficient of 0.975 indicates that the predictors of the model which family size and cost, have a correlation of 97.5% with the dependent variable (solid waste management) The study also revealed that a combination of family size and cost together contributed to 95.2% (R^2= 0.952) of the solid waste management.** Therefore, we concluded that the regression model was statistically significant and predict the results from our variables. **The side of the Model summary exemplified that the R-value indicated some simple correlations between our variables. This demonstrated a higher degree of correlation between the dependent and independent variables from the study. Similarly, the R square proved how the total variation between all the dependent variables and solid waste management was in relation. This lead us to conclude that there was a strong relationship between family size, cost and solid waste management in Muhanga district. From the shortcomings of the research, the following recommendations have been provided; there is need to create awareness and sensitize households on integrated solid waste management especially on how households can reduce, reuse and recycle the generated solid wastes at household level by the County Government.Segregation of solid wastes at the household should be encouraged as this makes it easy to deal with the different types of solid wastes in Muhanga City.**

Keywords:- *Factors, Household, Participation, Solid waste, Management.*

I. INTRODUCTION

Solid waste management is one of the most challenging developmental issues faced by authorities around the world but mostly in developing countries. Rapid urbanization, population growth and improved living conditions have led to increased volume of solid waste that requires proper management in order to preserve public health and environment (Bukari *et al.*, 2017). Though the services of solid waste management draw significant portion of municipal budget, municipalities are not yet able to fully cover the required costs of these services due to financial constraints (Ziraba *et al.*, 2016).

Globally, most waste is currently dumped or disposed of in some form of a landfill, Some 37% of waste is disposed of in some form of a landfill, 8% of which is disposed of in sanitary landfills with landfill gas collection system(Rodic, 2020). The Global population estimate in 2016 showed that there were approximately 7.3 billion people on earth with a growth rate of 1.14% (Denton *et al.*, 2015). Because of this, there is an increase in consumption rate, which brings about a direct effect in the generation of household solid waste. It is also expected to increase to approximately 2.2 billion metric tons per year by 2025 (Hoornweg, 2017). In sub-Saharan Africa, solid waste generated is approximately 62 million tons per year. About 60% of these solid waste generated in developing countries are from households. Despite accelerated pace of production, household solid waste collection rates are often lower than 70% in developing countries. More than 50% of the collected household solid waste is often disposed through uncontrolled land fill while 15% is processed through unsafe and informal recycling(Aryampa *et al.*, 2019). In many years ago, the major constituents of solid waste were wood, food wastes, vegetables etc. Solid waste at that time was simply household based and so generally biodegradable(Rene *et al.*, 2018). As the population density increased with time, there was a corresponding increment in the level of household solid waste generation, hence a need for a more viable solution(Peprah *et al.*, 2015).

While the quantity of waste produced in cities continues to increase daily, the effectiveness of the means of handling waste in terms of collection and disposal in developing countries remains low. The evidence of this has been given, the challenge of household solid waste

management is real(Isugi & Niu, 2016).The estimates of household solid waste generated per capital per day varies in volume from 0.1 to 0.3 Kg/capita/day(Isugi & Niu, 2016) . Some of the factors that have previously been established to influence household solid waste management are demographic features such as age, education and income (Peprah et al., 2015). Town authorities in Muhanga city collect household solid waste and dump it at designated sites but no proper treatment is given to household solid waste which piles in residential areas (Protasio, 2015).The sustainable development goals cannot be met unless household solid waste management is addressed as a priority (UNEP, 2015). Equally, if we want clean water and sanitation, we need to be looking at household solid waste. It is a key vector of disease and provides abundant breeding grounds for mosquitoes. Household solid waste especially food products can be fed to animals, and inedible remains converted into biogas, manure and clean renewable energy (Dhokhikah *et al*., 2015; Santoso, 2019).The composition of the household solid waste streams is a function of income, consumption patterns and recycling opportunities.

In Rwanda, access to waste collection service by households is at 42.1% and 0.2% in urban and rural areas respectively (NISR, 2017). While Government investment through subsidies, donors funding or through partnership with private companies is mainly for capital costs of treatment and disposal facilities, waste collection service costs and other operational costs are borne by municipalities. In addition, REMA (2009a) established EIA Guidelines for solid waste management in Rwanda while Kabera(2019) looked at Current status and Challenges in solid waste management practices. However, a research gap still exists since none of the reviewed researchers has assessed the participation of households in solid waste management in Secondary cities and other towns in Rwanda.

