

# Waste Minimization Factors Among Food Vendors in Manzese Ward, Dar Es Salaam

Geraldina Mwita, David Ndungutse, James G. Wanzima, David R. Mutekanga\*

Bugema University, Uganda

## Abstract

**Background:** This study was conducted in the Manzese Ward, Dar-es-Salaam, Tanzania. The objectives were to identify the individual and institutional factors associated with waste minimization among food vendors, determine the level of waste minimization among food vendors, and investigate the association between related factors (individual and institutional factors) and waste minimization among food vendors.

**Methods:** Quantitative data collection strategies were used. The study collected data from 234 participants, selected using a multistage sampling technique. Data were analyzed using descriptive and bivariate analyses, and a multivariate ordinal logistic model was fitted.

**Results:** The results show that most vendors are young (less than 35 years old), have basic education, and have a positive attitude toward waste minimization. The most significant factors for waste minimization among the food vendors' working in Manzese Ward were education level (AOR= 35; 95% CI: 69-0.70; p=029), monthly income (AOR= 49; 95% CI: 20-12; p=118), knowledge level (AOR= 36; 95% CI; 15-85; p<0.003), and attitude (AOR=17; 95% CI: 69-42; p<0.001). These factors are important for reducing waste and maintaining a low waste production by food vendors.

**Conclusion:** The levels of income, knowledge, and attitude of the vendors were identified as being crucial factors in minimizing waste. While provision of equipment for waste segregation, collection and removal, and the provision of sanitary facilities were identified as being important institutional factors contributing towards minimizing of waste.

**Keywords:** Waste minimization, waste management, Tanzania, food vendors

## Introduction

Waste minimization is a practice that reduces the produced and generated waste. This has also been reported to promote sustainable development, including meeting the Sustainable Development Goals (SDGs 3, 6, 7, and 11) (IISD SDG Knowledge Hub 2023 & UNDP, 2022) by reusing and reducing

waste in the community. In 2022, the World Bank reported that globally, urban areas generate over 2 billion tons of solid waste and noted that the increasing human population will inevitably raise this to over 3.5 billion tons by 2050 (World Bank, 2022)

While developed countries with high consumption and expenditure rates

produce an increasing amount of waste, developing countries produce less waste, although it is also growing (World Bank, 2020 & OECD, 2020). The United Nations Environment Programme (UNEP) has also reported that developing countries produce more biodegradable solid waste but face challenges in disposing and managing this waste, especially in rapidly growing urban areas. (UNEP, 2022). This is also attributed to ineffective waste segregation methods, resulting in environmental contamination (Fadhullah et al., 2022 & Mugambe et al., 2022).

As waste generation increases, with its associated consequences, there is an increased need for better ways to manage solid waste (World Bank, 2022). Unfortunately, the current methods of reducing, reusing, and recycling, including legislation, have not been as effective as initially expected (Mugambe et al., 2022 & European Commission, 2014).

UNEP (2020) reported that the highest waste generated in sub-Saharan Africa is from the residential sector, and a large percentage (54.4%) is never collected (UNEP 2022). In highly populated countries like Nigeria, the waste generated continues to increase by approximately 50% every five years. In South Africa, it has been reported that waste minimization is still a challenge in the country, where they are trying to develop different ways of managing their waste (Viljoen et al., 2021). The majority of food vendors in the urban areas of most African countries struggle to practice proper waste minimization,

yet waste generation levels continue to increase. This may be attributed to low minimization practices, especially among food vendors (Fadhullah et al., 2022).

Mugambe et al. (2022) further reported that waste minimization is a major concern in the capital cities of East Africa. This is mainly due to the quantities of waste generated by food vendors and unsafe disposal, resulting in public health risks. They further reported that there is a need for cities to develop innovative, unique, and effective ways to manage waste depending on the source and type of waste. In Tanzania, several researchers have reported that, despite a sustainable regulatory environment, the annual resource value of waste is approximately 1.46% of Tanzania's Gross Domestic Product (GDP), (Nyampundu et al., 2020). The goal of minimizing waste among food vendors in Manzese Ward in Dar es Salaam, Tanzania has remained a challenge (African Union Commission, 2015).

The Dar es Salaam City Council comprises three administrative Municipal Councils: Temeke, Ilala, and Kinondoni. Kinondoni is the largest, with a population of approximately 1.2 million and 27 wards, including Manzese Ward (Huisman et al., 2016). Manzese Ward is the largest business center in Kinondoni Municipality and is densely populated. It produces the highest tonnage of waste compared with the other 26 wards, mostly from food vendors (Nyampundu et al., 2020 & Ayo, 2019). This ward also faces challenges because of the lack of a

waste management system, resulting in dumping and littering.

