Sokoine University of Agriculture

MA. Dissertation

Determinants of Household Choices on Solid Waste Management Practices in Morogoro Municipality, Tanzania

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DETERMINANTS OF HOUSEHOLD CHOICES ON SOLID WASTE MANAGEMENT PRACTICES IN MOROGORO MUNICIPALITY, TANZANIA

A Dissertation Submitted in Partial Fulfilment of the Requirements for Master of Arts Degree in Project Management and Evaluation of Sokoine University of Agriculture, Morogoro.

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EXTENDED ABSTRACT

Effective solid waste management is a critical global challenge, impacting human well-being, environmental sustainability, and the ongoing climate crisis. This study delves into the complex relationship between household-level waste management and socioeconomic factors in Morogoro Municipality, Tanzania. As urbanization and consumption patterns evolve, understanding the dynamics shaping waste practices becomes paramount. Using a descriptive cross-sectional design, the study engaged 70 households across diverse wards: Mji mkuu, Mazimbu and Mji mpya. Structured interviews, complemented by insights from key informants, were conducted using the robust Kobo Collect survey tool. Descriptive statistics and Multivariate Probit Model were employed to examine waste management associations within and across wards. Key findings indicate that household waste management in Morogoro Municipality is intricately tied to socioeconomic factors. The majority of respondents were female (65.7%), aged 46 to 60 (34.3%), married (67.1%), and with primary education (55.7%). Self-employed individuals (65.7%) actively participated in waste management Multivariate Probit Model revealed intricate relationships between socioeconomic characteristics and waste practices. Chi-Square Tests illuminated associations between waste practices across wards, highlighting nuanced challenges. The study revealed inadequate solid waste management practices, with 68% of households resorting to dumping. Noteworthy waste categories included food remains and vegetables (38.6%), leaves/grass (28.6%), plastic (20%), and a mix of solid waste (12.9%). Community perception played a crucial role in shaping the success and effectiveness of solid waste management efforts. While the community perceived a positive stance on solid waste management, factors hindering effectiveness included collection fees and infrastructure. Multivariate Probit Model explored the association between socioeconomic characteristics and solid waste management practices. Significant predictors included education, income, infrastructure, land size, household size, time living in the area, waste storage facilities, fee for waste collection, and community awareness. The study's significance lies in its potential to drive policy adjustments. Urgent steps are recommended, including

grassroots environmental education and comprehensive policy enhancements to foster progress in waste management practices. The results underscore the need for tailored waste management strategies across different wards, considering specific challenges and promoting sustainable waste disposal practices. This research contributes to the global discourse on effective waste management, emphasizing the importance of context-specific interventions to address the intricacies of socioeconomic factors influencing household waste management practices.

Keywords; *Solid waste management practices, Solid waste management, socioeconomic factors, community perception, waste disposal practices*

IKISIRI KUU

Usimamizi mzuri wa taka ngumu ni changamoto kubwa kimataifa, ukiathiri ustawi wa binadamu, udumifu wa mazingira, na mgogoro wa hali ya hewa unaendelea. Wakati mchakato wa miji kukua na mitindo ya matumizi inavyobadilika, kuelewa mabadiliko yanayoendesha mazoea ya taka kunakuwa muhimu Nchini Tanzania usimamizi wa utunzaji wa taka Ngumu umekuwa ukitekelezwa na manispaa, makampuni pamoja na vikundi vinavyojishughulisha na ukusanyaji wa taka katika kaya. Kwa hivyo, utafiti huu ulilenga kuchunguza uhusiano tata kati ya usimamizi wa taka ngazi ya kaya na sababu za kijamii na kiuchumi, katika Manispaa ya Morogoro, Tanzania. Hasa, utafiti ulipitia kutambua taka ngumu zinazozalishwa katika ngazi ya kaya katika eneo la utafiti. ii. Kuchunguza uhusiano wa njia za uhifadhi wa taka ngumu katika ngazi ya kata. Kutathmini sababu zilizopelekea chaguo la kaya kwenye uhifadhi wa taka ngumu. Kuchunguza mitazamo ya jamii kuhusu usimamizi wa taka ngumu katika ngazi ya jamii. Muundo wa utafiti wa sehemu mtambuka ulitumiwa, na data zilikusanywa kwa kutumia chombo cha utafiti cha Kobo Collect kutoka kwa kaya na watendaji husika (Wahojiwa 70 na watoa taarifa muhimu 5). Takwimu za maelezo, takwimu za utambuzi, na uchambuzi wa regression zilitumiwa kuchambua data ya kiasi. Mfumo wa Usimamizi wa taka wa pamoja (IWM) na Mfumo wa (VBN) pia ulitumika kama mifumo wa kuongoza uchambuzi. Matokeo yalionyesha kuwa usimamizi wa taka Ngumu unaongezeka kila siku kutokana na uzalishwaji mwingi wa takata hata ivyo upungufu wa njia salama za utunzaji na simamizi wa taka Ngumu umeendelea kuwa changamono zinazopelekea uchafuzi wa mazingira na mripuko wa magonjwa. Hata hivyo matumizi ya njia za utunzwaji wa takataka zinatofautiana kutokana na eneo na eneo, ($p<0,05$). (68%) ya wakazi wa Morogoro wanatumia njia ya kuweka takataka katika mifuko ya plastiki, (62.50%), kutumia tena kwa matumizi menginehata (55.70%) kuchoma takataka na (50%) kufukia takataka katika mashimo.Hata hivyo njia ya utunzaji wa taka katika mifuko imeonekana si salama kutokana na changamoto mbalimbali zinazo pelekea athari za kimazingira na afya za binadamu. Uchambuzi ulibaini kuwa kuna uhusiano wa sababu za kijamii na kiuchumi zinazochangia machaguzi ya jamii katika njia za kuhifadhia takataka($p< 0.05$)

ambazo ni pamoja na eneo la nyumba, idadi ya wanakaya, vifaa vya kuhifadhia taka, kipato, elimu. Hata hivyo matokeo yalionesha kuwa (38.6%) ya taka zinazozalishwa kwa wingi ni mabaki ya vyakula na majani yanayodondoka kutoka kwenye miti (28.6%), kutokana na ucheleweshwaji wa ukusanyaji wa taka hizi na watendaji wa ukusanyaji wa taka katika kaya inapelekea uzagaaji wa taka katika maeneo ya wazi hivyo kupelekea uchafuzi wa kimazingira. Hata hivyo matokeo yalionesha kuwa mitazamo ya kijamii kuwa ni chanja juu viashiria vya utunzaji wa takataka kwa kiwango kikubwa (composite mean 2.00-5.00) hata hivyo kulikua kuna mitazamo hasi (composite mean below 2.00) juu ya ushirikishwaji wa mikakati juu ya gharama na ratiba za ukusanyaji wa takataka. Hata hivyo jamii imekubali kuwa na uelewa juu ya sababu zinazopelekea utunzaji mbaya wa takataka ikiwemo, ucheleweshaji wa kukusanya takataka(57.7%), gharama kubwa(67.3%) na ratiba juu ya ukusanyaji takatak(68.16%).Matokeo haya yanaashiria matumizi na machaguzi ya njia za utunzaji takataka yana uhusiano wa sababu za kijamii na kiuchumia katika utunzaji bora au usio bora wa takataka hata hivyo changamoto mbalimbali zinaweza pelekea mabadiliko ya usimamizi na utunzaji wa takataka. Hata hivyo kuna uhitaji wa usimamizi yakinifu katika utunzaji bora wa taka Ngumu katika jami ikiwa ni pamoja na usimamizi bora wa sharia ndogo ndogo za kimazingira,uwekezaji katika miundombino katika ukusanyaji wa takataka, uhusishwaji na utolewaji wa elimu na semina juu ya utunzaji wa takataka katika ngazi ya jamii, Kushughulikia changamoto na mapendekezo juu ya utunzaji na usimamiz wa taka katika yanayotolewa na jamii.

Maneno muhimu: *Taka Ngumu, Usimamizi wa Taka Ngumu, Njia za utunzaji wa taka Ngumu, Machaguzi ya kaya, Mitazamo ya jammii.*

DECLARATION

I, **Clara Pius Mdetele**, do hereby declare to the senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted to any other institution.

_____ _____

Clara Pius Mdetele Date
(MA Candidate)

The above declaration is confirmed by:

_____ _____

Dr. Tumaini Allan Date
(Principal Supervisor)

_____ _____

Dr. Edwin E. Ngowi Date
(Co-supervisor)

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DEDICATION

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CHAPTER ONE

1.0 GENERAL INTRODUCTION

1.1 Introduction

Solid Waste Management (SWM) emerges as one of the paramount challenges of our contemporary era, posing significant threats to both human well-being and environmental sustainability (Kellow *et al.,* 2019). The surge in global urbanization is a pivotal factor driving the escalation of waste generation, with the modern world's increasing urbanization and development inevitably leading to heightened consumption rates and, consequently, a surge in solid waste production (Allister, 2015). This correlation is emphasized by the UN edition of World Urbanization Projections, which predicts that around 90% of urban growth will be concentrated in Africa and Asian countries, primarily due to rural-to-urban migration (Nyampundu *et al.,* 2020). The confluence of population increase, industrialization, and economic growth in urban areas is intricately linked with this urbanization trend. Presently, global cities collectively produce a staggering 2.01 billion tonnes of solid waste, a figure projected to escalate to 3.40 billion tonnes by 2050 (Aaron and Patrick, 2020). The imperative to manage this mounting waste is a shared challenge faced by nation's worldwide, necessitating solutions that enhance cleanliness in an environmentally effective, technologically feasible, economically affordable, and socially acceptable manner (Sarintip and Suthi, 2019). This global call for sustainable development has underscored the profound importance of addressing environmental issues, particularly waste management, for the health of both people and their environments.

In many developing countries, a significant proportion of solid waste is left uncollected, finding its way into unregulated dumps or becoming the victim of open-burning practices (Barklign and Gashu, 2022). Extensive evidence from prior research indicates that in sub-Saharan Africa, one to two-thirds of generated solid waste remains uncollected, presenting a severe challenge to effective waste management. The National Environment Statistics for Tanzania reveal a staggering 2 101 500 tons of waste generated, with a substantial 57% of this originating from households (Nyampundu *et*

al., 2020). Despite these alarming figures, only 10-30% of the approximately 10,000 tons of municipal solid waste generated daily in the country undergo proper collection and disposal to controlled dumpsites, leaving an overwhelming volume of waste unattended (Nyampundu *et al.,* 2020). This situation has dire consequences, particularly affecting impoverished communities, as uncollected waste contributes to serious health and environmental impacts. Vin *et al.* (2018) attribute poor waste management in these countries to factors such as insufficient financial capital for municipalities to operate waste management services, the absence of advanced waste disposal technology, population and urban growth resulting from rural-to-urban migration, lack of community awareness and active involvement as key stakeholders, delays in paying household fees to organizations responsible for waste collection, and the unplanned dumping of waste.

According to study by Kala and Bolia (2020) and Zhao *et al*. (2020) highlight how income levels, education, and cultural norms intersect to affect SWM outcomes, higher income levels are associated with better access to waste management practices and greater participation in recycling programs and reuse while lower-income communities often face barriers such as fee for the collection of waste and resources. Education plays a crucial role in shaping attitudes toward waste management, with higher levels of education correlating with increased awareness of environmental issues and adoption of sustainable waste practices. The study conducted by Fadhullah et al. (2022) suggest that community perceptions of waste management efficacy and environmental impact are closely linked to individual behaviors, knowledge which accelerate to positive or negative perception.

Morogoro Municipality in Tanzania stands out as one of the dirtiest municipalities in the country (Mpollo, 2017). The municipality has struggled to provide adequate solid waste management services, a situation exacerbated by rapid urbanization since the 1990s, which occurred without concurrent technological strategies for waste management. This deficiency has led to the eruption of diseases such as cholera, typhoid and malaria (Mollel, 2016). Notably, the poor

management of solid and liquid waste in Morogoro Municipality has been identified as a significant factor contributing to the prevalence of cholera. The period between 2007 and 2017 saw Tanzania reporting 39 444 cholera cases with 600 deaths, reflecting a case fatality rate of 1.5% and an average annual incidence rate of 8.39 per 100 000 people (Hounmanou *et al.,* 2019). The World Bank emphasizes the considerable expense associated with effective waste management, often demanding 20-50% of municipal budgets (World Bank, 2019). A majority of Morogoro Municipality residents grapple with challenges in solid waste disposal, primarily due to the inefficiency of waste collection services and the lack of proper practices for solid waste management. This situation results in the irregular dumping of waste, contributing to environmental pollution and the outbreak of diseases (Ngereza *et al.,* 2021).

This study aimed to investigate the determinants of household choices and perceptions regarding solid waste management practices in Morogoro Municipality. Through an examination of the intricate factors influencing these choices, the research sought to contribute insights that could inform effective strategies for enhancing waste management practices at the household level.

1.2 Statement of the Problem

Municipal solid waste management remains a persistent challenge in urban areas, reflecting a global concern (Soni *et al.,* 2022). Morogoro Municipal, situated in Tanzania, grapples with the disposal of over 300 tonnes of solid waste daily, yet its disposal capacity hovers between 45-60% of the total waste generated (Mpollo, 2017). The consequences of inadequate waste management in Morogoro have been severe, contributing to the outbreak of diseases such as cholera, typhoid, and malaria, particularly affecting residents in informal settlements. These areas, lacking regular solid waste collection services, often resort to various forms of illegal dumping, posing health risks to the community (Chengula *et al.,* 2015).

In response to the escalating waste management challenges, Morogoro Municipality initiated the 'Mpango wa Kudhibiti Taka Ngumu' (MUTAMO) in 2005, aiming to engage 40 Community-Based Organizations (CBOs) in solid waste management (Kalwani, 2006). Unfortunately, these CBOs faced collapse due to a lack of requisite capacity, skills, knowledge, and technology. The municipal wards exhibit disparities in solid waste management practices, with some making strides while others lag behind.

Solid waste management at the household level presents a unique set of challenges, as highlighted by Mollel (2016). Issues such as the low capacity to pay municipal collection fees, limited accessibility of homes by municipal trucks and a lack of environmental education compound the problem. Even among those who can afford to pay, the frequency of collection remains low due to frequent breakdowns of collection vehicles. As a result, waste finds its way to unauthorized open spaces like graveyards and makeshift dumpsites, with households disposing of their waste within their immediate surroundings, including backyards, trenches and water sources. This prevailing scenario underscores the critical nature of improper waste management in Morogoro municipality (Lubwama, 2017).According to Zhao et al. (2020) addressing the issue of improper solid waste management which influenced by inadequate of resources for the collection of waste, environmental education and how awareness of community on solid waste management.

Most studies have shared different perspectives toward challenges and impact on solid waste management but remain a gap on how socio economic factors influence the household choices on the practices on solid waste management and how community perceive on solid waste management. This study intended to address the multifaceted factors that contributed to improper solid waste management practices at the household level in Morogoro Municipality. By uncovering the complexities of these challenges, the research aimed to propose solutions, including raising awareness through educational campaigns, to foster environmentally responsible practices and mitigate the adverse impacts of inadequate waste management.

1.3 Justification of the Study

The justification for this study stems from the observed shortcomings in household-level solid waste management. Previous studies have primarily explored into the impacts and challenges associated with solid waste management at the household level in Morogoro Municipal. Recognizing that effective solid waste management is instrumental in minimizing environmental pollution, safeguarding public health and conserving resources, this study sought to contribute valuable insights into the determinants of household choices and perceptions regarding solid waste management practices.

The successful completion of this study aimed to pave the way for implementing measures to enhance proper solid waste management at the household level. Furthermore, it aspired to align with the goals and targets of the Sustainable Development Goals (SDGs) by improving access to solid waste management for households in Morogoro Municipal. Waste management is widely acknowledged as a crucial component of sustainable development, and this research played a role in expanding the knowledge base concerning the determinants of household choices in this context.