In secondary cities like Muhanga, there are also problem of waste and its accumulation as the city growing due population increase in the city. However, the types and methods of solid waste management in Muhanga District remains unknown but the city of Muhanga continues to generate waste due to its urban expansion and population increase(LODA, 2017; Muhanga District, 2018).

II. PROBLEM STATEMENT

Solid waste management at household level is a major public health and environmental concern in urban areas of many developing countries. Generally, the higher the economic development, population and rate of urbanization, the greater the consumption rate, which brings about a direct increase for waste generated. The public sector in many African countries is unable to deliver services effectively, regulation of the private sector is limited and illegal dumping of household solid waste is a common practice (Victoire *et al.*, 2020).

In Rwanda, there is an increase in the amount of household solid waste generated following growth in rural-urban migration and urbanization(Victoire *et al*., 2020). This increase has not been accompanied with equivalent capacity to handle the generated household solid waste. Town authorities in Muhanga collect household solid waste and dump it at designated sites which piles in residential areas. Collection systems of these household solid wastes are inefficient and disposal systems are not environmentally friendly. Poorly-managed household solid waste leads to unhygienic environment abundant for breeding grounds of vector borne diseases, decontaminates clean water and hazard for man-made greenhouse gas emissions.

A successful household solid waste management services therefore requires widespread participation of households that starts by building local capacities to take an active role in the processes(Kabera, 2019). However, the factors influencing solid waste management in Muhanga City remains unestablished, Collection systems of these household solid waste is inefficient and disposal systems are not environmentally friendly. About 30% to 40% of all household solid waste generated in urban areas is uncollected and less than 50% of the population is served. Up to 80% of collection, transport is out of service or in need of repair. If the issue of sustainable household solid waste management in Rwanda is not considered urgently, all the towns in Rwanda will be engulfed in solid waste. In addition, identifying determinants of willingness to pay provides information about socioeconomic characteristics that need to be empowered in order to increase financial participation of households in improved solid waste management(Iraguha *et al*., 2022).

The study assessed the factors influencing households' participation in solid waste management in the city of Muhanga, Rwanda.

III. OBJECTIVES OF THE STUDY

This study paper has a general objective and specific objectives.

A. General objective

The goal of this research was to assess factors influencing participation of households in solid waste management in Muhanga city of southern province, Rwanda.

B. Specific objectives

- To analyze factors influencing household participation in solid waste management in Muhanga City
- To examine the solid waste management at household level in Muhanga city
- To establish whether there is a significant effect of household participation in solid waste management in Muhanga city.

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IV. HYPOTHESES

This study verified the null hypotheses follows.

- H_0: There is no significant relationship of household participation on solid waste management in Muhanga city
- H_1: There is a significant relationship of household participation on solid waste management in Muhanga city

V. REVIEW OF LITERATURE

A. Concept of community participation

The amount of solid waste produced is influenced by the population's economy and degree of household or individual income. According to earlier research, a rise in income causes a monthly increase in solid waste generation of one kilogram. It is a well-known fact that the generation of waste increases proportionally to economic development. Both in developing and industrialized nations, the production of waste and economic development have not been separated (Rene et al., 2018). A positive correlation between a community's wealth and the volume of solid waste produced typically exists, according to Medina's findings. Richer people consume more than poor people do, which causes a greater rate of waste generation for the former. Income and household size are the most significant factors affecting the quantity ofsolid wastes from household consumption.

For most municipalities in developing nations, finding funding for solid waste handling remains difficult (Adugbila, 2020). Rapid urbanization, economic development, and population growth have increased the production of solid refuse, necessitating the implementation of measures and systems for sustainable solid waste management by the relevant authorities. The majority of nations have decentralized the administration of solid waste to local governments and municipalities, with assistance from the central government coming in the form of policymaking and funding pricey disposal facilities like landfills. Local governments are responsible for paying the costs of collecting solid waste and other expenses related to administration and maintenance (Anirudh Rajashekar et al., 2019).

Municipalities are not able to completely cover these costs due to the fact that scarce financial resources are typically divided among various essential services. User fees are being implemented where waste generators are charged for solid waste collection services in accordance with the "polluter pays" concept. However, if the price was set without taking into account how much users value the service, whether they are willing and able to pay, and the reasons for that willingness to pay, users may refuse to pay it. Public expectations, participation levels, and acceptance of user fees as a means of financing trash collection services are all revealed by surveys on households' perceptions of and willingness to pay for solid waste management (Struk, 2016).