Tanzania's national waste management strategy emphasizes the right to a clean and healthy environment, which uses waste reduction technologies to reuse products where possible and recover value from them (United Republic of Tanzania, 2018). However, both Nyampundu et al. (2020) and Ayo (2019) reported an increasing rate of waste production in Kinondoni Municipality, which has risen from 4,600 tons to 11,000 tons in only one year and that this waste is mainly composed of items from food vendors. This volume of waste is the highest among the Municipalities of Ilala and Temeke.

The Manzese ward has also reported improper domestic waste disposal and low participation in waste minimization. There is also a low level of reuse at 31%, compared to 52% of the average for Dar es Salaam City (Ayo, 2019). Despite efforts by the local government and non-governmental organizations to encourage effective waste management, the situation has not improved. It continues to worsen (Ayo, 2019), resulting in an increase in related diseases, such as typhoid and cholera. Therefore, this study aimed to identify the factors associated with minimizing waste among food vendors in the Manzese Ward of Dar es Salaam city in Tanzania, and to recommend appropriate evidence-based intervention to authorities. Consequently, the specific objectives of the study are to (1) identify the individual and institutional factors related to waste minimization among food vendors in the Manzese ward; (2)

determine the level of waste minimization among food vendors in the Manzese ward; and (3) establish associations between related factors (individual and institutional) and waste minimization among food vendors in the Manzese ward.

## Literature Review

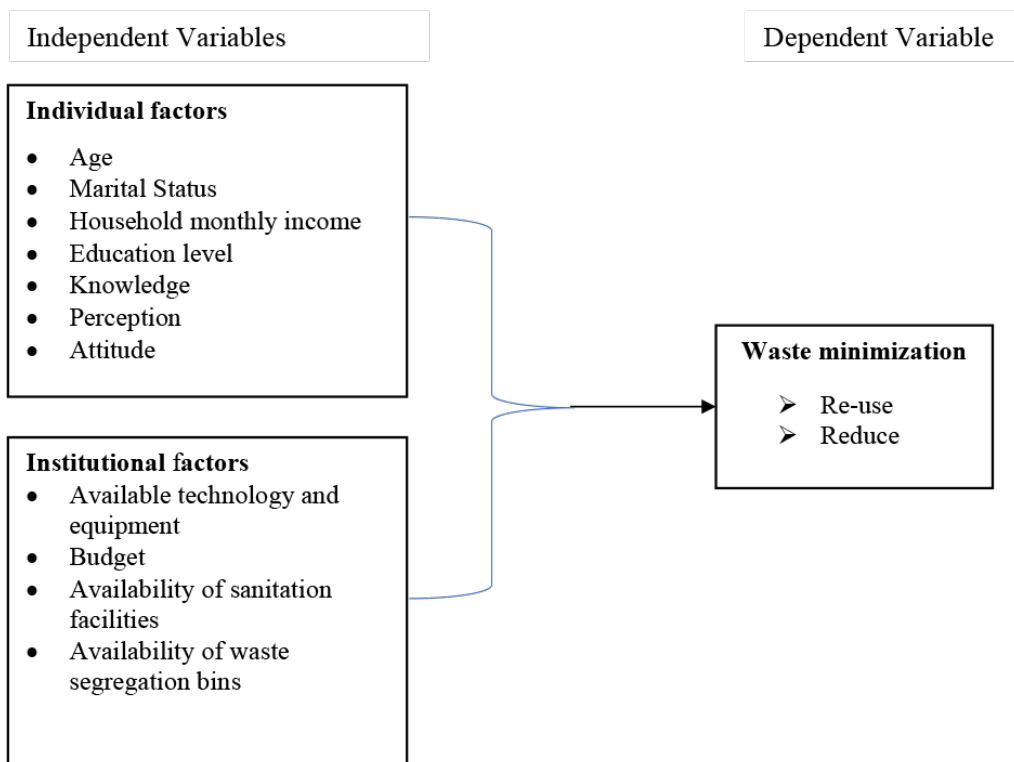
The planned behavior theory (Ajzen, 1991) was adopted for this study because of its application in waste minimization practices. Waste minimization has been reported to be strongly related to behavior; hence, the reliance on this behavior theory to anchor the activities of food vendors in the Manzese ward.