The study's outcomes were envisioned to make significant contributions to achieving the targets outlined in the Sustainable Development Goals (SDGs) for Tanzania, particularly SDG3 (good health and well-being) and SDG6 (clean water and sanitation). SDG3 aimed at addressing health inequalities and promoting overall well-being, while SDG6 emphasized the importance of ensuring the availability and sustainable management of water and sanitation for all (UNDG, 2015). The United Nations Environmental Programe highlighted the severe consequences of improper solid waste management, linking it to water contamination and the spread of diseases such as cholera and typhoid, which annually claimed millions of lives, especially among children (Godfrey *et al.,* 2018). Moreover, according to the U.S. Public Health Service (Chowdhury *et al.,* 2013) improper Municipal Solid Waste Management was identified to be associated with 22 human diseases, including cholera. According to the National Environmental policy 2021 highlight the

number of initiatives which have been taken by the Government to addressing the challenge of solid waste including formulation of Public health policy and enactment of Environmental Management act, Urban planning act, Water resource management. Through these justifications, the study aimed to shed light on the critical role of household choices in solid waste management for the broader goals of sustainable development and public health.

1.4 Objectives of the Study

1.4.1 General objective

The general objective of the study was to determine the household choices for solid waste management practices in Morogoro Municipal, Tanzania.

1.4.2 Specific objectives

The specific objectives of the study were;

i. To identify solid wastes produced at the household level in the study area
ii. To explore solid waste management practices at the household level in the study area.
iii. To assess factors that influenced household choices on solid waste management practices at the household level in the study area.
iv. To explore community perceptions on solid waste management practices at the community level in the study area.

1.4.3 Research questions

The research questions of this study were;

i. What were the solid waste produced in the study area?
ii. What were the household solid waste management practices in the study area?
iii. What were the elements that influence household decisions about solid waste management in the study area?
iv. How could community perception affect solid waste management?

1.5 Theoretical Framework

The theoretical framework underpinning this study drew on the Integrated Waste Management (IWM) model and Value, Belief and Norms (VBN) Theory. The **Integrated Waste Management (IWM)** model served as another guiding theoretical framework for this study. This model endorsed as an approach to waste management, integrates various strategies and techniques to mitigate the environmental and human health impacts of waste (UNEP, 2006). The IWM model advocates for a comprehensive and holistic approach to solid waste management, recognizing that activities such as waste reduction, reuse, recycling, and proper disposal methods are interconnected and should be addressed collectively. It acknowledges that individual characteristics, including income, education and occupation, play pivotal roles in shaping waste management behaviors and choices. The IWM model also emphasizes the importance of collaboration among diverse stakeholders, including households, government entities, waste management authorities, and the private sector, to achieve sustainable waste management outcomes.

The study was also guided by the **Value Belief Norms (VBN)** theory, originally developed by Stern et al. in 1999 to elucidate how individuals' personal values, beliefs, and norms shape their attitudes and actions concerning environmental issues. When applied to community perceptions regarding solid waste management, this theory suggests that individuals' environmental behaviors are influenced by their personal values, beliefs, and perceived social norms. According to the VBN framework, awareness of consequences plays a pivotal role in attributing responsibility, with individuals tending to take personal responsibility for waste management when they are aware of its consequences. It further posits that when individuals' personal values are in harmony with their beliefs regarding the outcomes of waste management and align with perceived social norms, they are more inclined to engage in positive waste management practices. Additionally, individuals' beliefs about the outcomes of waste management activities aid in understanding their perspectives on the environmental, social, and economic

impacts of proper waste management, including considerations such as fees for waste collection.

The study specifically incorporated variables from IWM model, such as income, education and occupation, to assess their influence on household-level solid waste management practices. This theoretical framework guided the examination of factors associated with solid waste management practices at the household level, providing a structured lens through which to analyze and interpret the study's findings.

1.6 Conceptual Framework

The conceptual framework underpinning this study was structured with background variables, independent variables serving as intermediate factors, and dependent variables. Relationships among these variables were hypothesized to provide insights into household choices regarding solid waste management practices. The framework, illustrated in Figure 1.1, was developed through an analysis of comprehensive ideas and principles derived from a thorough review of theoretical and empirical literature pertaining to household choices in solid waste management practices.The primary focus of the conceptual framework was on the dependent variable, solid waste management practices, encompassing various methods such as dumping, burning, landfill, and reuse. The framework aimed to elucidate the determinants of the specific solid waste management practices adopted in distinct wards. The household, as the unit of analysis, was influenced by independent variables, including aspects related to solid waste management such as collection, treatment, transportation, and disposal. Additionally, factors influencing household choices in solid waste management, categorized as social, economic, cultural, and environmental factors, were incorporated into the framework. Community perceptions, encompassing knowledge, behavior, policy options, and bylaws, were also integral components influencing household decisions.

These background variables played a crucial role in shaping the context within which household choices regarding solid waste management practices were made. The relationships and interactions

among these variables were systematically organized in the conceptual framework, providing a comprehensive and structured basis for understanding the multifaceted dynamics that contribute to household choices in solid waste management practices in Morogoro Municipality.

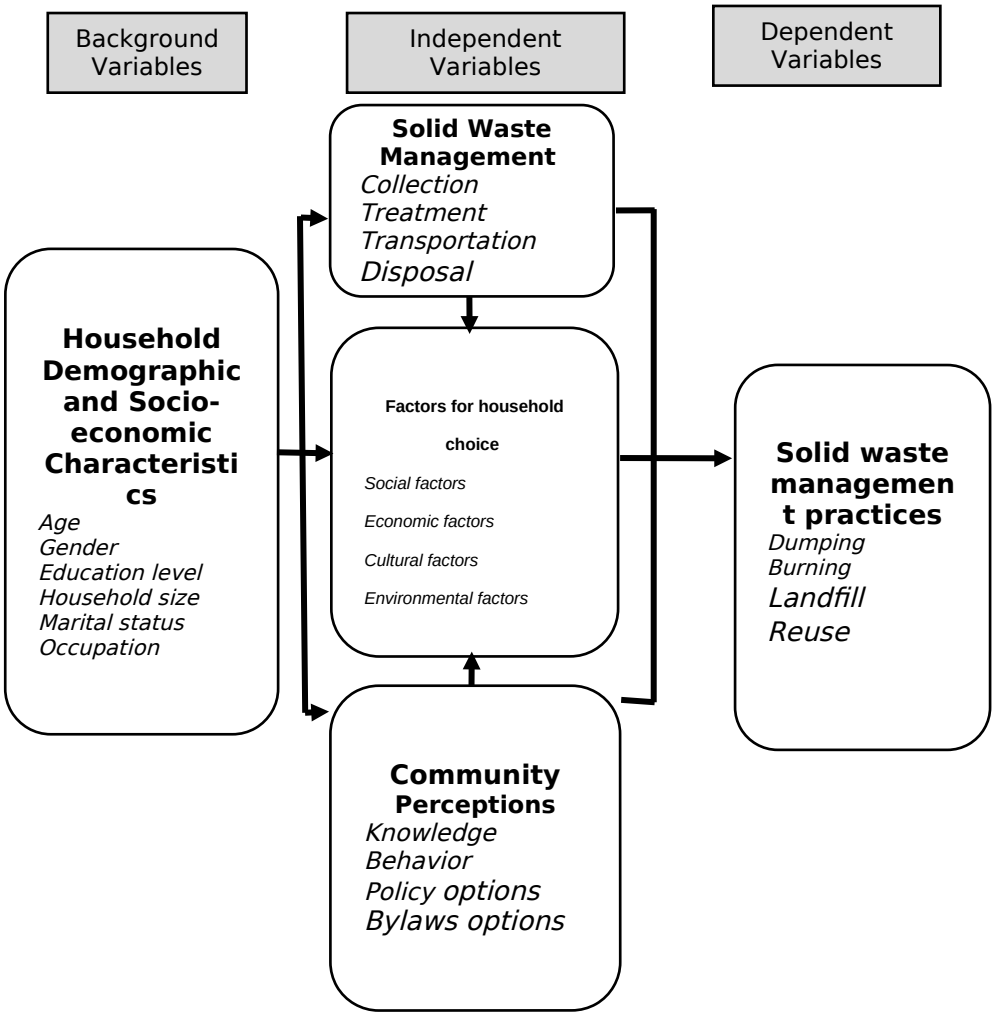

Figure 1.1: Conceptual framework modified by the author from the original notions of integrated waste management theory and empirical reviews

1.7 Research Methodology

1.7.1 Study area description

The study was conducted in Morogoro Municipal, a purposefully selected location with distinct characteristics that made it an ideal focal point for the investigation into household choices on solid waste management practices. Several factors guided the selection of Morogoro Municipal as the study area. Firstly, despite having a relatively small population, Morogoro Municipal was noted for producing a disproportionately high volume of solid waste. This unique aspect presented an intriguing aspect for exploration, given the potential disparities between waste generation and population size (Mpollo, 2017).

Moreover, Morogoro Municipal stood out as one of the fastest-growing urban areas, experiencing rapid demographic expansion. This growth occurred concurrently with a notable absence of strategic services for solid waste management, creating a compelling scenario for in-depth examination (Mollel, 2016). The municipality, serving as the Regional Headquarters of Morogoro Region, covered a total area of 72 939 square kilometers, constituting approximately 8.2% of the total land area of Tanzania mainland. It was comprised of 29 wards and 275 sub-wards, providing a diverse landscape for the study's exploration (Nyampundu *et al.,* 2020).

As of the 2022 population projection, Morogoro Municipal was home to an estimated 440 000 residents. The choice of Morogoro Municipal as the study area was further justified by its potential for effective community participation in municipal solid waste management. Despite the relatively modest population size, the municipality held promise for achieving meaningful community engagement, a critical aspect for understanding and influencing household choices in solid waste management practices (Vin *et al*., 2018).

In essence, Morogoro Municipal, with its unique combination of high waste generation, rapid urban growth and the absence of strategic waste management services, provided a rich context for investigating the determinants of household choices in solid waste management practices. Therefore, this study leveraged Morogoro Municipal's

distinct features to gain insights into household choices regarding solid waste management practices, offering a nuanced understanding of the challenges and opportunities within the context of a growing urban center grappling with waste management issues.

1.7.2 Research design

The research employed a cross-sectional design, integrating both quantitative and qualitative methods to comprehensively investigate the determinants of household choices on solid waste management practices in Morogoro Municipality, Tanzania. This design was chosen due to its efficiency in gathering data at a single time point, cost-effectiveness, and the relatively shorter time required compared to other research methods. The utilization of a cross-sectional design facilitated the collection of data from a diverse range of participants, allowing for an examination of variations among different groups within Morogoro Municipal.

In accordance with Gray (2014), the cross-sectional design aligns with a set of variables assumed under study and considers specific contextualized guidelines that connect theoretical notions with the strategy of inquiry, supported by methods and techniques for collecting empirical materials. This design, therefore, offers a theoretical and operational framework that aids in identifying the types of information to be collected for quantitative research, specifying their sources, and outlining the procedures for data collection.

The data collected in this cross-sectional study focused on capturing key variables related to solid waste management practices, household choices in waste management (including social, economic, cultural, and environmental factors) and community perceptions (encompassing knowledge, behavior, policy options, and bylaws). The study aimed to draw statistical and quantitative results while also seeking additional justifications for established relationships through qualitative findings. This combination of methods aimed to provide a comprehensive understanding and response to both the “how” and “why” aspects of the fundamental research questions.

1.7.3 Sampling procedures and sample size

In Morogoro Municipal, comprising 19 Wards, numerous sub-wards grapple with challenges related to solid waste management, particularly those accommodating informal settlements (Mpollo, 2017). For this study, three wards - Mazimbu, Mji Mkuu, and Mji Mpya - were randomly selected to ensure a diverse representation of the municipality. To gather in-depth insights, key informants for interviews were purposively chosen, with one participant selected from each of the three wards. These informants possessed relevant experience and knowledge crucial to understanding the intricacies of solid waste management within Morogoro Municipal.

Determining an appropriate sample size involved applying the formula by Nassiuma (2000), which considered factors like time constraints and resource availability. Simple random sampling techniques were then employed to select wards, sub-wards, and households, ensuring equitable representation across the municipality. This method bolstered the study's reliability by providing every ward, sub-ward, and household with an equal chance of inclusion in the research.

In determining the sample size for Morogoro Municipal, considering a projected population of 440,000 in 2022, the formula by Nassiuma (2002) played a pivotal role. This formula, influenced by various factors including time and resource constraints, ensured that the sample size was both practical and representative of the municipality's demographic landscape.

$n = (NCv^2) / (Cv^2 + (N - 1) e^2)$ .....Nassiuma (2000)

Where, n = the desired sample size,

N = Target population.

C_V = Coefficient of variation (take 0.5).

e = Tolerance at desired level of confidence (0.06) at 95% confidence level.

Where by: $n = (NCv^2) / (Cv^2 + (N - 1) e^2)$

$n = 440,000x0.25/0.25+ (440,000 – 1) 0.06^2$

n = 70

Therefore, the sample size for the study was 70 respondents. As such, the three randomly chosen wards, namely Mazimbu (26) Mji Mkuu (22), and Mji Mpya(22), were pivotal to capturing a comprehensive view of solid waste management practices, taking into account variations across different areas of Morogoro Municipal. The number of respondents from Mazimbu (26) is higher than that of other wards, primarily because of the larger population in Mazimbu compared to Mji Mkuu and Mji Mpya. Additionally, the rationale behind selecting these wards stems from their notably higher instances of improper solid waste management compared to other wards.

Furthermore, a purposive sampling approach was adopted to select five key informants, Environmental officer 1, Ward Executive Officer (WEO)3, one from each ward and waste collectors 2, renowned for their expertise in solid waste management. This strategic selection aimed to enrich the study with nuanced perspectives from individuals deeply immersed in the field.

1.7.4 Data collection

In this study, primary data were gathered through a meticulously designed structured questionnaire and an interview checklist. The questionnaire targeted households, recognized as the primary producers of solid waste at the household level. Administered via the Kobo Collect survey tool, the questionnaire featured a blend of closed-ended and open-ended questions, providing a comprehensive understanding of household perspectives on solid waste management practices.

Key Informant Interviews (KIIs) complemented the quantitative data by offering profound insights into the contextual nuances of solid waste management. The interviews involved five key informants, strategically chosen to represent different facets of the municipal setup: The interviews were a critical component for capturing in-depth information on challenges associated with solid waste management practices.

Household surveys, conducted using semi-structured questionnaire guides, were instrumental in acquiring information on various key variables. These variables included socio-economic factors like household demographics, education, and occupation, as well as solid waste management practices (collection, treatment, transportation, and disposal). Factors influencing solid waste management, such as social, economic, cultural, and environmental considerations, were also explored, along with community perceptions encompassing knowledge, behavior, policy options, and bylaws.

The questionnaire's content was crafted based on the research objectives and the conceptual framework of the study. The original questionnaire was developed on the Kobo Collect software, utilizing an Android mobile device with the Kobo Collect application. This technological approach facilitated efficient data collection and management.

Observational data were gathered by physically witnessing and documenting how solid waste was managed across different wards within the study area. This observational approach aimed to provide a firsthand account of the actual practices and events related to solid waste management in Morogoro Municipality, adding a qualitative dimension to the overall research methodology (Creswell & Creswell, 2017).

1.7.5 Data analysis

In the quantitative phase of the study, data sorting, coding, and analysis were conducted using the IBM-SPSS Statistics v.20 computer program. Qualitative data obtained from key informant interviews and open-ended questionnaire responses underwent Content Analysis using NVivo 12 software. The study unit of analysis was households.