The utmost sum of money a customer will agree to pay for a specific quantity of a product or service is known as the willingness to pay, also known as the reservation price (Combera,2018). Customers' desire to pay differs due to extrinsic differences, which are observable factors like age, income, and education, and intrinsic differences, which are unobservable factors (Aryampa et al., 2019).According to the regional circumstances in effect, the factors determining willingness to pay also vary. Researchers from various fields have looked into what influences households' willingness to pay for better solid waste management services in various nations, and their results make it clear that one factor may have different effects on willingness to pay in various contexts. The results of various studies on households' readiness to pay for solid waste management services are discussed in the following paragraphs (Bappah et al., 2016).

B. Concept of solid waste management

The majority of respondents did not have enough separation bins, followed by a lack of desire to do so, as the primary reasons for not segregating solid waste at home. However, there was a sizable difference in how domestic solid waste was managed depending on where people lived (Rene et al., 2018; Sharp et al., 2015)

Another study was conducted in 2009 in South Africa to determine how many households in the Tshwane Metropolitan area participated in recycling and disposing of solid refuse. The research revealed that household income, educational attainment, and institutional support were the major determinants of solid waste management. It was discovered that those with more wealth took part in domestic solid waste management more than those with less wealth. In addition, there was a positive relationship between participation of households in solid waste management and their educational level (Iraguha *et al.*, 2022).

Solid waste management is the collection, handling, and disposal of solid refuse that is thrown away after serving its purpose or becoming useless. Unsanitary conditions brought on by improper municipal solid refuse disposal can result in environmental pollution and outbreaks of vector-borne diseases, which are illnesses transmitted by rodents and insects. The management of solid waste involves complexprocedural difficulties. They also present a range of management, economic, and public issues that must be addressed (Rene *et al.*, 2018).

In the latter half of the 19th century, a technological strategy to solid-waste management started to take shape. In the United States, the first watertight trash cans appeared, and heavier vehicles were used to gather and transport waste. The first garbage incinerator was built in England in 1874, which was a major advancement in solid-waste cleaning and disposal methods. 15% of the main American cities at the turn of the 20th century were burning solid waste. But even then, the majority of the biggest towns continued to use archaic disposal techniques like open dumping on land or in water (Bappah *et al.*, 2016).

During the first half of the 20th century, technological developments persisted, leading to the creation of garbage grinders, compaction vehicles, and pneumatic gathering systems. But by the middle of the 20th century, it was clear that problems with pollution and threats to public health were being caused by open dumping and improper incineration of solid refuse. In order to replace open dumping and lessen the dependence on waste incineration, sanitary landfills were created. Many nations created distinct regulations for the disposal of hazardous and non-hazardous waste after dividing it into these two categories (Mian *et al.,* 2017). Risks to the environment and public health were reduced through landfill construction and operation. In order to meet strict air quality standards, new refuse incinerators were built with extensive air pollution control equipment and were intended to recover heat energy from the waste. Most developed nations' modern solid-waste management facilities now place more of an emphasis on recycling and waste reduction at the source than on incineration and land disposal (Aryampa *et al.*, 2019).

C. Theoretical Review

- *Individual behavior theories*

Research that created connections between solid waste administration and psychological models has advanced quickly over the last three decades. This provides information to governmental entities looking to create a solid waste control system. The lessons learned also demonstrate the importance of education in fostering a "spirit of responsibility" for environmental issues and the best means of resolving them (Maalla & Adipah, 2020). Additionally, it's important to educate households on the advantages and practice of source separation, the advantages and collection schedule, the duties and responsibilities of households (such as the time and location for trash delivery), and the methods of payment (Aryampa *et al.*, 2019).

By using less plastic, reusing glass jars and storage containers, and using recycled paper for packing, citizens must take the initiative to reduce trash at home. Reuse: Recycling needs to be encouraged to reuse discarded items and reduce waste, which will save time, money, and energy (Fadhullah *et al.*, 2022)

- *Self-regulation theory (SRT)*

SRT primarily focuses on controlling the ability of an individual to exhibit a behavior through self-evaluation, motivation, and modification of emotions and perceptions of those behaviors(Fadhullah *et al*., 2022).

According to SRT, individuals who resist ordinary tasks will create ways to make their tasks more interesting and positive. Although SRT offers a powerful psychological tool for controlling and altering behaviors, it has a major limitation of operationalization, since it comprises a set of functions, decision processes, constant monitoring, and cognitive approaches that are debated among researchers. Researchers asserted that consecutive self-regulation processes deplete further regulation, making individuals act unfavorably in certain situation(Katiyar, 2019). In addition, certain behaviors cannot be controlled as they are beyond conscious control, stemming from irresistible impulses. For example, some people indicate they spend too much time and money on clothes and personal items simply because they cannot resist shopping. Thus, there is debate concerning the extent that self-regulation can be established as a main factor of Solid waste management.