The reviewed literature identified that several individual factors such as age, education level, knowledge, perception, gender, income levels, and attitude were associated with waste minimization (Fadhullah et al., 2022; Babirye *et al.*, 2020; Mesfin *et al.*, 2014). Also, various institutional factors, such as technology and equipment, budget, availability of sanitary facilities, and availability of waste segregation bins, are associated with waste minimization among food vendors (Muiruri et al., 2020; Hilburn, 2015; Sebudde *et al.*, 2014). However, contextual gaps were identified, as none of the studies were conducted in Tanzania, particularly Manzese Ward (Hilburn, 2015). In addition, knowledge and content gaps exist, as most studies have not focused on waste minimization among food vendors but on institutions (Hilburn, 2015 & Abdalla *et al.*, 2013).

Furthermore, most of the studies lacked clear methodological approaches that were used to reach the study findings, leading to methodological gaps (Ouma et al., 2021; Mesfin et al., 2014; Abdalla et al., 2013). The current study addressed these gaps by investigating the factors influencing waste minimization practices

among food vendors in Manzese Ward, Dar es Salaam City, Tanzania. The conceptual framework (Figure 1) shows the relationship between the factors associated with waste minimization (independent variables) and the level of waste minimization (dependent variables).

**Figure 1**  
*Conceptual Framework*



## Methods

### Study Design

This study utilized a cross-sectional design with a quantitative research method to investigate the factors influencing waste minimization among food vendors. It assessed the structures, regulations, standards, and practices on the ground during the study. A quantitative relationship between the variables was obtained.

The study was conducted among food vendors in the Manzese ward in the Kinondoni District of Dar es Salaam City, Tanzania. The Manzese ward was chosen for the study because of its high number of food vendors, who generated the highest volumes of solid waste in Dar es Salaam City.

### Population and Sampling Technique

The study population consisted of 457 registered food vendors operating in the Manzese ward (Manzese Food Vendors Records, 2021). The sample size for this study was established using the Yammane formula of 1967 (Israel 1992) and included 234 food vendors. Three markets in Manzese ward—Manzese Market, Tandale Market and Sokoni Market were selected for the study. Seventy-eight vendors were randomly selected in each market.

### Research Instrument

Data were collected using a questionnaire to investigate factors associated with waste minimization

practices among food vendors in the Manzese ward, Dar Es Salaam.

### Ethical Considerations

We obtained ethical clearance from the Mulago Hospital Research and Ethics Committee (MHREC 2146) in Kampala, Uganda. In addition, we got permission from the Dar es Salaam City Council, Manzese City Ward Administration, and the three market authorities where data was collected. All participants received an explanation of the purpose of the study before signing up on the informed consent document and were assured of confidentiality. The relevant COVID-19 standard operating procedures mandated by the Ministry of Health and personal protection equipment and practices were duly followed. This was considered necessary because various variants of COVID-19 are still circulating, and data were collected from places where many people congregate.

### Data Analysis

Descriptive analysis was performed to generate frequencies, percentages, mean, and standard deviations, presented in the results section below. Chi-squared test was used to address research objective two. Significant factors were then subjected to ordinal logistic regression analysis to derive crude odds ratios (COR) and corresponding 95% Confidence Intervals (CI) to establish the direction of the relationship between the factors and waste minimization. The significant variables in the logistic linear regression analysis were later subjected to

multivariate analysis to derive Adjusted Odds Ratios (AOR) and Corresponding Index 95% C, thus addressing objective three.

## Results

The first objective of this study was to identify the individual and institutional factors related to waste minimization among food vendors, as summarized in Table 1.

**Table 1**

*Individual and Institutional Factors among the Food Vendors in Manzese Ward*

Factors		Frequency (N = 224)	Percent (%)
<b>Individual Factors</b>			
Age in Years	18-25	87	38.8
	26-35	80	35.7
	36-45	34	15.2
	>45	23	10.3
Marital status	Single	136	60.7
	Married	63	28.1
	Divorced	20	8.9
	Widowed	5	2.2
Household monthly income	< 50,000	155	69.2
	50,000-100,000	38	17.0
	> 100,000	31	13.8
Education level	No Formal Education	58	25.9
	Primary	22	9.8
	Secondary	58	25.9
	Post-Secondary	86	38.4
Knowledge	Good	123	54.9
	Poor	101	45.1
Perception	Important	162	72.3
	Not Important	62	27.7
Attitude	Positive	118	52.7
	Negative	106	47.3
<b>Institutional Factors</b>			
Technology and equipment adequate	Yes	84	37.5
	No	140	62.5
Budget with financial needs	Yes	91	40.6
	No	133	59.4
Functional sanitation facilities	Yes	104	46.4
	No	120	53.6
Availability waste segregation bins	Yes	70	31.3
	No	154	68.8
Level of waste Minimization	No	111	49.6
	Yes	113	50.4