Objective One (i), aimed at identifying solid waste types generated at the household level, underwent descriptive analysis, presenting frequencies and percentages. This analysis provided a comprehensive overview of the diverse solid waste compositions found in households across the study area.

Objective Two (ii) involved assessing the association between waste management practices in the three selected wards, utilizing Pearson Chi-Square Tests. This statistical method allowed for the examination of relationships between different waste management practices, contributing to a nuanced understanding of the variations across wards.

Objective Three (iii) explored the relationship between socioeconomic characteristics and solid waste management practices. Multivariate Probit Model was employed, specifically focusing on practices like re-use, landfill, burning, and dumping. Results were presented as odds ratios and confidence intervals, offering insights into the influence of various factors on household waste management choices.

Objective Four (iv) aimed to gauge community perceptions of solid waste management practices using a 5-point Likert scale underwent descriptive analysis, presenting composite mean.

Therefore, the data analysis process blended quantitative and qualitative methodologies, providing a holistic understanding of household choices and perceptions regarding solid waste management practices in Morogoro Municipality.

1.8 Study Limitation

The study encountered limitations primarily rooted in the unwillingness of some respondents to furnish reliable information upon request. This reluctance to disclose information may be attributed to various factors such as privacy concerns, fear of repercussions, or a lack of trust in the research process. It is acknowledged that these challenges can potentially introduce biases into the data, influencing the overall reliability and validity of the study findings.

To address this limitation, strategic measures were implemented. The collaboration of community leaders, including ward executive officers and street leaders, played a pivotal role in mitigating the hesitancy of certain respondents. These leaders, being trusted figures within the community, engaged in awareness campaigns emphasizing the importance of providing accurate information. Their involvement not only facilitated data collection but also contributed to building a rapport between the research team and the community.

Furthermore, the study faced constraints related to the observational aspect. While observation was employed to gather data on solid waste management practices, it presented challenges in capturing nuanced details and motivations behind certain behaviors. Observational limitations, such as the inability to discern underlying reasons for specific waste management choices, highlight the need for complementary methods to enhance the depth of understanding.

In addressing these limitations, the study emphasizes the importance of triangulation, combining multiple research methods, to enhance the credibility and reliability of the findings. Additionally, transparency regarding the encountered challenges is crucial for interpreting the study's outcomes accurately.

The willingness of community leaders to engage in education and awareness initiatives underscored the importance of community involvement in research endeavors. Future studies in similar contexts may benefit from adopting community-based participatory research approaches to foster trust, encourage open communication, and enhance the overall quality of data collected. Despite, these limitations, the study provides valuable insights into the determinants of household choices on solid waste management practices in Morogoro Municipality, Tanzania. Acknowledging and addressing these limitations not only strengthens the study's internal validity but also informs recommendations for future research methodologies in the field of waste management and environmental studies.

1.9 Description of the Organization of the Dissertation

The dissertation is structured into five main chapters, each contributing to a comprehensive understanding of the determinants of household choices on solid waste management practices in Morogoro Municipality, Tanzania.

Chapter 1: Introduction

The first chapter serves as an introduction, establishing the context and background of the research topic. It presents the problem statement, highlighting the urgency and significance of addressing solid waste management challenges. The justification of the study is outlined, emphasizing the critical role of effective waste management in environmental sustainability. Additionally, the chapter delineates the research objectives, guiding the subsequent investigations.

Chapter 2: Sub Saharan Journal Manuscript

The second chapter incorporates a publishable manuscript designed for the ***Sub Saharan Journal of Social Sciences and Humanities*** at SUA This manuscript aligns with the second and third research objectives, delving into the association of solid waste management practices across three wards and exploring the socioeconomic factors influencing household-level solid waste management practices in Morogoro Municipality, Tanzania.

Chapter 3: Research Paper

In the third chapter, a research paper is submitted to the **Tanzania journal of community Development at SUA.** Covering the first and fourth research objectives. The paper focuses on the types of solid waste predominantly produced at the household level and assesses community perception and awareness regarding proper solid waste management in Morogoro Municipality, Tanzania. This chapter adds depth to the understanding of waste generation patterns and community perspectives.

Chapter 4: General Discussion

The fourth chapter serves as a platform for the general discussion, offering an overarching synthesis of the main findings. It provides an in-depth overview and summary, elucidating the implications of the research outcomes. Through a comprehensive discussion, this chapter connects the research objectives, analyses key themes, and highlights the broader implications of the study.

Chapter 5: Conclusions and Recommendations

The final chapter encapsulates the conclusions drawn from the study, emphasizing key takeaways and lessons learned. It also presents practical recommendations derived from the research findings, offering actionable insights for policymakers, practitioners, and community stakeholders. Additionally, the chapter suggests avenues for future research and development in the field of solid waste management, contributing to the continuous improvement of waste management practices.

This organizational structure ensures a logical flow of information, guiding readers through the exploration of household choices on solid waste management practices in Morogoro Municipality. Each chapter plays a distinct role in presenting, analysing, and synthesizing critical aspects of the research, contributing to the overall depth and coherence of the dissertation.

CHAPTER TWO

PAPER I

2.0 Socioeconomic Factors associated with Household-Level Solid Waste Management Practices in Morogoro Municipality, Tanzania

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Socioeconomic Factors Associated with Household-Level Solid Waste Management Practices in Morogoro Municipality, Tanzania

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Abstract

Effective solid waste management stands as a critical global challenge, impacting human well-being, environmental sustainability, and the ongoing climate crisis. In Morogoro Municipality, the complex interplay between household-level waste management and socioeconomic factors amplifies this concern. As urbanization and consumption patterns evolve, comprehending the dynamics shaping waste practices becomes paramount. This study investigates the intricate relationship between socioeconomic factors and household-level solid waste management. Employing a descriptive cross-sectional design, we engaged 70 households across diverse wards: Mji Mkuu, Mazimbu, and Mji Mpya. Through structured interviews, we extracted insights, complemented by perspectives from ten purposively selected key informants. Leveraging the robust Kobo Collect survey tool and a designed question checklist, we harnessed descriptive statistics to fathom waste management associations within and across wards. Multivariate Probit Model unveiled intricate relationships between socioeconomic characteristics and waste practices. Noteworthy trends emerged, indicating a majority of female respondents (65.7%), aged 46 to 60 (34.3%), married (67.1%), with primary education (55.7%). A substantial number of self-employed individuals (65.7%) actively participated in waste management. Deeper analysis underscored the significant impact of independent variables on waste disposal practices through Multivariate Probit

Model. Chi-Square Tests illuminated associations between waste practices across wards, highlighting the nuanced challenge. In conclusion, household waste management in Morogoro Municipality is intricately tied to socioeconomic factors. These findings drive policy adjustments, given the inadequacy of current waste practices. Urgent steps include grassroots environmental education and comprehensive policy enhancements to foster progress in waste management practices.

Keywords; *Solid waste management, solid waste management practices, socioeconomic factors; household level*.

2.1 Introduction

Solid waste management is a crucial aspect of maintaining a healthy environment and protecting public health. It involves a multidisciplinary approach encompassing natural and social sciences, including processes such as collection, sorting, transportation, storage, treatment, and final disposal of solid waste (Nanda and Berruti, 2021). Effective solid waste management practices are necessary to prevent disease outbreaks like cholera and to mitigate the environmental impacts caused by inorganic and biodegradable waste (Allison, 2014). The management of solid waste plays a vital role in reducing and controlling the amount of waste generated from various human activities, thereby preserving the environment and safeguarding public health (Rasmeni and Madyira, 2019). However, improper waste management practices can contribute to environmental degradation and pose health risks to individuals through air and land pollution. Since different types of solid waste are produced within communities, there is no universal approach to managing all waste materials under all circumstances (EPA, 2020).

The implementation of solid waste management practices varies across different communities, and several factors influence their effectiveness. These factors include the availability of infrastructure,

income levels, and policy frameworks. Each community develops its own solid waste management practice, considering these influential

factors in shaping their approach to solid waste management. Solid waste management has emerged as a significant and pressing issue due to inadequate practices in storage, transportation, treatment, and disposal. The improper handling of solid waste results in a considerable portion of it being deposited in the environment through unacceptable means of disposal. This situation poses serious risks to both the environment and public health (Alam and Ahmade, 2013).

However, the government initiate some strategies through collaboration with private sector entities, Non-Governmental Organizations (NGOs), and Community-Based Organizations (CBOs) to participate in the management of solid waste (SWM) services but the problem of improper solid waste management still exists. In this context, Morogoro Municipality introduced the 'Mpango wa Kudhibiti Taka Ngumu' (MUTAMO) initiative, aiming to engage more stakeholders, including 40 CBOs, in the field of solid waste management (Kalwani, 2006). Unfortunately, these CBOs, involved in waste management, faced challenges and eventually ceased operations due to a lack of essential capacity, expertise, knowledge, and technology.

Existing literature, as explored by Birhanu and Berisa (2015), Yoada *et al.* (2014), and Fadhullah *et al.* (2022), sheds light on common solid waste management practices at the household level and their environmental challenges. dumping, is the practices employed mostly in developing countries such as Tanzania and Ethiopia contributing to environmental degradation and eruption of communicable diseases due to ineffective implementation and insuffient municipal solid waste management service (Ferronato and Torretta, 2019) landfills which are one of the oldest, cheapest, and widely used practices for solid waste management pose risks to soil fertility. However, for certain types of waste, such as hazardous materials, landfills may still be the most suitable option for safe

disposal (Kamaruddin *et al.,* 2017). Burning waste is an environmentally unfriendly practice, as it causes air pollution and adverse health effects such as respiratory issues, nausea,

headaches, rashes, and cardiovascular diseases (Ramadan *et al.,* 2022). Reuse, on the other hand, presents a promising approach to solid waste management, involving activities like repair, refurbishment, and repurposing. By promoting reuse, significant reductions in waste generation and the need for new products and materials can be achieved, leading to notable environmental, social, and economic benefits (Pariatamby *et al.,* 2014). The United Nations Environment Programme (UNEP) emphasizes the positive impacts of reuse in reducing waste generation and associated environmental impacts (UNEP report). Inadequate practices in solid waste management can result in improper waste handling, leading to the spread of diseases.

Existing literature, as explored by Fadhullah *et al.* (2022), Nyampundu *et al.* (2020), and Michael *et al.* (2019), highlights that many developing countries rely on environmentally unfriendly solid waste management practices such as landfilling, burning, and open dumping. These practices pose significant health risks to humans, including the potential outbreak of diseases such as cholera and typhoid. In Ethiopia, for example, Teshome (2021) notes that the majority of people in various locations frequently dispose of their solid waste through burning, landfilling, or open dumping due to the rudimentary and insufficient solid waste services available. In such cases, there is often a lack of proper infrastructure, with limited resources such as a single dump truck for solid waste collection and disposal services for an entire town. Warunasinghe and Yapa (2016) also highlight the prevalence of dumping, landfilling, and burning as common practices for solid waste management, pzarticularly when the waste consists mainly of organic materials such as vegetable and food remains and leaves. However, these practices are not sustainable and have the potential to cause severe environmental degradation, ultimately affecting the health and well-being of the local population.

Various studies, including those conducted by Yoada *et al.* (2014), Fadhullah *et al.* (2022), Coker *et al.* (2016), and McAllister (2015), emphasize the significant association between socioeconomic and demographic factors and household choices regarding solid waste

management practices. Household decisions regarding solid waste management are often influenced by the availability and convenience of services. Abegaz *et al.* (2021) conducted a study highlighting the impact of factors such as age, education level, occupation status, and monthly income on solid waste management practices. The findings revealed that these factors play a crucial role in determining whether households adopt effective or poor solid waste management practices.

The insufficient and ineffective implementation of solid waste management practices has led to increased environmental pollution, including air and land pollution, making the environment unfriendly for organisms and various activities (McAllister, 2015). The existing literature, as presented by Srivastava *et al.* (2015), Fernando (2019), and Dlamini *et al.* (2019), highlights the challenges faced in solid waste management practices. These challenges include poor infrastructure, inadequate planning, governance issues, lack of appropriate technology, weak enforcement of existing legislation, and the absence of economic incentives to promote environmentally sound development. The main objective of this study is to examine the socio-economic factors associated with solid waste management practices at the household level in Morogoro Municipality. Specifically, the study aims to explore the specific practices employed for solid waste management.

2.2 Theoretical Framework on the Socioeconomic Factors Associated with Household-Level Solid Waste Management Practices

The theoretical framework for understanding the socioeconomic factors associated with household-level solid waste management practices encompasses various perspectives and theories. This study adopted the Integrated Waste Management (IWM) model as an approach of waste management that incorporates multiple strategies and techniques to minimize the impact of waste on the environment and human health (UNEP, 2006). The IWM model assumes that an integrated and comprehensive approach to waste management is essential. It recognizes that solid waste management involves a range of activities, including waste reduction, reuse, recycling, and

appropriate disposal methods, which should be considered holistically. Likewise, the IWM model assumes that socioeconomic factors significantly influence household-level solid waste management practices. It acknowledges that individuals' socioeconomic characteristics, such as income, education, and occupation, can shape their waste management behaviors and choices. Furthermore, the IWM model assumes that effective waste management requires collaboration among various stakeholders, including households, government agencies, waste management authorities, and the private sector. It emphasizes the importance of partnerships and coordination to achieve sustainable waste management outcomes.

However, critics argue that the implementation of the IWM model can be challenging due to resource constraints, inadequate infrastructure, and limited stakeholder engagement. Achieving the integration of waste management activities at all stages requires significant investments, coordination, and cooperation among multiple actors, which can be difficult to achieve in practice. Similarly, critics suggest that the applicability of the IWM model may vary across different contexts and regions. Socioeconomic factors, waste management infrastructure, and cultural norms can differ significantly, affecting the feasibility and effectiveness of implementing an integrated waste management approach. In the same vein, some critics argue that the IWM model may be overly complex and difficult to operationalize. The integration of multiple waste management practices and the involvement of various stakeholders require careful planning, capacity-building, and effective governance, which can be resource-intensive and time-consuming.

Despite the critics, the IWM model is highly relevant in addressing the socioeconomic factors associated with household-level solid waste management practices. It provides a comprehensive framework for understanding and addressing waste management challenges by considering the interplay between socioeconomic factors, waste

reduction strategies, recycling initiatives, and appropriate disposal methods. By promoting collaboration among stakeholders and emphasizing the importance of holistic waste management approaches, the IWM model offers a pathway towards sustainable waste management practices.

Therefore, the IWM model as a theoretical framework for understanding the socioeconomic factors associated with household-level solid waste management practices provides a holistic and integrated approach to waste management. While it faces implementation challenges and contextual variations, the model's relevance lies in its ability to promote collaboration, address socioeconomic factors, and achieve sustainable waste management outcomes. The findings suggest that integrated waste management approaches, coupled with multi-stakeholder collaboration and education, can lead to improved waste management practices at the household level.

2.3 Methodology

2.3.1 Study Area

The study conducted for this paper took place in Morogoro Municipal, Tanzania, specifically focusing on three wards: Mji mkuu, Mazimbu, and Mji mpya. Morogoro Municipal serves as the regional headquarters of Morogoro Region and encompasses 29 wards and 275 streets. The projected population of Morogoro Municipal in 2022 was approximately 440 000.

The choice of Morogoro Municipal as the study area is justified by several factors. First of all, despite having a relatively small population, Morogoro Municipal generates a significant amount of waste. This implies that there may be specific waste management challenges unique to this area that warrants investigation. Moreover, Morogoro Municipal is experiencing rapid population growth, yet there

is a lack of strategic services for solid waste management. This suggests an urgent need to address waste management practices to keep pace with the increasing waste generation. Lastly, due to its comparatively smaller population, Morogoro Municipal presents an opportunity for effective community participation in municipal solid waste management. Understanding the socioeconomic factors influencing waste management practices in this context can provide valuable insights for developing targeted interventions and strategies to improve waste management practices and foster community engagement. Therefore, by selecting Morogoro Municipal as the study area, the research aims to address the specific waste management challenges faced by a rapidly growing municipality with limited services and explore the potential for community involvement in solid waste management.