Self-regulation is the ability to understand and manage your behavior and your reactions to feelings and contribution on the solid waste management happening around you. It includes being able to: regulate reactions to strong emotions like frustration, excitement, anger and embarrassment. calm down after something exciting or upsetting(Raghu & Rodrigues, 2020)

This theory accounts for the intention behavior gap by considering behavioral prepotency and self-regulatory capacity as direct predictors of behavior and as moderators of the intention behavior relationship with the solid waste management (Dorina *et al*., 2021)

- *Social behavior theories (SBT)*

Albert Bandura's social learning theory places a strong emphasis on the value of watching, modeling, and copying other people's behaviors, attitudes, and reactions to emotions. The interaction of environmental and cognitive variables that affect human learning and behavior is taken into account by social behavior theory (Saul, 2023). According to social behavior theory, humans only learn and make choices based on reason, leaving no room for feelings.(Raghu & Rodrigues, 2020). Although learning how to recycle may encourage people to do so, this theory contends that antisocial behaviors such as littering in public areas, pelting environmental hoardings with rocks, and vandalizing municipal buildings are the product of emotional responses shaped by evolution (Bappah et al., 2016). Therefore, a specific action cannot be understood by simple observation or learning (Maalla & Adipah, 2020) .

Previous scholars have emphasized the value of comprehending theories and their benefits (Raghu & Rodrigues, 2022)who advocated for the use of multiple behavior change methods within interventions to foster synergistic effects and boost their impact on solid waste management. A complex interactive process with social, motivational, behavioral, and emotional components, pro-environmental conduct is thus. An individual's self-interest, awareness, and information become crucial to self-control when learning a new behavior. This theory teaches us that learning and observation processes go beyond how information and skill are psychologically processed (Maalla & Adipah, 2020).

Earlier studies possess highlighted that social behavior theory may be applied to environmental and behavior change interventions, which typically emphasized individual and inter-personal interactions within society and the environment. Additionally, the theory frequently came to the conclusion that interventions are more

successful when different levels, such as individuals, communities, particular groups, and societies, are targeted (Davis et al. 2014). Thus, by emphasizing the community changes in relation to community participation in waste management in Muhanga district, the theory added to the research.

D. Empirical Review

Anantha (2019), conducted research on community involvement in household waste management. The goal of this research is to determine what factors affect how community members separate their household waste. This study is founded on the Theory of Planned Behavior (TPB), which takes into account a number of factors, including attitudes, subjective norms, and behavioral controls, in order to impact someone's behavior and broaden the TPB conceptual model to fill in any gaps. The findings of this research were obtained from a survey of 301 participants conducted at DKI Jakarta and Depok. The results of this research demonstrate that attitudes are the most significant determinant of garbage sorting intention and behavior. While other elements, such as demographics, subjective standards, and beliefs about the ability to regulate behavior, do not have significant effect.

Walailak Atthirawong (2022), conducted a study on the elements influencing Bangkok, Thailand's household involvement in solid waste management segregation and recycling. To determine whether there was a statistically significant difference in the degree of household participation between the various zones in Bangkok, Analysis of Variance (ANOVA) was used. The research also employed multiple regression analysis to examine the factors influencing the level of household participation. Questionnaires that were delivered by hand were used to gather the data. Bangkok was divided into three zones, and a total of 400 interviewees were chosen using multi-stage random sampling.

The findings indicated that roughly two-thirds of the inhabitants had advanced knowledge and comprehension of solid waste management. However, the ANOVA findings showed that there was little variation in household participation levels between residents of various zones. The level of household involvement in solid waste segregation and recycling in Bangkok was greatly impacted by ongoing local government training and promotion programs, as well as resident age. The discussion of the study's findings is given last, and additional research is also mentioned.

Fidele (2022), performed a study on the methods used to treat solid waste in the City of Kigali and assessed how the locals felt about waste management in terms of attitudes and involvement. This study employs a mixed methodology to better comprehend Kigali City's garbage management system. The information was gathered by giving out questionnaires to respondents, interviewing local residents, contacting all trash collection and recycling businesses, government organizations, and other sources like national household surveys and reports. Each identified district has a unique mix of municipal solid waste (MSW) quantity and variety.

The results show that when using waste management techniques, a person's mindset and perception are crucial. Laws and rules governing WM are not properly implemented. Open landfill fires contaminate the air by producing smoke, dangerous gases, and airborne particles due to incomplete burning. Additionally, at the maximum anaerobic decomposition, methane concentrations can approach up to 50% of landfill gas composition. These gases help to enhance the greenhouse gas effect, contribute to global warming, and change the climate.