Regarding individual factors, the results in Table 1 indicate that most vendors (74.5 %) were youths between 18 and 35 years old, and the majority (60.7%) were single (not married). Most vendors (69.2 %) earn below 50,000/= Tanzanian shillings (US\$20) per month, and the majority (51.8%) have not been to school at all. However, despite the low levels of education, most vendors (54.9%) had good knowledge of waste minimization.

The findings in Table 1 further reveal that most respondents (72.3%) perceived recycling waste as an important activity and had a positive attitude toward waste reduction (52.7 %).

Regarding institutional factors (Table 1), most (62%, 59.4%, 53.6%, and 68.8%) reported that they had never had adequate technology and equipment for waste reduction, had no financial budget

allocation for waste minimization, did not have functional sanitary facilities, and did not have waste segregation bins in their markets.

The study's second objective was to determine the level of waste minimization among food vendors in this ward. This study examined those who did nothing and used one or several methods. The results (Table 1) show that only 50.4% of the vendors used several waste management methods. About half of the vendors did not do anything towards minimizing waste in the Ward.

The third objective was to establish the association between factors (individual and institutional) and waste minimization practices among food vendors in the Manzese ward. Data were analyzed using Chi-square and ordinal logistic model findings, which are summarized in Tables 2 and 3.

**Table 2**

*Association between Individual Factors and Waste Minimization among Food Vendors in Manzese Ward.*

<b>Demographic Characteristics</b>	<b>High N(%)</b>	<b>Low N(%)</b>	$\chi^2$	<b>p-Value</b>
<b>Age in Years</b>				
18-35	79(47.3)	88 (52.7)	1.327 <sup>a</sup>	.249
36+	32(56.1)	25 (43.9)		
<b>Marital status</b>				
Single	77(47.8)	84(52.2)	.683 <sup>a</sup>	.408
Married	34(54.0)	29(46.0)		
<b>Education level</b>				
Primary	21(26.2)	59(73.8)	27.034 <sup>a</sup>	<b>0.000**</b>
Post-Primary	90(62.5)	54(37.5)		
<b>Monthly income in TShs</b>				
< 50,000	67(43.2)	88(56.8)	8.060 <sup>a</sup>	.005
50,000+	44(63.8)	25(36.2)		
<b>Knowledge</b>				
Good	93(75.6)	30(24.4)	74.088 <sup>a</sup>	<b>0.000**</b>
Poor	18(17.8)	83(82.2)		
<b>Attitude</b>				
Positive	96(81.4)	22(18.6)	100.888 <sup>a</sup>	<b>0.000**</b>
Negative	15(14.2)	91(85.8)		

**\*\*Significant at 5%**

The results in Table 2 indicate that apart from age, the other individual factors were associated with waste minimization [Marital  $\chi^2=.683$ , P= 0.000]; age  $\chi^2= 1,327$ , p= 0.000; education  $\chi^2= 27.034$ , p= 0.000; Income  $\chi^2= 8.060$  p= 0.000; Knowledge  $\chi^2= 74.0888$ , p=0.000; and attitude  $\chi^2= 100.888$ , p= 0.000].

Chi-Square was used to examine the association between institutional factors and waste minimization among food vendors in Manzese Ward, and the results are given in



**Table 3**

*Chi-Square Results for the Association between Institutional Factors and Waste Minimization among Food Vendors in Manzese Ward*

<b>Institutional Factors</b>	<b>High N(%)</b>	<b>Low N(%)</b>	<b><math>\chi^2</math></b>	<b>p-Value</b>
Technology and equipment adequate				
Yes	52(61.9)	32(38.1)	8.202 <sup>a</sup>	.004
No	59(42.1)	81(57.9)		
Budget with financial needs				
Yes	53(58.2)	38(41.8)	4.628 <sup>a</sup>	.031
No	58(43.6)	75(56.4)		
Availability of sanitation facilities				
Yes	60(57.7)	44(42.3)	5.144 <sup>a</sup>	.023
No	51(42.5)	69(57.5)		
Availability waste segregation bin				
Yes	46(65.7)	24(34.3)	10.638 <sup>a</sup>	.001
No	65(42.2)	89(57.8)		

**\*\*Significant at 5%**

Table 3 indicates that all institutional factors were significantly associated with waste minimization practices. (Technology and equipment adequate ( $\chi^2=8.202$ ,  $P=.004$ ); budget with financial needs ( $\chi^2=4.628$ ,  $p=.031$ ); availability of sanitation facilities  $\chi^2 = 5.144$ ,  $p= .023$ ; and availability of waste segregation bins  $\chi^2= 10.638$ ,  $p = 0.001$ ).