2.3.2 Research Design

The research design meticulously chosen for this study was a descriptive cross-sectional design, a strategic approach lauded for its manifold advantages. As Setia (2016) affirms, this design stands out for its adeptness in gathering precise information from respondents at a singular juncture. Renowned for its precision in encapsulating a snapshot of the research variables, it excels in achieving descriptive goals, thereby facilitating the exploration of inter-variable relationships.

Therefore, by embracing the descriptive cross-sectional design, this study sought to furnish an all-encompassing panorama of the socioeconomic underpinnings intertwined with household-level solid waste management practices in Morogoro Municipality, Tanzania. This design harmonized perfectly with the aspiration to amass data from a diverse spectrum of households in a precise temporal frame. Such synchronization empowered the researchers to dissect the current landscape of solid waste management practices and delve into the intricate nexus between socioeconomic facets and these very practices.

2.3.3 Sampling Procedures and Sample Size

The sampling procedures for this study involved the use of simple random sampling to select the wards, sub-wards, and households. This method ensured that each ward, sub-ward, and household had an equal chance of being included in the study, enhancing the representativeness of the sample. Additionally, a purposive sampling technique was utilized to select five key informants who possessed relevant expertise and knowledge in the field of solid waste management.

The sample size for the study was determined based on calculations using Nassiuma's (2000) guidelines. A total of 70 respondents were selected to participate in the study. This sample size was deemed appropriate to gather sufficient data and provide meaningful insights into the socioeconomic factors associated with household-level solid waste management practices in Morogoro Municipality, Tanzania. The selected sample size aimed to balance the need for adequate representation and feasibility of data collection within the available resources and time constraints.

$n = (NCv^2) / (Cv^2 + (N - 1) e^2)$

Where; n = the desired sample size,

N = Target population.

C_V = Coefficient of variation (take 0.5).

e = Tolerance at desired level of confidence (0.06) at 95% confidence level.

Where by: $n = (NCv^2) / (Cv^2 + (N - 1) e^2)$

$n = 315{,}866 \times 0.25 / 0.25 + (315{,}866 - 1)\ 0.06^2$

n = 70

Therefore, the sample size for the study was 70 respondents.

2.3.4 Data collection

Quantitative and qualitative data for this study on socioeconomic factors associated with household-level solid waste management practices in Morogoro Municipality, Tanzania were collected using a structured questionnaire. The questionnaire, administered through the Kobo Collect survey tool, comprised a combination of closed-ended

and open-ended questions. This approach enabled the collection of detailed information about various aspects of solid waste management from the individuals responsible for these activities in the households.

In addition to the questionnaire, qualitative data were gathered from key informants. A checklist of semi-structured questions was used to guide the interviews with the key informants, allowing for in-depth discussions and the exploration of nuanced perspectives related to solid waste management. The use of a structured questionnaire ensured standardized data collection, facilitating comparability and enabling quantitative analysis of the collected data. The inclusion of open-ended questions in the questionnaire provided opportunities for respondents to provide detailed insights and opinions on solid waste management practices. Therefore, by incorporating both quantitative and qualitative data collection methods, this study aimed to obtain a comprehensive understanding of the socioeconomic factors influencing household-level solid waste management practices in Morogoro Municipality.

2.3.5 Data analysis

The collected data from the Kobo tool in this study on socioeconomic factors associated with household-level solid waste management practices in Morogoro Municipality, Tanzania were analysed using IBM SPSS Statistics software (version 26). To ensure data quality, a data cleaning process was conducted to eliminate any errors or inconsistencies. For the quantitative data analysis, descriptive statistics were employed. Frequencies and percentages were calculated to provide a quantitative summary of the data, allowing for a better understanding of the patterns and characteristics of the respondents' waste management practices.

To assess the association between waste management practices in the three wards, the Pearson Chi-Square Tests were utilized. This statistical test helped determine if there was a significant relationship between solid waste management practices across wards. Furthermore, Multivariate Probit Model analysis was employed to explore the relationship between socioeconomic characteristics and

solid waste management practices, specifically focusing on re-use, landfill, burning, and dumping. The results of the logistic regression analysis were presented in terms of odds ratios and confidence intervals.

Qualitative data obtained from the open-ended questions and key informant interviews underwent content analysis. This method involved identifying common themes and patterns in the responses to gain insights into the qualitative aspects of solid waste management practices and associated socioeconomic factors. Therefore, the combination of quantitative and qualitative data analysis provided a comprehensive understanding of the socioeconomic factors influencing household-level solid waste management practices in Morogoro Municipality.

2.4 Results and Discussion

2.4.1 Socio-demographic and Economic Characteristics of Respondents

Understanding the socio-demographic and economic characteristics of the respondents is crucial for examining how these factors influence household-level solid waste management practices in Morogoro Municipality. By analysing the gender distribution and other relevant demographic characteristics, policymakers and waste management practitioners can tailor their strategies and interventions to address the specific needs and preferences of different groups within the community.

Table 2.1 presents a summary of the socio-demographic and economic characteristics of the respondents involved in solid waste management practices in Morogoro Municipality, Tanzania. The sample size consisted of 70 respondents, and their characteristics were analysed to gain insights into the demographic composition of the participants. The results indicate that out of the 70 respondents, 24 individuals, accounting for approximately 34.3% of the sample, were male. On the other hand, the majority of respondents, comprising 46 individuals, were female, constituting about 65.7% of the sample. This finding aligns with the research conducted by Christina *et al.* (2021), which also observed a higher percentage of

females being responsible for waste management at the household level. This suggests that females are more involved in household duties, including environmental cleanliness, and tend to stay at home compared to males.

Table 2.1: Demographic characteristics of respondents under study (n=70)

Demographic variables		Frequency	Percentage (%)
Gender	Female	46	65.7
	Male	24	34.3
Age category	18 – 25 years old	17	24.3
	26 – 35 years old	7	10.0
	36 – 45 years old	20	28.6
	46 – 60 years old	24	34.3
	Above 60 years old	2	2.9
Marital status	Married	47	67.1
	Single	14	20.0
	Widow/Widower	9	12.9
Education level	No formal education	5	7.1
	Primary school education	39	55.7
	Secondary school education	19	7.1
	Tertiary education	7	10.0
Employment status	Government Employee	5	7.1
	Self-employed	46	65.7
	Unemployment	19	27.1

The respondents in the study were categorized into five age groups. The results showed that 34.3% of the respondents fell within the age range of 46-60 years, while 28.6% were aged between 36-45 years. Additionally, 24.3% of the respondents were in the age group of 26-35 years, and 10.0% were aged between 18-25 years. The age group

of 60 and above had the lowest percentage, accounting for only 2.9% of the respondents.

The findings regarding the age distribution and their involvement in waste management practices align with a study conducted by Nsimbe *et al*. (2018). Their study also revealed that a majority of the respondents responsible for waste management were mature adults aged between 45-60 years, constituting 34.8% of the sample. This suggests that mature adults possess the necessary reasoning skills and comprehension of solid waste management issues, making them more likely to take responsibility for waste management activities.

Examining the socio-demographic characteristics, such as age, is essential in understanding the dynamics of household-level solid waste management practices in Morogoro Municipality. Different age groups may have varying levels of awareness, knowledge, and capacity to engage in sustainable waste management practices. By considering the age distribution of the respondents, policymakers and waste management stakeholders can tailor their interventions and educational programs to target specific age groups and address their unique needs and perspectives.

The majority of the respondents in the study, accounting for 67.1%, were married. Only 20.1% of the respondents were single, while 12.1% were identified as widows or widowers. These findings are consistent with the results of a study conducted by Laor *et al*. (2018), who reported that more than half of the respondents (63.2%) were married, followed by 31.5% who were single.

The marital status of individuals had implications for their involvement in household-level solid waste management practices. Married individuals had additional responsibilities and shared decision-making processes within the household, which can influence their engagement in waste management activities. Singles, on the other hand, had more autonomy and flexibility in managing their own waste. The presence of widows or widowers in the study highlights the importance of considering the specific needs and circumstances of individuals who may be managing waste on their own.

By understanding the distribution of marital statuses among respondents, policymakers and waste management practitioners can develop targeted strategies and interventions to promote sustainable waste management practices. These strategies can take into account the different roles and responsibilities associated with various marital statuses and address the specific challenges and opportunities that arise within each category.

In terms of education, the findings reveal that a small percentage of respondents, specifically 7.1%, had informal education. The majority of respondents, accounting for 55.7%, had received primary education, while only 7.1% had attained secondary education. Those with tertiary education constituted only 10% of the sample. These results align with the findings of a study conducted by Han *et al.* (2018), which reported that 84.4% of respondents had received primary education or below, while only 15.6% had attended secondary school or above.

The level of education can significantly influence individuals' knowledge, awareness, and understanding of solid waste management practices. Higher levels of education are often associated with increased awareness of environmental issues, including the importance of proper waste management. Individuals with formal education may have access to information and resources that enable them to adopt more sustainable waste management practices.

On the other hand, individuals with limited education face challenges in understanding the environmental and health impacts of improper waste disposal and may be less aware of the available waste management options. They may rely more heavily on traditional or conventional waste disposal methods that are less environmentally friendly. Therefore, by considering the educational background of respondents, policymakers and stakeholders can design educational programs and campaigns tailored to different educational levels. These initiatives can aim to raise awareness, provide information on

sustainable waste management practices, and promote behavior change among individuals with varying educational backgrounds.

In terms of employment status, the study found that 7.1% of the respondents were government employees, while the majority, accounting for 65.7%, were self-employed. Only 27.1% of the respondents were unemployed. These findings align with a study conducted by Abegaz *et al.* (2021), which reported that the majority of people (71%) in a similar context were self-employed, engaged in various economic activities.

The high percentage of self-employed individuals in the sample suggests that many households in Morogoro Municipality rely on their own businesses or informal economic activities for their livelihoods. Self-employment often offers flexibility and opportunities for income generation, but it can also have implications for waste management practices. Self-employed individuals may face unique challenges in managing solid waste effectively. They may have limited resources or access to waste management infrastructure and services compared to formal workplaces or government institutions.

As a result, self-employed individuals may resort to informal waste disposal methods or may not prioritize proper waste management practices. Therefore, understanding the employment status of respondents is important in identifying specific socioeconomic factors that may influence household-level solid waste management practices. Policymakers and stakeholders can use this information to tailor interventions and initiatives to address the needs and circumstances of self-employed individuals, promote sustainable waste management practices within their businesses, and provide support or resources to improve waste management infrastructure in self-employed sectors. Furthermore, by addressing the waste management challenges faced by self-employed individuals, there is an opportunity to promote sustainable practices, enhance environmental consciousness, and contribute to the overall improvement of solid waste management in the Morogoro Municipality.

2.4.2 Solid Waste Management Practices

Based on the findings presented in Figure 1, the most commonly used solid waste management practice among the respondents in Morogoro Municipality was dumping, accounting for 68.6% of the households. Reuse ranked second with a prevalence of 62.9%, closely followed by burning at 55.7%, and landfill at 50%.

These findings are consistent with a study conducted by Yoada *et al.* (2014), which reported that the most common practice among households was dumping, with a prevalence rate of 61.0%. Dumping often involves households disposing of their waste at designated waste bins and having it collected by private contractors. However, it is important to note that the study's findings also highlight the negative impact of dumping as a waste management practice, including environmental degradation and the potential spread of diseases when not effectively implemented.

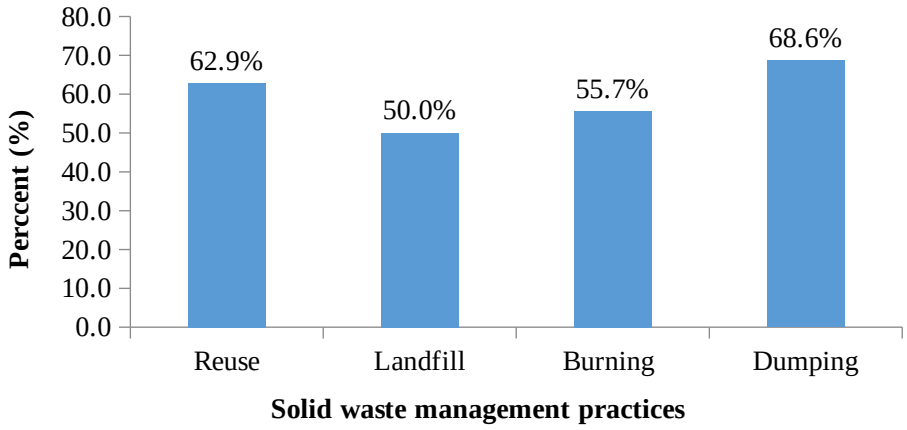

Figure 2.1: The overall pattern solid waste management practices in percentage

The high prevalence of dumping as a solid waste management practice in Morogoro Municipality raises concerns about the environmental and health implications associated with improper waste disposal. Dumping can contribute to the contamination of land, water bodies, and air, posing risks to human health and ecosystems.

It is crucial to address these challenges by promoting sustainable and environmentally friendly waste management practices.

The relatively high adoption of reuse as a solid waste management practice is encouraging, as it reflects a recognition of the value of reusing materials instead of discarding them. Reuse can contribute to waste reduction, resource conservation, and economic benefits. Efforts should be made to further promote and support reuse practices within the community.

The findings emphasize the need for comprehensive and effective solid waste management strategies that prioritize waste reduction, recycling, proper disposal, and public awareness. It is essential to educate and engage households in sustainable solid waste management practices, highlighting the potential environmental and health consequences of inadequate waste disposal methods. By promoting alternative practices such as recycling and composting, stakeholders can work towards mitigating the negative impacts of dumping and burning while fostering a cleaner and healthier environment for the residents of Morogoro Municipality.

2.4.3 Solid Waste Management Practices Across Three Wards

The results presented in Table 2.2 indicate that there are significant differences in waste management practices among the three wards (Mazimbu, Mji Mkuu, and Mji Mpya). The table shows the frequency and percentage of respondents who reported engaging in different waste management practices, such as waste reuse, landfill use, burning waste, and waste dumping, in each ward. The "Chi-Square Tests" results indicate whether these differences in waste management practices between the wards are statistically significant or simply due to chance. A Chi-Square test is a statistical method used to determine if there is a significant association between two categorical variables, in this case, the solid waste management practices and the wards.

The results of the Chi-Square tests show that there is a statistically significant association of solid waste management practices across the wards for each of the practices examined (waste reuse, landfill

use, burning waste, and waste dumping). This means that the differences in waste management practices observed between the wards are not random but are influenced by the ward in which the respondents live. In practical terms, this means that the solid waste management practices are not uniform across the three wards. Each ward has its own patterns and tendencies regarding waste management. For example, one ward may have a higher proportion of people who practice waste reuse, while another ward may have more people using landfills for waste disposal. Additionally, certain waste management practices may be more prevalent or less prevalent in specific wards compared to others.