- *Gap analysis*

Various factors were looked into as the factors for household participation in solid waste management, according to the imperial reviewed literature of various studies in different locations by different researchers (Anantha, 2019; Walailak, 2022 and Fidele, 2022). The gap for household involvement in waste management, however, is revealed by this research given the various environments and situations of various cultural aspects. So, using the family size and cost as factors of household involvement in solid waste management, this research evaluated the factors influencing household participation in Muhanga District, Southern Province of Rwanda. Descriptive and regression analysis were also used by the researcher as study methodology.

E. Conceptual framework

A conceptual framework is an analytical instrument with numerous settings and modifications. It is used to organize and categorize thoughts. Strong conceptual frameworks efficiently and easily recallable reflect something real. According to Shields (2013), the conceptual framework is a representation of the independent and dependent factors visually. The household involvement in this study—which takes into account costs and family size—is an independent variable. Solid refuse collection, solid waste transport, and solid waste disposal are the independent factors that make up the dependent variable, waste management.

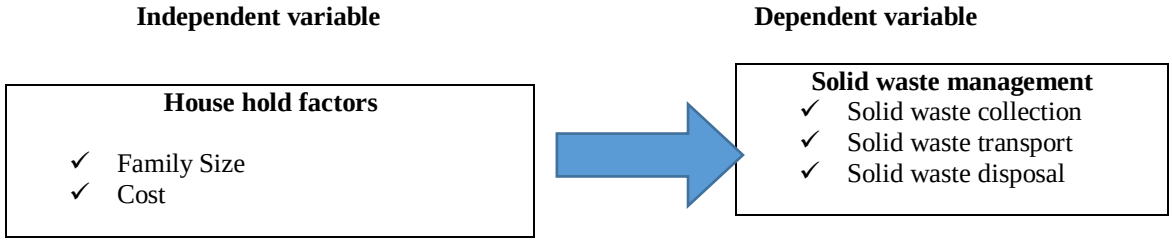

Fig. 1: Conceptual Framework

Source: Researcher compilation; 2023

VI. MATERIALS AND METHODS

A. *Research design*

The goal of this study was to identify the variables that influence household participation in waste management. A suitable research design must be used in order to accurately analyze the research issue and offer solutions. A research design applies general study hypotheses to data gathering and analysis procedures. (Creswell, 2009). As a result, the descriptive survey research method was used for this study.

B. *Area of the study physical presentation*

The secondary city of Muhanga, though it is administratively a component of the Southern Province, is physically located in central Rwanda, 45 kilometers southwest of Kigali. It expands near the junction of the main thoroughfare that links Kigali with Kibuye in the west and with Huye in the south (Muhanga, 2013). The city also includes a key section of the Muhanga-Ruhango- Nyanza heritage corridor. Due to its geographical location, the city serves as the gateway to the west and south of the country. This central location is strategic and the availability of land (compared to Kigali) offers alternatives for businesses in need of space at proximate distance to the capital. The study was carried out in three sectors which are Cyeza, Shyogwe and Nyamabuye as shown by figure 2.