To establish the level of association between individual and institutional factors and waste minimization among food vendors, a multivariate Ordinal Logistic tool was used, and the results are given in Table 4.

**Table 4**

*Multivariate Ordinal Logistic Results for the Association between the Two Factors (Individual and Institutional) and Waste Minimization among Food Vendors*

Factors	Waste Minimization		COR (95%)	p-Value	AOR (95%)	p-Value
	High N (%)	Low N (%)				
<b>Individual Factors</b>						
<b>Age in Years</b>						
18-35	79(47.3)	88 (52.7)	.70(.38-1.28)	.250	1.42(.55-3.66)	.464
36+	32(56.1)	25 (43.9)	1	-	1	-
<b>Marital status</b>						
Single	77(47.8)	84(52.2)	.28(26-0.82)	0.304	.11(69-0.70)	089
Married	34(54.0)	29(46.0)	1	-	1	-
<b>Education level</b>						
Post-Primary	90(62.5)	54(37.5)	.21(.12-.39)	.000	.35(.14-.89)	.029
At most Primary	21(26.2)	59(73.8)	1	-	1	-
<b>Monthly income in TShs</b>						
50,000+	44(63.8)	25(36.2)	.43(.24 -.77)	.005	.49(.20-.12)	.118
< 50,000	67(43.2)	88(56.8)	1	-	1	-
<b>Knowledge</b>						
Good	93(75.6)	30(24.4)	.14(.7-27)	.000	.36(15-85)	.003
Poor	18(17.8)	83(82.2)	1	-	1	-
<b>Attitude</b>						
Positive	96(81.4)	22(18.6)	.26(.12-.54)	.000	.17(69-.42)	.000
Negative	15(14.2)	91(85.8)		-	1	-
<b>Institutional Factors</b>						
<b>Technology and equipment adequate</b>						
Yes	52(61.9)	32(38.1)	2.2(.12-.4)	.004	.89(.31-.25)	.894
No	59(42.1)	81(57.9)	1	-	1	-
<b>Budget with financial needs</b>						
Yes	53(58.2)	38(41.8)	.2(.15-.39)	.032	.49(17-.14)	.186
No	58(43.6)	75(56.4)	1	-	1	-
<b>Functional sanitation facilities</b>						
No	60(57.7)	44(42.3)	.1.8(.18-.31)	.024	.92(30-27)	.889
Yes	51(42.5)	69(57.5)		-	1	-
<b>Availability of waste segregation bin</b>						
No	46(65.7)	24(34.3)	.2.6(14-.47)	.001	.12(38-37)	.752
Yes	65(42.2)	89(57.8)	1	-		-

The results in Table 4 show that for demographic factors, the following were significantly associated with the level of waste minimization before and also after controlling confounding: Education level was significantly associated with level of waste minimization among food vendors before and after controlling confounding [(COR= .21; 95% CI: .12-.39;  $p < 0.001$ ), and (AOR= .35; 95% CI: .14-.89;  $p < 0.001$ )] respectively; Knowledge level was also significantly associated with the level of waste minimization before and after confounding [(COR=.14; 95% CI: .7-.27;  $p < 0.001$ ), and (AOR= .36; 95% CI: .15-.85;  $p < 0.001$ )] respectively; Attitude was also significantly associated with the level of waste minimization before and after controlling confounding [(COR=.26; 95% CI: .12-.54;  $P < 0.001$ ) and (AOR= .17; 95% CI: .69- .42;  $P < 0.001$ )] respectively.

The remaining demographic factors, including age, marital status, and income, were not significant before or after confounding. To establish if the institutional factors are significantly associated with waste minimization before and after controlling for confounding, the results in Table 4 show that the following factors were significant both before and after controlling for confounding: budget with functional needs [(COR=.2; 95% CI: .15-39;  $p = .032$ ) and (AOR= .49; 95% CI: - 17-14;  $p = .186$ )], respectively; and availability of waste segregation facilities [(COR= 2.6; 95% CI: .14-.47;  $p = 0.001$ ) and (AOR= .12; 95% CI: 38-37;  $p = 752$ )], respectively (Table 4).