Table 2.2: The association between waste management practices across wards (n=3)

		Ward						Total		Chi-Square Tests		
Waste management practices		Mazimbu		Mji Mkuu		Mji Mpya				Pearson-value	df	Sig.
		Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent			
Reuse	No	16	61.5	5	22.7	5	22.7	26	37.1	10.544	2	0.005*
	Yes	10	38.5	17	77.3	17	77.3	44	62.9			
Landfill	No	19	73.1	7	31.8	9	40.9	35	50.0	9.175	2	0.010*
	Yes	7	26.9	15	68.2	13	59.1	35	50.0			
Burning	No	15	57.7	5	22.7	11	50.0	31	44.3	6.329	2	0.042*
	Yes	11	42.3	17	77.3	11	50.0	39	55.7			
Dumping	No	14	53.8	4	18.2	4	18.2	22	31.4	9.646	2	0.008*
	Yes	12	46.2	18	81.8	18	81.8	48	68.6			

2.4.3.1 Reuse

The Table 2.2 results show that the Chi-Square test for reuse, indicates a statistically significant association between wards and waste reuse practices (Chi-Square value = 10.544, df = 2, p-value = 0.005*). This implies that the waste reuse practices are not uniform across wards, and there is a significant difference in the proportion of people who engage in waste reuse in each ward. The highest proportion of households engaging in reuse is found in Mji Mpya and Mji Mkuu wards (77.3%), while Mazimbu ward has a lower proportion (38.5%). These differences indicate that the adoption of reuse as a waste management practice is more prevalent in Mji Mpya and Mji Mkuu wards compared to Mazimbu ward. The preference for using

waste reuse as a waste management practice in specific wards were found to be influenced by several factors, including environmental consciousness, resource conservation efforts, economic incentives, cultural traditions, and access to creative opportunities. Studies such as Yu *et al*. (2020), Jaafarzadeh Haghighi *et al.* (2019), Kothari and Gupta (2020), and Agboh-Noameshie *et al.* (2017) have explored the drivers behind waste reuse behaviors in different communities. These studies have highlighted the role of environmental awareness and the desire to reduce waste generation, as well as the economic benefits and creative potential associated with waste reuse practices. Moreover, cultural norms and traditions can play a significant role in influencing people's inclination towards reusing waste materials. Understanding these influencing factors can aid in the development of targeted educational and policy initiatives to promote waste reuse practices in the identified wards, fostering sustainable waste management practices and resource conservation. The variation in waste reuse practices calls for targeted efforts in sustainable waste management.

2.4.3.2 Landfill

In landfill waste management practice, the Chi-Square test indicates a statistically significant association between wards and the use of landfills for waste disposal (Chi-Square value = 9.175, df = 2, p-value = 0.010*). This implies that the use of landfills for waste disposal varies significantly between wards, indicating differences in waste management practices. Upon examining the frequency and percentage Table 2.2, it is evident that the proportions of households practicing landfill waste management differ across the three wards in Morogoro Municipality, Tanzania. The highest proportion of households engaging in landfill waste management practice is observed in Mji Mkuu ward (68.2%) and Mji Mpya ward (59.1%), whereas Mazimbu ward has a lower proportion (26.9%). The preference for using landfills as a waste management practice in specific wards were influenced by a combination of factors, including the availability and accessibility of landfill facilities, the inefficiency of waste collection services, waste disposal costs, cultural attitudes and norms towards waste, environmental awareness. Studies such as Ba-Swe *et al.* (2020), Kaza *et al.* (2018), Lee and Wong (2018),

Pampaloni *et al*. (2015), Ogola *et al.* (2019), and Osibanjo and Nnorom (2011) have explored these influences in various contexts, highlighting the multifaceted nature of factors shaping people's preferences for landfill use in different communities. Variations in landfill waste management across wards necessitate considering factors like accessibility of waste collection services, and environmental awareness.

2.4.3.3 Burning

In Table 2.2, the chi-square test indicates statistical significance association of burning waste practice across the wards (Chi-Square value = 6.329, df = 2, p-value = 0.042*). Implying that, there are significant differences in burning waste as a waste management practice across the different wards. The proportion of households practicing the burning waste management practice is highest in Mji Mkuu (77.3%) and Mji Mpya (50%) wards compared to Mazimbu (42.3%) ward. These findings suggest that in Mji Mkuu and Mji Mpya wards, there is a prevalent poor practice of solid waste management that is not environmentally friendly. The high percentage of households resorting to burning waste as a disposal method raises concerns about the sustainability and potential negative impacts on the environment. The preference for using burning as a waste management practice in specific wards were influenced by several factors, including limited waste collection services and disposal infrastructure, abundance of deciduous trees that shed their leaves and inadequate solid waste management policies. Studies such as Osmani and Hudson (2016), Phan *et al.* (2019), Rahman *et al.* (2018), and Song *et al.* (2017) have investigated the drivers behind waste burning practices in different regions. These studies have highlighted the significance of local context and socio-economic factors in shaping people's reliance on burning as a waste disposal method, as well as the implications of such practices on environmental and public health concerns. The prevalence of burning waste in Mji Mkuu and Mji Mpya wards raises concerns about the need for environmentally friendly waste management practices.

2.4.3.4 Dumping

The Chi-Square test indicates a statistically significant association across wards and waste dumping practices (Chi-Square value = 9.646, df = 2, p-value = 0.008*). This means that the practice of dumping waste differs significantly between wards, indicating variations in waste disposal behaviors. The proportion of households practicing the dumping waste management practice is highest in Mji Mkuu (81.8%) and Mji Mpya (81.8%) wards compared to Mazimbu (46.2%) ward. The high prevalence of dumping waste raises concerns about the proper disposal of waste and the potential consequences for public health and the environment. When waste collection by the responsible organizations is delayed or inadequate, households may resort to improper dumping, leading to unsanitary conditions and an increased risk of diseases such as cholera.

The preference for using dumping as a waste management practice in specific wards was be influenced by a combination of factors, including adequate waste collection and disposal infrastructure, awareness about proper waste management practices. Studies such as Das *et al.* (2020), Sujauddin *et al.* (2018), Sahid *et al.* (2019), and Uddin *et al.* (2017) have examined the drivers behind waste dumping behaviors in various contexts. These studies have shed light on how the absence of efficient waste management systems and educational campaigns can lead to illegal dumping practices, with adverse effects on the environment, public health, and community aesthetics. Understanding these factors is essential for implementing targeted interventions to encourage proper waste disposal practices and discourage harmful dumping behaviors in the identified wards.

Overall, the results suggest that waste management practices vary significantly across different wards. It highlights the importance of implementing tailored waste management strategies for each ward to address specific challenges and promote sustainable waste disposal practices. Understanding these differences can help policymakers and local authorities develop targeted interventions to improve waste management practices in each ward.

2.4.4 Factors Associated with Waste Management Practices Preferences

Table 2.3 presents the findings of a Multivariate Probit model analysis conducted to examine the association between socioeconomic characteristics and solid waste management practices, including re-use, landfill, burning, and dumping. The results are reported in the form of coefficient along with their corresponding significance level. Three asterisks (***) denote a significance level of $p < 0.01$, two asterisks (**) indicate a significance level of $p < 0.05$, and (*) indicates a significance level of $p<0.1$.

Table 2.3: The Multivariate Probit Model of social economic characteristics on preference of solid waste management practices (n=70)

Variable	Dumping			Landfill			Reuse			Burning		
	Coef.	Std.Err.	P>z	Coef.	Std.Err.	P>z	Coef.	Std.Err.	P>z	Coef.	Std.Err.	P>z
Education	0.637	0.508	0.210	0.068	0.458	0.881	2.018	0.498	0.000***	0.560	0.412	0.173
Income	1.758	0.446	0.000***	-0.377	0.450	0.403	-0.021	0.579	0.970	0.249	0.453	0.583
Household size	-0.539	0.457	0.239	-0.177	0.466	0.704	-1.034	0.608	0.089*	1.421	0.414	0.001***
Duration of residence	1.630	0.490	0.001***	-0.398	0.504	0.101	0.465	0.023**	0.371	0.206	0.508	0.686
Waste storage facility	0.104	0.466	0.024**	0.159	0.465	0.033**	-0.367	0.614	0.550	0.322	0.486	0.508
Fee waste collector	-0.032	0.523	0.051**	0.407	0.433	0.347	0.279	0.427	0.514	-0.193	0.431	0.655
Infrastructure	-1.128	0.515	0.028**	-0.829	0.508	0.103*	0.100	0.521	0.848	-0.188	0.489	0.701
Land size	0.191	0.387	0.621	0.390	0.338	.049**	0.264	0.327	0.019*	0.631	0.357	0.077*
cons	-1.642	0.953	0.085	-0.950	1.081	0.379	-2.955	1.282	0.021	-1.495	1.085	0.168
/atrho21	-0.534	0.367	0.145									
/atrho31	0.515	0.365	0.158									
/atrho41			0.993									

	0.002	0.285	
/atrho32			0.730
	0.151	0.438	

/atrho42	-0.321	0.261	0.218
/atrho43	0.270	0.368	0.463
rho21	-0.489	0.279	0.080
rho31	-0.474	0.283	0.094
rho41	0.002	0.285	0.993
rho32	0.150	0.428	0.726
rho42	-0.311	0.236	0.188
rho43	0.263	0.342	0.442

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Likelihood ratio test of rho21 = rho31 = rho41 = rho32 = rho42 = rho43 = 0:
chi2 (6) = 6.34137 Prob > chi2 = 0.3861
Level of significance: *** meaning (P<0.01), ** meaning (p<0.05), * meaning (0.1)

Education

The coefficient for education indicates a positive significance association with waste reuse preference (Coef=2.018; p=0.000). This suggests that individuals with higher education levels are more likely to prefer waste reuse as a solid waste management practice due to familiarity with pro-environmental behavior and education about environmental protection which influence them to engage in proper solid waste management practice. However, education does not significantly affect preferences for dumpsite usage, landfill disposal, or burning. This result is similar to the study by Fredrick *et al. (*2018) and Maryati *et al. (*2018) which said education plays a vital role in proper solid waste management due to more awareness about proper methods for solid waste such as reuse which help to decrease the accumulation of solid waste which contribute to the improper solid waste management.

Income

Income plays a significant role in the preference for solid waste management methods, particularly dumping, as indicated by a coefficient of 1.758 and p-value of 0.000. This implies that individuals with higher incomes are more inclined to opt for dumping as a means of waste disposal, likely because they have the financial capability to pay for solid waste collection services. However, income does not notably impact preferences for landfill disposal, waste reuse, or burning. This finding is consistent with the research conducted by Adzawla *et al*. (2019), which suggests that income influences households' engagement in pro-environmental behaviors such as dumping for solid waste management, as individuals with higher incomes are more likely to afford waste collection fees compared to those with lower incomes. Additionally, it is observed that many households in Morogoro practice dumping as their primary method of solid waste management, involving waste collectors who collect solid waste from households in exchange for a fee for the collection service

Household Size:

Household size shows a significant association with the preference for waste reuse in solid waste management, with a coefficient of -1.034 and a p-value of 0.089. This indicates that smaller households

tend to prefer reuse due to the smaller volume of waste they generate compared to larger households. However, household size does not significantly impact preferences for dumping, landfilling, or burning. This finding is consistent with research conducted by Yoada et al. (2019), which suggests that smaller household size plays a significant role in encouraging waste reuse. Smaller households typically produce less waste, facilitating easier reuse compared to larger households which produce a higher volume of waste and contribute to environmental pollution if waste is not effectively managed. Poor monitoring of solid waste collection exacerbates the issue, as larger households may struggle with the timely pickup of waste by collectors, leading to the accumulation of waste and the potential outbreak of diseases.

Duration of residence

Individuals who have resided in their current residence for a longer period have significantly engaged in dumping (Coef 1.630, p = 0.001), and re-use behavior (Coef 0.101, p = 0.023). However, the length of time living in a residence is not significantly associated with landfill or burning behaviors. These findings suggest that individuals who have been living in an area for a longer duration are more likely to be familiar with the waste management practices prevalent in that area and are more likely to adopt pro-environmental behaviors such as re-use. On the other hand, engaging in dumping behaviors indicates that longer-term residents may have a better understanding of the negative consequences of improper waste disposal. This finding is consistent with the research conducted by Nanda and Berruti (2021), which emphasizes the strong relationship between the lengths of time a community has been settled and the types of waste management practices employed. Individuals who have resided in an area for a longer period tend to have more established waste management systems and are more aware of the importance of pro-environmental behaviors.

Waste storage facility

Waste storage facilities exhibit a significant association with dumping, with a coefficient of 0.104 (p=0.024) as well as with landfill disposal, with a coefficient of 0.159 (p=0.033), in preferences for solid waste

management. However, waste storage facilities do not significantly influence preferences for waste reuse or burning. This indicates that facilities like dumpsites and plastic bags, which aid in solid waste management, have a positive impact when effectively managed. Additionally, the availability of land for landfill purposes can help reduce the accumulation of unwanted solid waste, such as vegetable and food remnants, which can be utilized as manure for agricultural activities. These findings align with recent research by Smith et al. (2023), which emphasizes the significant impact of the availability and accessibility of waste storage facilities on waste disposal behavior. Individuals and households with convenient access to such facilities are more likely to opt for dumpsite usage and landfill disposal methods.

Waste collection fee

Paying a fee for waste collection is significantly associated with engaging in dumping behavior, with a coefficient of -0.032 (p=0.051) However, the payment of a fee for waste collection is not significantly associated with reuse, burning, or landfill behaviors. The presence of a fee for waste collection helps in waste management through waste collectors who visit households to collect waste and delays in household payment of collection fees contribute to the accumulation of solid waste in households, leading to outbreaks of diseases such as cholera and typhoid due to improper solid waste management. These findings suggest that the cost associated with waste collection can influence waste management behavior. This result aligns with the findings of Lee *et al.* (2014), which highlight the significance of paying a fee for solid waste management in influencing engagement in dumping practices. The collection fees collected by waste management organizations can contribute to the operational activities involved in proper solid waste management including transportation and disposal facilities.

Infrastructure

Infrastructure was significant to dumping (Coef -1.128; P=0.028) and landfill (Coef -0.829; P=0.103), this suggests that infrastructure facilitates the transportation of waste from households to dumpsites. When infrastructure is inadequate, it can lead to improper solid waste

management due to the accumulation of waste without proper collection. Additionally, the community's choice of waste disposal practices is influenced by the availability and quality of infrastructure. Effective dumping practices require infrastructure for the transportation of solid waste. Therefore, this result is similar to research conducted by Johnson et al. (2023), highlighting the intricate relationship between infrastructure and dumping and landfill practices in waste management. Infrastructure, encompassing physical structures, transportation networks, and waste disposal facilities, significantly influences the disposal methods chosen by individuals and communities. The availability and quality of infrastructure play a pivotal role in shaping waste management behaviors. In areas with inadequate waste collection systems and limited landfill capacity, individuals may resort to illegal dumping as a convenient and immediate solution to dispose of waste. Poorly maintained roads and insufficient transportation infrastructure can exacerbate this issue by hindering access to formal waste disposal facilities.

Land size

Land size significantly influences the choice of landfill disposal methods among households, Coef 0.390 (p=0.043). This suggests that households with larger land sizes tend to prefer landfills over those with smaller land sizes. Landfills help reduce the accumulation of solid waste, thereby mitigating the risk of disease outbreaks. However, it's important to note that landfills can also contribute to environmental pollution, such as land pollution. This result aligns with Research by Garcia et al. (2023) and underscores the impact of land size on households' choice of landfill as the preferred practice for solid waste management. Their study reveals that households with larger land sizes are more inclined to opt for landfill disposal methods. This association can be attributed to several factors. Firstly, households with ample land space may perceive landfill disposal as a convenient and cost-effective solution, as they have the physical capacity to accommodate landfills on their property. Additionally, larger land sizes may mitigate concerns about environmental and health hazards associated with landfills, as the distance between the landfill site and residential areas can be increased, minimizing potential negative impacts. Furthermore, households with larger land

sizes may have fewer restrictions and regulations regarding landfill construction and operation, making landfill disposal a more feasible option compared to households with limited land space.