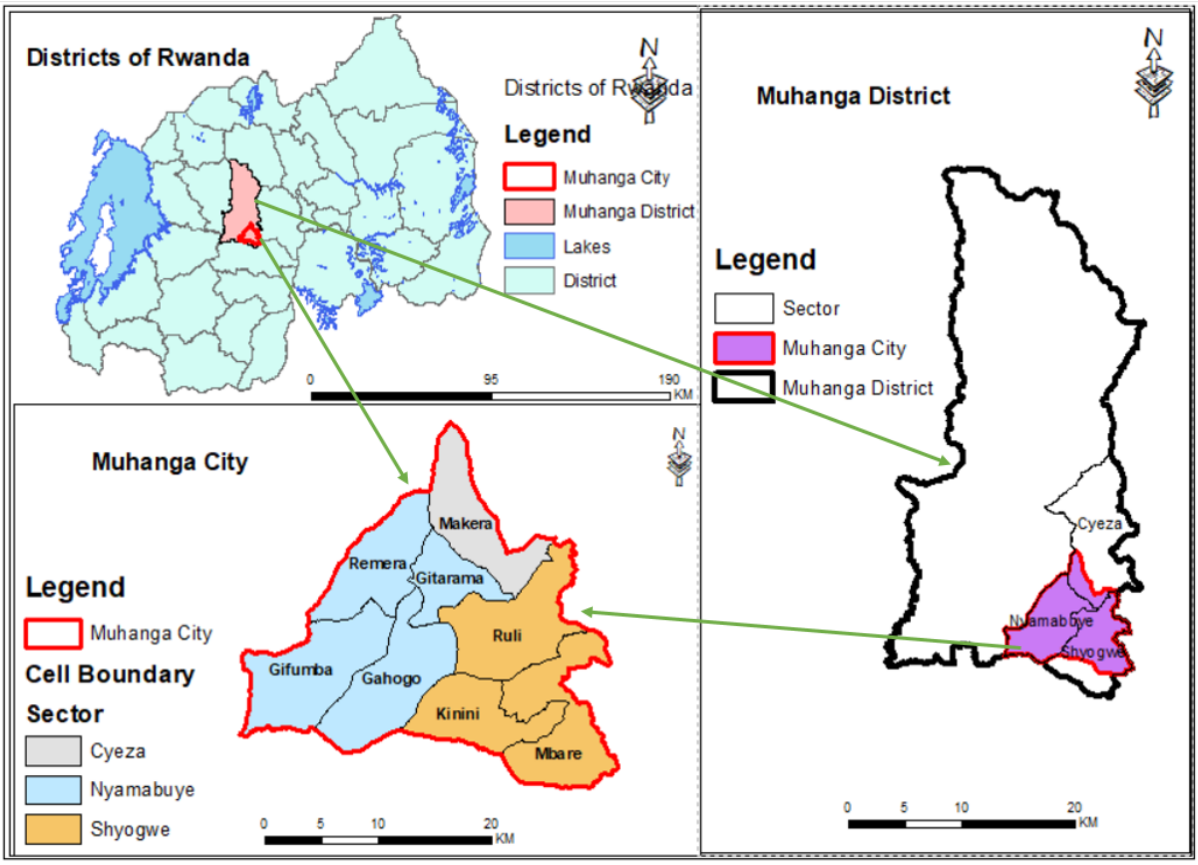

Fig. 2: Location of study area

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C. Target population, sample size and sampling procedures

A research population is generally a large collection of individuals or objects that is the main focus of a scientific query. It is for the benefit of the population that researches are done. (Moser, 2011). Therefore, the population for this study was119,625 households in selected sectors of Muhanga district, which are 30,209 households in Cyeza, 44,771 households in Shyogwe and 44645 households in Nyamabuye.

A sample was a smaller set of standards designated from the population. This study practices 4% of margin errors and privacy level is 95%. The study applied the formulation of Taro Yamane to control the sample size of this study.

Where:

$$n = \frac{N}{1 + N(e)^2}$$

n = Sample Size N = Study Population e = Margin of error

And then the sample size is:$n = \frac{119,625}{1+119,625(0.05)^2}$; $n = \frac{119,625}{300} = 399$

Then the sample size is 399 respondents. The sampling techniques used was systematic sampling technique in which where researcher selected the participants based on the interval between households. This is because the technique produces estimate of overall population parameters with great precision (Shuttle, 2009). The calculation of each sample was done by using the approach of proportionate stratification, where the sample size of each stratum is proportionate to the population size of the stratum. Proportionate sampling method to be used to select representative sample from the three sectors since they comprise of different population sizes. Purposive sampling was used to select household heads to be administered the questionnaire.

D. Data Collection Instruments

➢ *Questionnaire technique*

In order to gather written and quantitative data about the variables influencing household participation in solid waste management, the researcher distributed these kinds of questions among respondents. The questionnaire includes a series of closed questions about topics that are expected of the respondent information. The Likert scale method is used to structure questionnaires, and it asks respondents to rate a succession of statements as strongly agreeing (4), agreeing (3), disagreeing (2), or strongly disagreeing (1).

➢ *Documentation tool*

One of the fundamental benefits of document studies, according to Robert (2014), is the ability to more thoroughly examine the sources in order to learn more about a particular aspect of the topic. This is the in-depth analysis of the topic's published papers, reports, magazines, journals, and policy reports. The researcher used this documentary technique to gather secondary data because it examines the literature and seeks out global viewpoints to create a comparative framework for analysis and evaluation for readers.

E. Data Analysis Methods

The data that was gathered from the questionnaires given to households in Cyeza sectors, Nyamabuye sector and Shyogwe sector in was analyzed using Statistical Package for Social Sciences (SPSS) version 23 with the help of software for analysis. The results obtained were recorded in form of frequencies, percentages, and tables. The Correlation Coefficient and descriptive statistics were used to examine the impact of the electronic banking system on customer satisfaction.