However, the following institutional factors were insignificant either before or after controlling for confounding or both: Technology and Equipment adequacy – significantly associated before confounding but insignificant after controlling for confounding [(COR=.2.2; 95% CI: .1.2-.4;  $p = 0.0040$ ) and (AOR= .89; 95% CI: .31-.25;  $p = .894$ )], respectively; functional sanitation facilities [(COR= 1.8; 95% CI: .18-31;  $P = .024$ ) and (AOR= .92; 95% CI: 30-.27;  $p = .889$ )], respectively (Table 4).

## Discussion

The fact that many youths (below 35 years) were found in the vending business in this market may be attributed to the increasing number of youths who need jobs and the ease of entry into the food vending business. This calls for future policies to closely examine the behavioral attributes of the youth food vending business. According to Mesfin *et al.* (2014), most young people (65%) aged 31-35 years are less likely to be open to corrections on waste segregation practices compared to respondents age group 20-25 years. Muiruri *et al.* (2020) reported that both young and older people do not mind proper waste minimization and that both tend to dispose of waste without considering the adverse effects on human and environmental health.

The results of this study further indicate that most food vendors in Manzese ward are single (not married) people. Earlier, Ropke (2009) reported that single people litter more than married persons, indicating that the high waste production in Manzese

can be partly attributed to the many single food vendors. Hence, re-emphasizing the need to reexamine behavioral attitudes regarding food vending in Manzese wards. Also, the findings in this study show that most vendors earn below 50000 Tanzanian Shillings (US Dollars 20) and could influence waste minimization more. McAllister (2015) confirmed that people's income levels influence waste minimization and that wealthier individuals consume more than lower-income ones, resulting in higher waste generation by the rich.

The study results show that the majority (74.1%) of the food vendors have received some level of formal education. This could clearly explain the relatively good (54.9%) level of knowledge on waste management. Hogan (2002), reported that environmental education activities allow a community to use the information needed to improve its environment. Hilburn (2015) also emphasized that knowledge of recycling programs had a positive relationship, and households were likely to practice it. This means that good knowledge by Manzese Ward vendors is a good indicator that they can quickly work towards waste minimization.

The results in Table 1 show that most respondents did not have adequate technology and equipment for waste reduction, possibly because of the high cost of procuring the technology apparatus. This could be true, as Hazra and Goel (2019) reported in India. The absence of budgets and financial allocations for waste minimization could be attributed to

leaders not listing waste minimization as a priority. This result agrees with Kreith and Tchobanoglous's (2019) earlier findings, which is the same situation in Kenya (Nyampundu *et al.*, 2020). The absence of sanitation facilities has been reported by other researchers, such as Sebudde *et al.* (2012) and Muiruri *et al.* (2020), who found that lack of sanitation facilities in food markets affected solid waste management practices and increased the volume of waste, leading to congestion and littering. In addition, the absence of waste segregation bins, negatively affects even those who are motivated and want to use them. This is in agreement with a report by Hazra and Goel (2019) that the lack of containers for waste segregation contributes to littering and illegal dumping.

The results in Table 2 indicate that most respondents (58.9%) regularly reused the waste, which is very important, as Cole *et al.* (2016) reported. This implies that with reuse, many otherwise disposable products are retained for reuse so that they can contribute to the reduction of the environmental impact and also reduce budget costs for such reusable products.

The educational level of the respondents is significant in minimizing waste. Some reports (Hogan 2002 & World Bank 1999) agree with the findings of this study. However, other researchers (Asmawati, 2015; Miller, 1999; Pfeffer *et al.*, 2000) disagree, indicating that information and knowledge are essential but insufficient to result in action. Monthly income being significant at the bivariate level and insignificant at the

multivariate level has also been reported earlier by several authors (Santos *et al.*, 2005 & Rhodes *et al.*, 2008). Following the “subconscious psychological self-defense” theory by Abu-Zant (Al-Khatib, 2018), the implication is that waste minimization is taken more seriously as food vendors begin to attract more customers with high pay and education and at the same time, increased income levels for the food vendors means that they can afford to hire cleaners in their workplace.