2.5 Conclusion and Recommendations

2.5.1 Conclusion

The findings of this study highlight the influence of various socio-economic factors on household-level solid waste management practices in Morogoro Municipality, Tanzania. It is evident that various factors, such as education, income, infrastructure, land size household size, time living in the area, and paying a fee for waste collection, play a significant role in shaping waste disposal behaviors. It further evident that the current waste management practices at the household level are inadequate, leading to potential health risks and unpleasant odors within the community. Based on these findings, several recommendations can be made to improve solid waste management practices in the municipality.

2.5.2 Recommendations

To begin with, there is a need for targeted educational programs and awareness campaigns aimed at promoting sustainable waste management practices. These initiatives should focus on raising awareness about the environmental and health impacts of improper waste disposal and provide practical solutions for waste reduction, reuse, recycling, and proper waste disposal techniques.

Furthermore, policy interventions are crucial in addressing solid waste management challenges. The government should strengthen regulations and enforcement mechanisms to discourage improper waste disposal practices such as burning and dumping. Stricter penalties for illegal dumping should be imposed to deter individuals from engaging in such behaviors.

Moreover, collaboration between the municipal council and waste management service providers should be strengthened to ensure effective waste collection and disposal services. This can be achieved by improving waste collection infrastructure, implementing regular and reliable waste collection schedules, and promoting community engagement in waste management activities.

Additionally, financial incentives or subsidies can be considered to encourage households to actively participate in sustainable waste management practices. This could include offering discounts or incentives for households that engage in recycling or waste reduction activities.

Lastly, continuous monitoring and evaluation of waste management practices should be conducted to assess the effectiveness of implemented interventions and identify areas for improvement. This can help policymakers and waste management practitioners make informed decisions and adjust strategies as needed.

In general, a comprehensive and multi-faceted approach that combines education, policy reforms, infrastructure development, community engagement, and continuous monitoring is essential to improve household-level solid waste management practices in Morogoro Municipality. By addressing the socioeconomic factors associated with waste management, the municipality can move towards a cleaner, healthier, and more sustainable environment.

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CHAPTER THREE

MANUSCRIPT II
Assessment of community perception on Proper solid waste management at Household-level in Morogoro Municipality, Tanzania

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Abstract
Effective solid waste management is integral to environmental sustainability and public health. The success of waste management initiatives is intricately linked to the perceptions of the community, as their awareness and attitudes significantly influence the outcomes. This study, conducted in Morogoro Municipality, Tanzania, aimed to assess the community's perception of proper solid waste management at the household level. Employing a descriptive cross-sectional design, data were gathered from 70 respondents and 5 key informants using the Kobo Collect survey tool. Inferential statistics, specifically Pearson chi-square tests, were applied to analyze the data. Descriptive statistics, including frequencies and percentages, were used to explore the types of solid waste generated at the household level. The findings revealed that 38.6% of respondents produced vegetable waste, 28.6% produced leaves/grass, 20% produced plastic waste, and 12.9% generated various types of solid waste. The Chi-Square Tests demonstrated no significant differences in community awareness regarding the importance of proper solid waste management among wards, except for a significant difference

in the indicator of the decrease in the eruption of diseases. Descriptive statistics were employed to analyze the community's perception of obstacles hindering proper solid waste management. The Likert scale indicated a positive perception overall, with the highest composite mean score being 2.60. In conclusion, while the community holds a positive perception of solid waste management, certain factors, such as collection fees and infrastructure, hinder its effectiveness and efficiency at the household level. It is recommended that municipal authorities enhance strategies for solid waste management and implement educational campaigns to raise awareness in the community.

Keywords; *Solid waste management, proper solid waste management, community perception household level, Morogoro Municipality*

3.1 Introduction

Improper solid waste management poses a critical challenge characterized by the unauthorized disposal of waste, contributing to environmental degradation and health risks (Nzediegwu *et al.,* 2020). Solid waste encompasses discarded materials from various sources such as domestic, commercial, industrial, agricultural, and institutional activities, including construction debris and street sweeping (Kassaye, 2018; Nanda and Berruti, 2021). The types of solid waste, originating from households, cover a spectrum, including organic waste like vegetable remains, tree leaves, and plastics. Proper waste disposal is paramount to minimizing environmental risks and protecting human and animal health.

Local authorities, as highlighted in the study by Malik *et al.* (2015), bear the responsibility for effective and efficient solid waste management, with a particular emphasis on waste minimization at the household level. In contrast, Keramitsoglou and Tsagarakis (2013) argue that residents themselves play a pivotal role in waste management, being the primary waste producers. Despite numerous strategies developed, such as environmental education and training campaigns, challenges persist in waste management, requiring increased efforts to mobilize community participation (Azevedo *et al.,* 2021; Moh, 2017; Yukalang *et al.,* 2018).

Effective solid waste management involves the proper implementation of collection, transportation, and disposal practices, including dumping, reuse, recycling, and decomposing (Das *et al.,* 2019; Moh *et al.,* 2017). However, poor implementation, such as improper dumping, can lead to inadequate waste disposal. Private sector involvement, timely waste collection, and community awareness are crucial factors for successful waste management. Stakeholder engagement, including municipalities, community-based organizations (CBOs), and companies, is vital for effective waste management. However, challenges persist in developing countries due to issues such as poor infrastructure, technology, technical expertise, planning, and financial constraints (Kumar *et al.,* 2017; Nzediegwu *et al.,* 2020; Zohoori and Ghani, 2017).

Inadequate environmental education and awareness contribute to improper solid waste management in developing countries (Debrah *et al.,* 2021; Chengula *et al.,* 2015). The lack of active engagement and awareness among households, crucial stakeholders in waste management, further hinders proper waste disposal. Delays in households paying collection fees and unfavorable relationships with waste collectors add to the challenges. The absence of active campaigns and training exacerbates these issues (Yukalang *et al.,* 2017; Azevedo *et al.,* 2021).

Literature by Kumar and Anand (2017), Sahu and Mishra (2023), Olukanni *et al.* (2020), and Serge (2021) emphasizes the role of community perception in waste management. Community perception reflects how the community views the effectiveness, efficiency, and overall impact of waste management practices on their daily lives and the environment. It is influenced by factors such as waste management services, community involvement, education, cultural beliefs, economic constraints, environmental awareness, and regulations. Positive community perception fosters cooperation, compliance, and environmental consciousness, contributing to effective waste management. Conversely, negative perception poses challenges to waste disposal efforts (Olukanni *et al.,* 2020).

Community perception plays a significant role in shaping the success and effectiveness of solid waste management efforts (Haider *et al.,* 2015; Fadhullah *et al.,* 2022). The way community members perceived and engaged with waste management practices had both positive and negative contributions to the overall waste management process (Kumar and Anand, 2017). Positive perception led to increased cooperation, compliance, and environmental consciousness, contributing to more effective and sustainable waste management practices (Olukanni *et al.,* 2020). However, negative perceptions had detrimental effects on waste management efforts, thereby increasing the challenges of waste disposal (Olukanni *et al.,* 2020).

Addressing community perceptions through education, communication, and involvement could lead to more sustainable waste management practices and better environmental outcomes. The overall objective of this study was to assess community perception of solid waste management, specifically exploring types of solid waste, community awareness of the importance of proper solid waste management, and obstacles hindering proper waste management. The study aimed to assess community perception of solid waste management in Morogoro Municipality, Tanzania, with a focus on types of solid waste, community awareness, and obstacles hindering proper waste management. By understanding and addressing community perceptions, this research sought to contribute to more sustainable waste management practices and better environmental outcomes.

3.2 Theoretical Framework

The Value Belief Norms (VBN) theory guided this study, initially developed by Stern et al. in 1999 to explain how individuals' personal values, beliefs, and norms influence their attitudes and behaviors toward environmental issues. When applied to community perception toward solid waste management, the theory proposes that individuals' environmental behaviors are influenced by their personal values, beliefs, and perceived norms. The VBN framework explains that awareness of consequences constantly affects the ascription of responsibility. However, awareness of consequences contributes to the belief in taking personal responsibility for waste management. The VBN theory suggests that when individuals' values align with their beliefs about the consequences of waste management and are consistent with perceived norms, they are more likely to engage in positive waste management behaviors. Moreover, individuals' beliefs about the consequences of waste management practices help to understand their perceptions of the environmental, social, and economic impacts of proper waste management, such as fees for the collection of waste.

The VBN theory elucidates how values, beliefs, norms, and behavior impact the perception of the community towards solid waste management. Values and Motivations: The VBN theory suggests that underlying personal values, such as environmental concern, community well-being, and ethical responsibility, can shape how individuals perceive solid waste management practices. A community that places a high value on environmental protection and sustainability is likely to view proper waste management more favorably, leading to positive perceptions and behaviors. Beliefs: Beliefs about the effectiveness of solid waste management practices, the potential consequences of improper waste disposal, and the benefits of waste reduction can shape community attitudes. By emphasizing accurate information and communicating the positive impact of proper waste management on health, aesthetics, and the environment, communities can foster more positive perceptions and attitudes. Social Norms: Social norms, or perceived societal expectations regarding waste management behavior, can significantly influence how individuals dispose of their waste. By establishing and promoting norms that prioritize responsible waste disposal and recycling, communities can create an environment where proper waste management becomes the accepted standard. In this study, several important findings have been realized - social norms and beliefs are among the factors contributing to the perception of solid waste management in the community, highlighting the significance of addressing values, beliefs, and social norms in promoting positive attitudes and behaviors for sustainable waste management practices.

3.3 Methodology

The methodology for this study employed a cross-sectional design, conducted with 70 respondents and 5 key informants, including ward officers, environmental officers, and street chairs in Morogoro municipal, between October to November 2022. Data were systematically collected using the Kobo Collect survey tool, incorporating a structured questionnaire designed for both quantitative and qualitative insights. The qualitative data, derived from open-ended questions and Key Informant interviews, underwent rigorous content analysis to extract meaningful patterns and themes.

On the other hand, IBM-SPSS version 26 facilitated the quantitative data analysis.

For the analysis of quantitative data, descriptive statistics were the primary tool. Frequencies and percentages were calculated, providing a comprehensive quantitative summary of the data, and offering insights into the proportion of solid waste produced at the household level. In assessing community awareness regarding the importance of solid waste management, descriptive statistics, specifically frequencies and percentages, were employed to generate quantitative summaries.

To analyze the perceived obstacles hindering proper solid waste management, the Pearson Chi-Square test was utilized. This statistical test allowed for an examination of the relationships between variables and the identification of significant associations. It played a crucial role in gauging the impact of various factors on the community's ability to manage waste effectively.

For evaluating community perception of solid waste management, a Likert scale was employed. A composite mean score higher than 2.00 was indicative of a positive perception, while a composite mean score lower than 2.00 suggested a negative perception. This method allowed for a nuanced understanding of how the community perceives and responds to different aspects of solid waste management.

The comprehensive approach to data collection and analysis ensured a multifaceted understanding of community perception, awareness, and the challenges faced in solid waste management at the household level in Morogoro Municipality. The combination of qualitative and quantitative methods offered a holistic view, enriching the findings and enhancing the validity of the study.

3.4 Result and Discussion

3.4.1 Proportion of solid waste produced at the household level in three wards (Mji mkuu, Mji mpya and Mazimbu)

The investigation into the proportion of solid waste generated at the household level in three wards, namely Mji Mkuu, Mji Mpya, and Mazimbu, revealed intriguing patterns in Table 3.1. Among the 70 households surveyed, a predominant share of 38.6% acknowledged that vegetables and food remain constitute the highest proportion of solid waste. Notably, residents of Mji Mpya reported the highest incidence at 59.1%, followed by Mji Mkuu at 31.8%. This trend suggests a concentration of domestic activities, particularly cooking, in these areas, leading to the generation of food-related waste.

Similarly, 28.6% of respondents, equivalent to 20 households, identified leaves and grasses as the most prevalent solid waste. The data indicated that this waste type was prominently observed in Mji Mkuu (45.5%), followed by Mazimbu (26.9%). This aligns with findings in Accra and Southern Ghana by Yoada *et al.* (2014), where a majority of solid waste at the household level comprised food remains, leaves, and vegetables, accounting for 93.1% of the waste. Such consistencies in findings underline the universality of domestic activities generating specific types of waste.

The category of plastics, bottles, and cans constituted 20% of the reported solid waste. The distribution across wards indicated a varying degree of prevalence, with Mji Mpya at 9.1%, Mji Mkuu at 13.6%, and Mazimbu at 34.6%. This highlights the diversity in waste composition, with the popularity of plastic-related waste particularly notable in Mazimbu.

Table 3.1: Solid waste produced at three wards

Nature of Solid Waste	Wards			TOTAL
	Mji Mpya	Mji Mkuu	Mazimbu	
Vegetables and food remain	13 (59.1%)	7(31.8%)	7(26.9%)	27(38.6%)
Leaves/grass	3(13.6%)	10(45.5%)	7(26.9%)	20(28.6%)
Plastics/ bottles/cans	2(9.1%)	3(13.6%)	9(34.6%)	14(20%)
All	4(18.2%)	2(9.1%)	3(11.5%)	9(12.9%)
TOTAL	22(31.4%)	22(31.4%)	26(37.1%)	70(100%)

The results signify the dominance of organic waste, especially vegetable and food remain, in the solid waste generated at the household level. This is consistent with findings in various settings, indicating a commonality in the types of waste resulting from routine domestic activities (Yoada *et al.,* 2014). The prominence of leaves and grasses, especially in Mji Mkuu, suggests a regional variation in green waste, possibly influenced by factors like landscaping practices or environmental awareness.

The prevalence of plastic waste, although constituting a smaller percentage, is significant, especially in Mazimbu. This aligns with broader concerns about plastic pollution and necessitates targeted waste management strategies to address its environmental impact.

Comparisons with similar studies, such as Yoada *et al.* (2014), bolster the reliability of the findings, emphasizing the reproducibility of waste composition patterns across diverse geographical contexts. These insights into the composition of solid waste at the household level provide a foundation for tailored waste management strategies, acknowledging the unique characteristics of each ward. Furthermore, this understanding is crucial for municipal authorities to design effective waste collection, recycling, and disposal initiatives that align with the specific waste streams prevalent in each locality.

3.5 Community awareness of the Advantages of properly managing solid waste

Based on the data from Table 3.2 which present the awareness of respondents on the advantages of proper solid waste management practices across different wards, the following interpretations were made.

Maintenance of Environmental Quality and Cleanliness: The survey revealed a strong awareness among the respondents regarding the positive impact of proper solid waste management on environmental quality and cleanliness. Across all three wards (Mazimbu, Mji Mkuu, Mji Mpya), the majority of respondents (ranging from 57.70% to 63.60%) agreed that waste management practices, including reuse and dumping, contribute significantly to maintaining environmental quality and cleanliness. The Chi-square test indicated no significant difference in awareness among the wards ($\chi^2 = 0.186$, $p = 0.911$), emphasizing the consistency in respondents' understanding of the environmental benefits of proper waste management. This aligns with the importance of environmental education, which has been effective in raising awareness and promoting responsible waste disposal practices (Sarker *et al.,* 2012; Ike *et al.,* 2018).

Reduce air pollution Rate: Respondents demonstrated a heightened awareness of the role of proper solid waste management in reducing air pollution. The majority in each ward (ranging from 50.00% to 68.20%) agreed that appropriate waste management practices contribute to lowering the air pollution rate. The Chi-square test indicated no significant difference in awareness among the wards ($\chi^2 = 1.556$, $p = 0.459$), suggesting a uniform understanding across communities. This finding resonates with Bautista's (2019) study in the Philippines, highlighting the global awareness of communities on the connection between proper waste management and reduced air pollution. It underscores the significance of community education in fostering environmental consciousness.