➢ *Correlation Analysis*

The Pearson correlation coefficient was used in this research. The degree of correlation between two factors can be determined using Pearson's coefficient of correlation. This coefficient allowed us to assume that the two variables have a linear relationship, that they are causally related, that one of the variables is independent and the other is dependent, and that both variables are subject to a significant number of independent causes that combine to produce a normal distribution. In a sample, it is denoted by and is by r_s design constrained as $-1 \leq r_s \leq 1$.

➢ *Regression analysis model*

Based on research objectives and null hypotheses, the following are multiple regression models that were developed in answering and finding the effects and relationship between e-banking and customer satisfaction. The regression model of this research was used in the form: $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$

Where: Y= Solid waste management; X_1= Family size; X_2= Cost (Moderator); and $\beta_1 - \beta_4$ = Slope or coefficient of estimates. β_0= constant; ε = Error term.

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VII. RESULTS AND DISCUSSIONS OF FINDINGS

A. *Regression analysis*

In regression the researcher analyzed the model summary, variances and coefficients of variables.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.975[a]	.952	.951	.94590	.952	1545.652	3	236	.000
a. Predictors: (Constant), Family size, cost									

Table 1: Model Summary

Source: Primary Data (2023)

From the table 1; regression analysis revealed a positive relationship (R = 975). The R coefficient of 0.975 indicates that the predictors of the model which family size and cost, have a correlation of 97.5% with the dependent variable (solid waste management) The study also revealed that a combination of family size and cost together contributed to 95.2% (R^2= 0.952) of the solid waste management.

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4148.827	4	1382.942	1545.652	.000[b]
	Residual	211.156	394	.895		
	Total	4359.983	398			

a. Dependent Variable: Solid waste management

b. Predictors: (Constant), Family size, cost

Table 2: ANOVA

Source: Primary Data (2023)

Table 2. shows that variations in solid waste managementis explained by the model to the extent of 0.4148.827 out of 4359.983 or 95.1 % while other variables not captured by this model explain 4.8 % (211.156 out of 4359.983) of the variations in solid waste management. F value of the model produces a p-value of 0.015 which is significantly different from zero. A p-value of 0.015 is less than the set level of significance of 0.05 (0.000<0.05) for a normally distributed data. This means that family size and cost are the factors that contribute to the household participation in solid waste management in Muhanga district. In coordination with Muhanga's district administration, a sectoral strategy is used to collect solid waste and engage the people. While sectors coordinate the collection of solid refuse, cooperatives or businesses that collect waste attempt to impose a pricing structure, efficiency control, and even sanctions on households that are unwilling to abide by the agreement. The Kanyinya dumpsite, which serves the entire city of Kigali, is where garbage is collected, transported by trucks, and disposed of. Low-income communities typically discard their trash at the nearest vacant lots, water channels (ruhurura), public areas, creeks, or rivers in areas where trash collection is lacking, contaminating the environment. The findings indicated that some residents of the Muhanga neighborhood fire trash in their backyards, severely polluting the air with hazardous gases and particulates. Residents who live close to the watershed discard their trash there. Some people dispose of their refuse in the water channel without paying the required collection fees; during the wet season, this waste is carried by the water toward the watershed, where it pollutes the water and causes harm to aquatic life and eutrophication. These findings are in line with those of Manaf et al. (2021), who identify irregular garbage collection services, a lack of waste collection tools, and a lack of strong legal protections as major barriers to waste recycling in Rwanda.

B. *Hypothesis test*

Pearson Correlation coefficient foretells the degree to which the association between dependent and independent variable exist. The correlation coefficient demonstrates the relationship between our data set. Like Wigmore says, the correlation coefficient is also defined as the indicator of the relationship between two variables in research. It is a statistical measure in which one change from a variable predicts the number of changes that could happen to another variable. The correlation coefficient can only exist in a range of -1 being the lowest and +1 being the highest correlation indicator. Henceforth, correlation signifies that the variables can also be interchanged to get similar results. Throughout this study, we measured the degree of freedom to assess the possibilities that could lead us to reject the null hypothesis. Thanks to the one-sample test and t-statistics, we were able to relate the degree of freedom from the variables and established a conclusion also based on the value of P from a one-sample test table.