The knowledge level was found to be very significant in minimizing waste, which is supported by several previous studies (Al-Khatib *et al.*, 2008 & Aini *et al.*, 2002). This implies that high education level of the community improves waste storage and other functions of good waste management practices. Also, a positive attitude was found to be highly significant and increased the level of waste minimization by 1.15. However, while Desa *et al.* (2012) reported that education and change of attitude are interwoven, other researchers agree on the significance of a positive attitude (Adeyemo & Gboyesola, 2013; Ogola *et al.*, 2011).

Institutional factors such as technology and equipment adequacy were significantly associated with waste minimization at bivariate levels but not at multivariate levels. Henry *et al.* (2006) agree with the findings of this study. When technology and adequate equipment are available to vendors for waste minimization in the form of waste disposal bins, garbage trucks, boots,

and rakes, the levels of improper trash disposal will be reduced, and waste minimization will be improved. Budgets with functional needs were significant for waste management at all levels. Zafar (2019) and the World Bank (2020) agree with these findings.

Functional sanitation facilities were significant at the bivariate, but not multivariate, level. Several researchers agree with these findings (Abdalla *et al.*, 2013 & Sebudde *et al.*, 2014). To curb the increasing waste accumulation and poor waste management, all stakeholders, including but not limited to council authorities, market leadership, vendors, and the community, need to be involved in developing working plans to minimize waste.

Finally, the availability of waste segregation bins was significant at all levels. This finding is similar to those reported by other researchers (UNEP, 2022; Tsiboe *et al.*, 2019; Suttibak *et al.*, 2008; Sharholy *et al.* 2008). This implies that enforcing waste management practices through sensitization and education of the presence of waste segregation bins is essential to minimize waste among food vendors effectively.

## Conclusion and recommendations

This study concludes that there is a less than optimal level of use of waste minimization practices among food vendors in Manseze ward. The levels of income, knowledge, and attitude of the vendors were identified as being crucial in minimizing waste. Among the institutional factors, provision

of equipment for waste segregation, collection and removal, and the provision of sanitary facilities were identified as being important in contributing towards minimizing of waste.

It is therefore recommended that those factors listed above should be given high priority by the vendors and the market administration, respectively, to ensure the minimization of waste in the Manzese ward.

### References

- Abdalla, M.A., Suliman, S.E. & Bakhiet, A.O. (2013). food safety knowledge and practices of street-food vendors in Atbara City (Naher Elneel State Sudan). *African Journal of Biotechnology*. 8 (24), 6967-6971.
- Adeyemo, F.O. and Gboyesola, G.O. (2013) Knowledge, attitude and practices on waste management of people living in the university area of Ogbomoso, Nigeria. *International Journal of Environment Ecology, Family and Urban Studies*, 3, 51-56.
- African Union Commission (2015). Agenda 2063 The Africa We Want September 2015. Popular Version. [https://au.int/sites/default/files/documents/36204-doc-agenda2063\\_popular\\_version\\_en.pdf](https://au.int/sites/default/files/documents/36204-doc-agenda2063_popular_version_en.pdf)
- Aini mat said. (2002). Practices, attitudes and motives for domestic waste recycling. *The International. (n.d.). Journal of Sustainable Development and World Ecology* 9(3):232-238. <http://doi.org/10.1080/13504500209470119>
- Ajzen, I. (n.d.). The theory of planned behavior. *organizational behavior and human decision processes*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-t](https://doi.org/10.1016/0749-5978(91)90020-t).
- Al-Khatib, I. A., Arafat, H. A., Daoud, R., & Shwahneh, H. (2008). Enhanced solid waste management by understanding the effects of gender, income, marital status, and religious convictions on attitudes and practices related to street littering in Nablus - Palestinian territory. *Waste Management*, 29(1), 449–455. <https://doi.org/10.1016/j.wasman.2008.02.004>
- Asmawati, A. (2015). The Effectiveness of skimming–scanning strategy in improving students’ reading comprehension at the second grade of SMK Darussalam Makassar. *Eternal (English, Teaching, Learning, and Research Journal)*, 1(1), 69-83.
- Ayo, E. E. (2019). Solid waste management in Dar es Salaam, Tanzania. Dar es salaam City Council. [https://www.waste.ccacoalition.org/sites/default/files/files/6\\_dar\\_es\\_salaam\\_uneall\\_march\\_2019\\_nairobi.pdf](https://www.waste.ccacoalition.org/sites/default/files/files/6_dar_es_salaam_uneall_march_2019_nairobi.pdf)
- Babirye J., Vuzi P.Mutekanga D. R. (2020). Factors influencing adherence to proper health care waste management practices among health workers in Wakiso District, Uganda. *Journal of Environmental Science and Public Health* 4 (2020): 96-111. <https://www.fortunejournals.com/articles/factors-influencing-adherence->