Decrease in the Eruption of Diseases such as Cholera: Awareness regarding the role of proper solid waste management in reducing the outbreak of diseases, particularly cholera, was evident among the respondents. Approximately 52.9% of the community agreed that proper waste management contributes to a decrease in diseases like cholera. However, a significant difference in awareness was observed among the wards ($\chi^2 = 11.838$, $p = 0.003^*$), indicating divergent perceptions influenced by factors such as education, training, and participation in waste management practices. This underscores the importance of localized interventions and community-specific awareness campaigns. This finding diverges from Sultana *et al.* (2021) study, where a lack of environmental education contributed to low to moderate awareness of diseases caused by poor solid waste management.

Table 3.2: Perception of respondents on the advantage of waste management practices across wards (n=70)

Approach measures	Response	Wards			Chi-square test	P-value
		Mazimbu	Mji mkuu	Mji mpya		
Maintenance of environmental quality and cleanliness	**No**	11 (42.30)	9 (40.90)	8 (36.40)	0.186	0.911
	Yes	15 (57.70)	13 (59.10)	14 (63.60)		
Reduce air pollution rate	**No**	10 (38.50)	11 (50.00)	7 (31.80)	1.556	0.459
	Yes	16 (61.50)	11 (50.00)	15 (68.20)		
Decrease the eruption of diseases such as cholera	**No**	6 (23.10)	16 (72.70)	10 (45.50)	11.838	.003*
	Yes	20 (76.90)	6 (27.30)	12 (54.50)		

*** The Chi-square statistic is significant at the .05 level.**
Numbers in the bracket indicate percentage measure

The consistent awareness across wards regarding the positive impacts of proper solid waste management on environmental quality and air pollution signifies a shared understanding among community members. This reflects the effectiveness of environmental education initiatives in Morogoro Municipality. However, the significant difference in awareness concerning the decrease in diseases like cholera highlights the need for targeted educational interventions. It underscores the role of education, training, and community participation in influencing perceptions and behaviors related to waste management.

These findings collectively emphasize the importance of multifaceted community engagement strategies to ensure a comprehensive understanding of the advantages of proper solid waste management. The significance of localized approaches, considering the unique characteristics of each ward, becomes evident, reinforcing the need for tailored awareness campaigns and educational programs.

3.6 Obstacles to Proper Solid Waste Management

Based on the data from Table 3.3, which presents the perception of respondents on the obstacles hindering proper waste management practices across different wards, the following interpretations and critical discussions can be made.

3.6.1 High cost for the collection fee

The data from Table 3.3 indicates that 67.3% of respondents perceive the high cost of waste collection as a significant obstacle to proper waste management. This high percentage suggests that the community views the cost of waste collection as a hindrance to efficient waste management at the household level. The reluctance to pay collection fees is linked to a lack of community involvement in decision-making regarding these fees. Stakeholders, including households, were not part of the decision-making process, leading to resistance in contributing to the high collection fees. This finding resonates with Kirama and Mayo's (2016) study, which identified that fees for waste collection hinder the effectiveness of waste management due to a lack of awareness and education about the necessity of paying for waste disposal services.

3.6.2 Late waste collection

Approximately 57.7% of respondents identified late waste collection as a significant obstacle to proper solid waste management. This issue is attributed to poor infrastructure, infrequent vehicle availability, and a lack of service tools for waste transportation. Timely waste collection is crucial for effective waste management, and delays can lead to environmental pollution. This finding aligns with Ramos *et al*. (2012) study, which highlighted that insufficient waste collection vehicles and inadequate infrastructure contribute to delays in waste collection in developing countries.

3.6.3 Waste collection frequency

The majority of respondents (68.16%) agreed that irregular waste collection frequency contributes to poor waste disposal. The absence of a specific interval for waste collection in households indicates a lack of proper implementation by stakeholders. This lack of regular waste collection results in the accumulation of waste, leading to environmental pollution and potential health risks. The findings emphasize the importance of involving the community in decision-making on waste collection intervals. Guerrero *et al.* (2012) also supported the idea that community involvement in decision-making is crucial for raising awareness and ensuring effective waste management strategies.

Table 3.3: Perception of respondents on the obstacles hindering proper solid waste management across wards (n=70)

Approach measures	Response	Wards			% mean
		Mazimbu	Mji mkuu	Mji mpya	
High cost for the collection fee	No	4(15.40)	5(22.7)	14(59.90)	45.86
	Yes	22(84.60)	17(77.30)	8(40.10)	67.3
Late waste collection	No	7(26.90)	9(40.90)	13(59.10)	42.3
	Yes	19(73.10)	13(59.10)	9(40.90)	57.7
Frequency of waste collection	No	13(50.00)	6(27.30)	4(18.20)	31.8
	Yes	13(50.00)	16(72.70)	18 (81.80)	68.16

***The Chi-square statistic is significant at the .05 level.**

Numbers in the bracket indicate percentage measure

The identified obstacles reveal critical challenges in the waste management system in Morogoro Municipality. The high cost of waste collection underscores the need for transparent and inclusive decision-making processes involving all stakeholders, especially the community. Education and awareness programs should emphasize the necessity of collection fees for sustaining waste management services.

Late waste collection and irregular collection frequency highlight infrastructure and logistical issues. Investments in waste management infrastructure, including vehicles and tools, are essential to ensure timely waste collection. Additionally, involving the community in decision-making on collection intervals enhances the effectiveness of waste management practices. These findings align with the broader literature on waste management challenges in developing countries (Kirama and Mayo, 2016; Ramos *et al.,* 2012; Guerrero *et al.,* 2012).

3.7 Community Perception Toward Solid Waste Management

Based on the data from Table 3.4, which presents the community perception of solid waste management practices across different wards, the following critical interpretations and discussions were made.

Table 3.4: Community perception of proper solid waste management across wards (n=70)

Approach measures	Ward			Composite mean	Max.	Min.	Std.	Rank
	Mazimbu	Mjimkuu	Mjimpya					
1. Campaigns and training on environmental issues	2.10	1.98	2.30	2.13	4	1	0.90	4
2. Challenges related to technology	2.00	2.41	1.86	2.09	4	1	1.20	5
3. Municipal responsibilities	2.50	1.91	2.95	2.45	4	1	1.33	3
4. Collectors' services and municipal dump	4.42	4.50	4.50	4.47	5	1	1.06	1
5. Distance to the dumpsite	3.04	3.59	2.95	3.19	4	1	0.58	2
6. Influence of Community participation	1.04	1.05	1.00	1.03	2	1	0.17	6
The overall composite mean score	2.52	2.57	2.60	2.56			0.87	

Source: Research survey 2022

3.7.1 Campaigns and training on environmental issues

The composite mean scores (2.13) indicate that the respondents across all three wards had positive campaigns and training on environmental issues to proper solid waste management. The community said that campaigns and training help to add knowledge for the best practices of waste disposal to reduce the increase of environmental pollution. To make the environment healthy and clean, campaigns and training are very important for proper solid management. This result is in line with the result of Sultana *et al.* (2021) who noted that the provision of campaigns, education, and training concerning environmental aspects contribute to raising knowledge of the community on proper waste management hence lack of these strategies causes poor waste disposal, Moreover, training helps the community to be more efficiency and effective on the implementation of the practices on waste management. The

environmental expert should conduct training and campaigns in households to raise more knowledge on the management of solid waste properly.

3.7.2 Challenges related to technology

The composite mean scores (2.09) suggest that respondents had a high perception of technology as a challenge for proper solid waste management. Perception of community comes due to that, community perceives technology challenges which include infrastructure, vehicles are the main challenges in the collection of solid waste from the households, frequent breaking down of collection vehicles, limited roads in slum areas for transportation of solid waste from their household, Moreover frequently broken down of vehicles for waste collection contribute to poor waste disposal due to some household are not reached in time by waste collectors. Municipalities should improve technology on solid waste management by introducing other technologies for the management of waste which will favor their community such as recycling and composting, also stakeholders who deal with the collection of waste from households should make services with their vehicles and make an adequate of vehicles for waste collection. According to the findings of (Leaksmy *et al.,* 2018; UN-HABITAT, 2010). noted that the community indicates technology as a challenge for solid waste management which leads to improper solid waste management, inadequate designated vehicles for transportation of solid waste, and poor infrastructure, especially in slum settlements to transport solid waste and this causes some areas not reached by waste collectors. However, technology is the challenge facing developing countries for solid waste management hence the problem of poor waste disposal still exists.

3.7.3 Municipal responsibility

The composite mean scores (2.45) suggest the respondents have a positive perception of the responsibility of municipal toward proper solid waste management through effective management to the tenderer deals with the collection of waste from households and provision of municipal dump to the community. Moreover, this indicates community recognizes that municipalities should play an

active role in implementing effective on proper waste management. However, others said that the municipality is not doing enough in terms of waste management due lack of municipal dumps in some wards This finding is consistent with the result of Alzamora *et al.* (2021) who noted that in developing countries Municipal are responsible for proper solid waste management on financing services through general taxes, management of solid waste is a process which includes collection, transportation and disposing and all this need money so municipal should take responsibility to finance to decrease the problem of poor waste disposal. However, the role of the municipality is to manage or supervise the tenderer who took a tender for solid waste management to be well effective and efficient in proper solid waste management.

3.7.4 Collectors' services and municipal dump

The composite mean scores (4.47) suggest the respondents perceive positively perception collectors' services toward proper solid waste management The respondents perceive that adequate and effective collectors' services for solid waste management contribute to proper solid waste management however inadequate services for solid waste collection contribute improper waste disposal hence eruption of diseases. This indicates that communities possess a general understanding of the services that waste collectors should provide and recognize the importance of having a readily available municipal dumpsite. However, the community's perception of sufficient solid waste management services promotes proper waste disposal practices. Nevertheless, there is criticism regarding the inconsistent implementation of waste collection services in terms of scheduled intervals for waste pickup, and occasional delays in the collection process. These findings are similar to the result of (Olukanni *et al.,* 2020) who noted community perceives that waste collection services contribute to proper disposal however inadequate services for waste collection contribute to poor waste disposal hence there is an important for effective and efficient services such as municipal dump which help to reduce the accumulation of solid waste for a long time to wait for waste collectors to collect that waste contribute to the eruption of diseases such as cholera.

3.7.5 Distance to the dumpsite

The respondents agreed that distance from their residences to the dumpsite contributes to proper or improper solid waste management, with a composite mean score (of 3.19), This indicates respondents had a positive perception of solid waste management through their perception, that longer distance to the dumpsite contributes to poor waste disposal and short distance contribute to proper solid waste disposal. Long distances from households to dumpsites contribute disposal of waste in an irregular space which causes environmental pollution, This reveals that distance from dumpsites to the community influences the impact of environmental pollution hence the municipal should consider the distance when imposing dumps at a certain community. This result is in line with the findings of (Addo *et al.,* 2017) who noted that long distances from the dumpsite to households contribute to improper solid waste management and eruption of diseases due to the disposal of waste in unauthorized spaces such as on graves, roads, However, dumpsite near to the community can contribute to some problem such as air pollution through bad smell when municipal or collectors services delay collecting waste from the dumpsite.

3.7.6 Influence of Community Participation

The respondents in all three wards have a relatively low composite mean score (1.03) are relatively low across all three wards, This indicates respondents generally have a low perception of community participation, which reveals that the community perceives that local government and stakeholders have responsibilities in deciding on management of waste hence participation of community is not necessary for the management of waste at households. Moreover, the community perceives that their opinion is not included in decision-making, especially on collection fees and schedules for waste collection. So this highlights the importance of engaging and involving the community in waste management initiatives and raising awareness about the collective responsibility for maintaining a clean and sustainable environment. These findings are in line with the findings of Malik *et al.* (2015) who noted that community involvement is the intervention for proper solid waste management this is due to that awareness of the community can be raised by involving them in

different issues concerning environmental protection hence to protect their health on the eruption of diseases caused due to poor waste disposal.

3.8 Conclusion and Recommendation

The findings of this study offer valuable insights into the community's perception of proper solid waste management at the household level in Morogoro Municipality, Tanzania. In general, the community displayed a positive outlook on solid waste management, emphasizing the importance of effective waste collection, transportation, and disposal practices. However, specific indicators, such as the role of the municipality and the influence of community participation, revealed areas of negative perception.

The study identified significant obstacles hindering effective solid waste management, including high waste collection fees and delays in waste collection. Despite the community's awareness of the impacts of proper and improper waste management practices, concerns persist regarding the implementation of stakeholder initiatives, particularly in waste collection from households.

The positive community perception of solid waste management aligns with existing literature emphasizing the importance of community awareness and engagement in waste reduction efforts (Kumar and Anand, 2017; Olukanni *et al.,* 2020). Nevertheless, the identified negative perceptions on certain indicators indicate areas for improvement. The role of the municipality in waste management needs clarification and effective communication to enhance community understanding and cooperation.

The significant obstacles, such as high waste collection fees and delays in waste collection, highlight the practical challenges faced by the community. These challenges often result from inadequate infrastructure, lack of community involvement in decision-making, and the need for transparent communication between stakeholders and the community (Kirama and Mayo, 2016; Ramos *et al.,* 2012).

The government should establish a comprehensive action plan for education and campaigns to promote sustainable practices in solid waste management. These initiatives must emphasize raising awareness about the importance of proper waste disposal, the environmental impacts of improper practices, and the crucial role of community participation. Furthermore, stakeholders involved in waste collection should actively engage the community in decision-making processes, including the formulation of regulations on waste collection fees and determining collection intervals. This collaborative approach between stakeholders and the community will foster a sense of ownership and responsibility, ultimately contributing to more effective waste management. Additionally, there should be a focus on technological advancements to address the challenges faced in waste management. Promoting recycling practices and integrating technology for waste tracking and disposal can significantly enhance efficiency and sustainability in waste management processes (Kumar *et al.,* 2017). In conclusion, implementing these recommended measures will contribute to more sustainable waste management practices and better environmental outcomes in Morogoro Municipality.

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CHAPTER FOUR

4.0 GENERAL DISCUSSION

The study aimed to determine the determinants of household choices regarding solid waste management practices in Morogoro Municipality, Tanzania. By exploring solid waste management practices at the household level and evaluating factors associated with these practices, the research provided insights into the complexities of waste management. Integrated waste management theory and System theory guided the analysis, with both qualitative and quantitative data analysed using content analysis and various statistical methods.

Solid waste management emerges as a critical concern globally, and the study's findings shed light on Morogoro Municipality's unique challenges. The positive community outlook on solid waste management, particularly emphasizing effective waste collection, transportation, and disposal practices, was evident. However, negative perceptions were identified concerning the role of the municipality and the influence of community participation. Food remains and vegetable waste predominated at the household level, reflecting domestic activities such as cooking

The study highlighted variations in solid waste management practices across the wards (Mji mkuu, Mji mpya, and Mazimbu), influenced by factors such as inadequate municipal dumps, delays in waste collection, limited collection services, and poor policy implementation. The disparity in the engaging of solid waste management practices among three wards were attributed to various factors, leading some wards to prioritize one practice over others. For instance, Mji Mkuu exhibits a higher prevalence of landfilling and burning compared to Mji Mpya and Mazimbu due to availability of land for landfill and the abundance of trees shedding leaves. However Dumping emerged as the most common solid waste management practice (68.6% of households), but its effectiveness was hindered by poor implementation, contributing to illegal dumping. Chi-square tests confirmed statistically significant associations of solid waste

management practices across the wards, emphasizing the need for tailored approaches in each region.

Ineffective solid waste management practices in certain wards led to adverse consequences, including health impacts and environmental pollution. Delays in waste collection resulted in illegal dumping, contributing to human health risks. Observations revealed compromised effectiveness of waste collection companies in Mazimbu and Mji Mpya due to delays of collection of solid waste leading to prolonged waste accumulation and disease outbreaks. The frequent breakdown of vehicles used for solid waste collection contributes to improper solid waste management, resulting in the emergence of diseases like cholera and environmental pollution. Nevertheless, the community holds the belief that the municipality is accountable for solid waste management, this responsibility encompasses the provision of suitable dumping facilities, as well as overseeing and managing organizations involved in collecting solid waste from households.