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Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.880	.772		2.437	.016	.360	3.400
	Family size	.193	.021	.137	9.239	.000	-.235	-.152
	Cost	1.004	.020	.887	49.140	.000	.964	1.044

a. Dependent Variable: Solid waste management

Table 3: Coefficients

Source: Primary Data (2023)

The regression output is laid on Table 3 Standardized coefficients (Beta) were used to determine the relative importance of the significant predictors of solid waste management. The *t* column for data analysis is the t-test statistic (t). This is the test statistic calculated for the individual predictor variable. This is used to calculate the p-value. Lastly, the researcher calculated the P-Value in the last column of Sig. probability level (p). This shows whether or not an individual variable significantly predicts the dependent variable. The larger the absolute standardized coefficient, the larger the contribution of that predictor to solid waste management as indicated by the T-statistics. The family size contributes to (β=0.137) to solid waste management and followed by cost (β=0.887).

In fact, a unit change in family size would lead to increase in solid waste management by a factor of 0.137, and a unit change in cost, lead to increase in solid waste management by a factor of 0.887 which is the most predator of the research. The study also found that all the p-values were less than 0.05, ant t test greater than 0.05; this indicates that all the variables were statistically significant in influencing the solid waste management and the researcher reject null hypothesis which stated that H_0: There is no significant relationship of household participation on solid waste management in Muhanga city and accepted alternative hypothesis stated that H_1: There is a significant relationship of household participation on solid waste management in Muhanga city.

The results of the research are in line with Hardy and Greission (2022) who analyzed the possibility of contribution of cost and solid waste management. They have discussed about the community ability to pay the fees for solid waste collection and disposal, according to the cost of solid waste collection is the most factors that contribute to solid waste management within the community. Therefore, for the data collected and analyzed it has revealed that also in Muhanga the cost is one of the most factor that contribute to solid waste management in selected sectors of Muhanga.

C. Correlation analysis

		Solid waste management	Family size	Training
Solid waste management	Pearson Correlation	1	-.068	.675**
	Sig. (2-tailed)		.297	.000
	N	399	399	399
Family size	Pearson Correlation	.068**	1	-.135*
	Sig. (2-tailed)	.000		.036
	N	399	399	399
Cost	Pearson Correlation	.675**	-.135*	1
	Sig. (2-tailed)	.000	.036	
	N	399	399	399

Table 4: Summary of Correlation

Source: Primary Data (2023)

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Key 1- Solid waste management, 2- Family size 3- Cost, 4- Working environment

Results in Table4, Pearson correlation revealed that there was a weak positive relationship between family size and solid waste management at the coefficient of correlation was 0.068. The probability value = .000 which is less than 0.05. This means that there is a relationship of 6.8% between family size and solid waste management. Secondly and correlation analysis indicated a strong relationship between Cost and solid waste management of 0.675 The probability value = .000 which is less than 0.05. This implies that there is a relationship of 67.5% between Cost and solid waste management.

VIII. CONCLUSION AND RECOMMENDATIONS

A. Conclusion

The goal of this research was to assess factors influencing participation of households in solid waste management in Muhanga city of southern province, Rwanda; more specifically, the research had the following specific objectives were to analyze factors influencing household participation in solid waste management in Muhanga City, to examine the solid waste management at household level in Muhanga city and to establish whether there is a significant effect of household participation in solid waste management in Muhanga city.

The ANOVA tables proved better understandings of how the regression equation predicts the behaviors of the dependent against independent variables, and the model equation proved that the data are fit in the equation. The regression models predicted that the dependent variable was strongly significant as the data sample we have is fit. In the "sig." column, we find that the value of P is less than 0.005 that is P<0.005 (note that the value less than 0.005 is interpreted as 000 in the SPSS outputs).

Therefore, we concluded that the regression model was statistically significant and predict the results from our variables.The side of the Model summary exemplified that the R-value indicated some simple correlations between our variables. This demonstrated a higher degree of correlation between the dependent and independent variables from the study. Similarly, the R square proved how the total variation between all the dependent variables and solid waste management was in relation. This lead us to conclude that there was a strong relationship between family size, costandsolid waste management in Muhanga district.

B. Recommendations

From the shortcomings of the research, the following recommendations have been provided; there is need to create awareness and sensitize households on integrated solid waste management especially on how households can reduce, reuse and recycle the generated solid wastes at household level by the County Government.

Segregation of solid wastes at the household should be encouraged as this makes it easy to deal with the different types of solid wastes in Muhanga City. Indeed, sorting of household solid waste should start in households in whole city should be in the forefront in promoting this which can also lead to generating electricity and production of fuel from burning household solid waste; from compost manure, which can be recovered well to be an income generating venture. Variety of techniques of handling household solid waste should easily be available for residents in all cities to curb issues of waste mismanagement.

Strategies should be put in place to curb illegal dumping. In addition, short-distance strategic dumping sites should be provided within the vicinities of the households.

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