Socio economic factors, including employment, household size, time living, and age, influenced solid waste management preferences. The result show that there is association between solid waste management practices and socioeconomic factors, individual who are employed are able to engage in dumping because it easy to pay collection fee, smaller household size are able to engage in burning because the less solid waste which are produce hence it make easy for them to burn compare to large family. However Education, did not show a significant correlation with solid waste management practices due differing in education program, cultural beliefs, variation in waste management infrastructure. This suggesting the need for nuanced interventions.

Despite community awareness, identified obstacles to effective solid waste management, such as high collection costs, late waste collection, and irregular collection frequencies, persisted. Dissatisfaction with waste collectors stemmed from delays caused by vehicle breakdowns. While the community possessed knowledge about solid waste management, concerns about inadequate

implementation by waste collectors hindered optimal engagement in proper practices. The community demonstrated awareness of the benefits of proper solid waste management, understanding its advantages in disease prevention and environmental cleanliness. However, variations in awareness among wards underscored the necessity for localized educational initiatives

Therefore, the study provides a comprehensive understanding of the intricate dynamics of household choices in solid waste management in Morogoro Municipality. The findings emphasize the importance of targeted educational initiatives, stakeholder collaboration, and technological advancements to address specific challenges, fostering more sustainable waste management practices and improved environmental outcomes.

4.1 Reflection on the Results of the theory

This study adopted the integrated waste management theory. This theory is endorsed as an approach to waste management, integrating various strategies and techniques to mitigate the environmental and human health impacts of waste. The households make choices in engaging in solid waste management practices to mitigate the environmental and health impacts caused by solid waste. However, the adoption of other practices for solid waste management did not mitigate impacts on the environment and human health. Moreover, factors such household size, income, associated with the choices for solid waste management practices, these factors can contribute household to engage in proper or improper solid waste management. The choices for the practice of solid waste management can lead to the environmental pollution such as air pollution and land pollution however the use of reuse for the management of solid waste is emphasized to reduce the accumulation of solid waste especially plastic waste such as battles.

CHAPTER FIVE

5.0 GENERAL CONCLUSIONS AND RECOMMENDATIONS

5.1 General Conclusions

Despite the significant role of socio-economic factors and positive awareness about the challenges associated with proper solid waste management practices, the implementation of such practices in Morogoro Municipality faces notable challenges. The study reveals that current waste management practices at the household level are insufficient, leading to potential health risks and unpleasant odors within the community. Indiscriminate dumping, prevalent in the majority of Morogoro municipal areas, contributes to irregular waste disposal and the outbreak of diseases, such as cholera. Additionally, the limited number of solid waste collectors faces challenges in collecting waste from various wards. The lack of environmental campaigns and education at the household level further exacerbates improper solid waste management. Addressing these challenges is crucial for the successful implementation of solid waste management practices in Tanzania. Although there has been some improvement in the effective implementation of solid waste management practices in Tanzania, there is still room for further enhancement in waste management.

5.2 General Recommendations

The study's findings carry significant implications for policymakers and environmental practitioners. The government is urged to formulate a comprehensive action plan for education and sustainable waste management. This should involve community participation in waste collection regulations and the promotion of technology to encourage recycling practices and reduce long-term waste accumulation. Policymakers should consider interventions that strengthen regulations, impose penalties for illegal dumping, and foster collaboration between municipal councils and waste management service providers to ensure effective waste collection and disposal services. Financial incentives, such as discounts for recycling or waste reduction, can be instrumental in encouraging households to adopt sustainable waste management practices.

Continuous monitoring and evaluation are essential for identifying areas of improvement and informing decision-making processes.

The recommendations aim to create an environment conducive to the successful implementation of solid waste management practices. By incorporating community participation, technological advancements, and policy interventions, Tanzania can overcome current challenges and pave the way for a more sustainable and efficient waste management system.

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APPENDICES

Appendix 1: Questionnaire and checklist for the respondents

I: QUESTIONNAIRE FOR HOUSEHOLD on solid waste management practices

Instructions:
Please fill in the questionnaire by ticking the relevant square drawn next to each answer and filling blank spaces to the questions that need explanation.

PERSONAL PROFILE:
1. Date of interview……
2. Gender: Female [ ] Male [ ]
3. Age;

(a) Below 18 years old [ ] (b) 18 – 25 years old [ ]
(c) 26 – 35 years old [ ] (d) 36 – 45 years old [ ]
(e) 46 – 55 years old [ ] (f) Above 56 years old [ ]

4. Marital status:
   a) Single [ ] b) Married [ ] c) Widow/widower [ ]
   d) Divorced [ ] e) Separated [ ]

5. Education:
   a) No formal education [ ] b) Primary school education [ ]
   c) Secondary school education [ ] d) Post-secondary school education [ ]
   Other (Specify)……..

6. Employment:
Self-employed [ ] b) Employed [ ]
   c) Unemployed [ ] d) Retired [ ]

7. Family size;

a) One member [ ] c) Three members [ ]
b) Two members [ ] d) More than four members [ ]

8. For how long you have been living in this place?

a) Below 1 year [ ] c) 3-4 years [ ]
b) 2- 3 years [ ] d)Above 5 years [ ]

9. What are the main types of solid waste generated in your household?

a) Vegetables and food remains [ ]
b) Leaves/grass [ ]
c) Plastics/bottles/cans [ ]
d) Both [ ]

10. Do you have any storage facility for storing solid waste in your household?

a) Yes [ ]
b) No [ ]

11. If the answer is 'yes' in question 10, what type of storage facilities do you have for storing solid waste in your household?

a) Metal or plastic container [ ]
b) Plastic bags [ ]
c) Basket or carton container [ ]
d) Immovable container [ ]
e) No container [ ]

12. What kind of methods or practices do you use for solid waste management after collection or stored solid waste from your household?

a) Reuse [ ]
b) Landfill [ ]
c) Burning [ ]
d) Dumpsite [ ]
e) Open dumping [ ]

13. Is there a fee for solid waste collection?
    a) Yes [ ]
    b) No [ ]

14. How much do you pay for your household's solid waste collection?

15. What is your payment schedule?
    a) Per day [ ] c) Per month [ ]
    b) Per week [ ] d) Per year [ ]

16. Who collects solid garbage from your home once it has been stored?
    a) Municipal [ ]
    b) CBOS/ NGO'S [ ]
    c) Private company [ ]
    d) Others (*specify*) ……..

17. How frequently did the institution or collection services come to collect the waste that was being stored?
    a) After 2 days [ ]
    b) After 5 days [ ]
    c) After 1 week [ ]
    d) Irregular [ ]

18. What happens if the collection services delay collecting waste?
    a) Solid waste remains there indefinitely [ ]
    b) Burning waste or Landfill [ ]
    c) Dumping in open space [ ]

SECTION B

Factors influencing solid waste management practices

19. What social factors influence your household's solid waste disposal practices?
    a) Education [ ]
    b) Age [ ]
    c) Infrastructure [ ]
    d) Gender [ ]

20. What economic factors influence solid waste management practices in your household?

a) Income [ ]
b) Occupation [ ]

21. What cultural factors influence solid waste management in your household?

a) Attitude [ ]
b) Habit [ ]

22. What are the advantages of properly managing solid waste in your household? (*Tick all that apply*)

a) Maintenance of environmental quality and cleanliness [ ]
b) Decrease of mortality late [ ]
c) Decrease the eruption of diseases such as cholera [ ]

23. What are the consequences of improper solid waste management in your household? *(Tick all that apply)*

a) Eruption of diseases such as cholera [ ]
b) Increase in mortality rate [ ]
c) Air pollution [ ]
d) Land pollution [ ]

24. What are the obstacles you face when it comes to solid waste management? *(Tick all that apply)*

a) High cost for the collection fee [ ]
b) Late waste collection [ ]
c) Interval of the day of waste collection [ ]
d) Other (*specify)* ……

SECTION: C

Community perception of solid waste management practices at the household level

25. Choose the appropriate answer for the following statement where; **SA**= Strong Agree, **A**= Agree, **N**=Neutral, **DA**= Disagree, **SDA**= Strong disagree

Statement	**SA**	**A**	**N**	**DA**	**SDA**
Lack of training of environmental issues contribute to improper solid waste management					
Technology is the challenge for solid waste management					
Municipal is responsible to manage solid waste at community					
Solid waste collectors services are adequate for solid waste management					
There is a long distance from the resident to the dumpsite					
Community participation influence effective of solid waste management					

Appendix 2: Checklist for ward, street leaders and environmental municipal officer

1. Which solid waste management practice is commonly used by households in your ward?
2. What are your roles and responsibility in promoting community awareness and participation in solving the problem of solid waste management?
3. Does Municipality provide transportation for the collection of solid waste?
4. What are the factors affecting solid waste management in your locality?
5. What are the impact resulting from the choice used for solid waste management in your locality
6. Are you involved in planning, decision making, or implementation with different institutions or organizations involved with solid waste management?
7. How many institutions or organizations deal with collection of solid waste in your ward?
8. What do you think is needed for the institution or organization involved in the collection of solid waste to be effective and efficient, especially in an informal settlement for the social-economic and environmental benefit in your community?
9. Do you have any suggestions to improve the situation in your community on the issue of solid waste management? If yes what are they?
10. What are the challenge facing on transportation of solid waste?

Appendix 3: Iteration

Iteration 2: log likelihood = -102.67787
Iteration 3: log likelihood = -102.67376
Iteration 4: log likelihood = -102.67375
Multivariate probit (SML, # draws = 5) Number of obs = 70
Wald chi2 (44) = 73.86
Log likelihood = -102.67375 Prob > chi2 = 0.0032

	Coef.	Std.Err.	z	P>z	[95%Conf.	Interval]
Dumping						
Education	0.637	0.508	1.250	0.210	-0.359	1.633
Employment status	-0.377	0.450	-0.840	0.403	-1.260	0.506
Household size	-0.539	0.457	-1.180	0.239	-1.436	0.357
Duration of residence	1.630	0.490	3.330	0.001***	0.670	2.590
Waste storage facility	0.322	0.486	0.660	0.508	-0.630	1.274
Fee waste collector	0.279	0.427	0.650	0.514	-0.559	1.117
Infrastructure	-1.128	0.515	-2.190	0.028**	-2.137	-0.119
Land size	0.264	0.327	0.810	0.019*	-0.376	0.905
cons	-1.642	0.953	-1.720	0.085	-3.510	0.227
Landfill						
Education	0.068	0.458	0.150	0.881	-0.828	0.965
Employment status	1.758	0.446	3.950	0.000***	0.885	2.631
Household size	-0.177	0.466	-0.380	0.704	-1.091	0.737
Duration of residence	-0.398	0.504	-0.790	0.430	-1.385	0.589
Waste storage facility	0.159	0.465	0.340	0.033**	-0.753	1.071
Fee waste collector	0.407	0.433	0.940	0.347	-0.442	1.257
Infrastructure	-0.829	0.508	-1.630	0.103*	-1.824	0.166
Land size	0.191	0.387	0.490	0.621	-0.567	0.949
cons	-	1.081	-0.880	0.379	-3.069	1.169

	0.950					
Reuse						
Education	2.018	0.498	4.050	0.000***	1.042	2.994
Employment status	-0.021	0.579	-0.040	0.970	-1.157	1.114
Household size	-1.034	0.608	-1.700	0.089*	-2.225	0.158
Duration of residence	0.565	0.631	0.900	0.371	-0.672	1.802
Waste storage facility	-0.367	0.614	-0.600	0.550	-1.571	0.837
Fee waste collector	-0.032	0.523	-0.060	0.051**	-1.057	0.994
Infrastructure	0.100	0.521	0.190	0.848	-0.921	1.121
Land size	0.631	0.357	1.770	0.077*	-0.069	1.331
_cons	-2.955	1.282	-2.300	0.021	-5.468	-0.441
Burning						
Education	0.560	0.412	1.360	0.173	-0.246	1.367
Employment status	0.249	0.453	0.550	0.583	-0.639	1.137
Household size	1.421	0.414	3.430	0.001***	0.610	2.231
Duration of residence	0.206	0.508	0.400	0.686	-0.790	1.202
Waste storage facility	0.104	0.466	0.220	0.024**	-0.810	1.017
Fee waste collector	-0.193	0.431	-0.450	0.655	-1.038	0.652
Infrastructure	-0.188	0.489	-0.380	0.701	-1.146	0.770
Land size	0.390	0.338	1.150	0.049**	-0.273	1.053
_cons	-1.495	1.085	-1.380	0.168	-3.621	0.632
/atrho21	-0.534	0.367	-1.460	0.145	-1.253	0.185
/atrho31	-0.515	0.365	-1.410	0.158	-1.230	0.200
/atrho41	0.002	0.285	0.010	0.993	-0.556	0.560
/atrho32	0.151	0.438	0.350	0.730	-0.708	1.010
/atrho42	-	0.261	-1.230	0.218	-0.833	0.190

	0.321					
/atrho43	0.270	0.368	0.730	0.463	-0.451	0.990
rho21	-0.489	0.279	-1.750	0.080	-0.849	0.183
rho31	-0.474	0.283	-1.680	0.094	-0.843	0.197
rho41	0.002	0.285	0.010	0.993	-0.505	0.508
rho32	0.150	0.428	0.350	0.726	-0.609	0.766
rho42	-0.311	0.236	-1.320	0.188	-0.682	0.188
rho43	0.263	0.342	0.770	0.442	-0.423	0.757

Likelihood ratio test of rho21 = rho31 = rho41 = rho32 = rho42 = rho43 = 0:

chi2 (6) = 6.34137 Prob > chi2 = 0.3861

Marginal effects after mvprobit
y = Linear prediction (predict)
= .82498253

Variables	dy/dx	Std.Err.	z	P>z	[	95%	C.I.
Education*	0.637	0.508	1.250	0.010	-0.359	1.633	0.314
Employment status*	-0.377	0.450	-0.840	0.403	-1.260	0.506	.3
Household size	-0.539	0.457	-1.180	0.239	-1.436	0.357	0.286
Time living	1.630	0.490	3.330	0.001	0.670	2.590	0.714
Waste storage facility*	0.322	0.486	0.660	0.508	-0.630	1.274	0.286
Fee waste collector*	0.279	0.427	0.650	0.514	-0.559	1.117	.6
Infrastructure *	-1.128	0.515	-2.190	0.028	-2.137	-0.119	0.343
Land size	0.264	0.327	0.810	0.019	-0.376	0.905	0.543

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Kuhusu Tasnifu Hii

Utafiti huu wa kina unachunguza uhusiano kati ya sababu za kijamii na kiuchumi zinazopelekea machaguzi ya kaya katika njia za uhifadhi wa taka Ngumu pamoja na mitazamo ya jamii juu ya usimamizi na uhifadhi wa taka ngumu katika Manispaa ya Morogoro, Tanzania. Utafiti unaonesha njia za uhifadhi na usimamizi wa taka Ngumu unatofautiana baina ya kata na kata ikichangiwa na sababu mbalimbali za miundombinu na asili ya eneo husika. Utafiti unaonesha mitazamo ya jamii juu ya usimamizi na utunzaji wa taka Ngumu na kuangalia changamoto na madhara yanayotokana na njia za uhifadhi wa taka Ngumu. Uhifadhi wa taka Ngumu umekuwa na changamoto kubwa zinazopelekea uharibifu wa mazingira na afya za kibinadamu. Matokeo yanaonesha upungufu wa njia bora za uhifadhi wa Taka ndio unaosababisha athari za mazingira na afya za binadamu. Hata hivyo utafiti unasisitiza uwezekano wa uboreshwaji na uongezekaji wa njia bora za uhifadhi wa takataka kuendana na teknolojia ya sasa.