- to-proper-health-care-waste-management-practices-among-health-workers-in-wakiso-district-uganda.html
- Cole, M., Lindeque, P. K., Fileman, E., Clark, J., Lewis, C., Halsband, C., & Galloway, T. S. (2016). Microplastics alter the properties and sinking rates of zooplankton faecal pellets. *Environmental Science & technology*, 50(6), 3239-3246.
- Desa, A., Kadir, N. B. A., & Yusooff, F. (2012). Environmental awareness and education: a key approach to solid waste management (SWM) – A case study of a university in Malaysia. InTech eBooks. <https://doi.org/10.5772/48169>
- European Commission, (2014) Waste prevention and management. [https://ec.europa.eu/environment/green-growth/waste-prevention-and-management/index\\_en.htm](https://ec.europa.eu/environment/green-growth/waste-prevention-and-management/index_en.htm)
- Fadhullah, W., Imran, N. I. N., Ismail, S. N. S., Jaafar, M. H., & Abdullah, H. (2022). Household solid waste management practices and perceptions among residents in the East Coast of Malaysia. *BMC public health*, 22(1), 1. <https://doi.org/10.1186/s12889-021-12274-7>
- Hazra T. & Goel S, (2019). Solid waste management in Kolkata, India: practices and challenges. *Waste Management*, Volume 29, Issue 1, 2009, Pages 470-478, ISSN 0956-053X. <https://doi.org/10.1016/j.wasman.2008.01.023>.
- Henry, R. K., Yong-Sheng, Z., & Jun, D. B. (2006). Municipal solid waste management challenges in developing countries – Kenyan case study. *Waste Management*, 26(1), 92–100. <https://doi.org/10.1016/j.wasman.2005.03.007>
- Hilburn, A. M. (2015). Participatory risk mapping of garbage-related issues in a rural Mexico municipality. *Geographical Review*, 105(1), 41–60. <https://doi.org/10.1111/j.1931-0846.2014.12044.x>
- Hogan, K. (2002). A sociocultural analysis of school and community settings as sites for developing environmental practitioners. *Environmental Education Research*, 8(4), 413–437. <https://doi.org/10.1080/1350462022000026818>
- Huisman Herman, Breukelman Hans & Keesman Bert (2016). Expert mission on integrated solid waste management ( ISWM) in Dar es Salaam, Tanzania. <https://www.rvo.nl/sites/default/files/2016/11/Tanzania%20Report%20Expert%20Mission%20Solid%20Waste%202016.pdf>
- Hub, I. S. K. (n.d.). HLPF 2023 Reviews SDGs 6, 7, 9, 11, and 17, Begins Discussion of VNRs | News | SDG Knowledge Hub | IISD. <https://sdg.iisd.org/news/hlpf-2023-reviews-sdgs-6-7-9-11-and-17-begins-discussion-of-vnrs/>
- Israel, G. D. (1992). Determining sample size evaluation and organizational development, IFAS, University of Florida. PEOD-. November, 1992. <https://www.psychosphere.com/Determining%20sample%20size%20by%20Glen%20Israel.pdf>

- Lopes, A. B. (2001). Book Review. *Administrative Science Quarterly*, 46(3), 558-560. <https://doi.org/10.2307/3094875>
- Manzese Food Vendors Records (2021). Annual report of Manzese food vendors operations (2021). Filed at the Kinondoni District Offices of Dar es Salaam City Authority.
- McAllister, Jessica (2015). Factors influencing solid-waste management in the developing world (2015). All Graduate Plan B and other Reports. 528 <https://digitalcommons.usu.edu/gradreports/528>. <https://doi.org/10.26076/2c24-5944>
- Meherishi, L., Narayana, S. A., & Ranjani, K. S. (2019). Sustainable packaging for supply chain management in the circular economy: *Journal of Cleaner Production*, 237, 117582.
- Mesfin, A., Worku, W., & Gizaw, Z. (2014). Assessment of health care waste segregation practice and associated factors of health care workers in Gondar University Hospital, North West Ethiopia, 2013. *Universal Journal of Public Health*, 2(7), 201–207. <https://doi.org/10.13189/ujph.2014.020703>
- Miller, W. R., & Thoresen, C. E. (1999). Spirituality and health. In W. R. Miller (Ed.), *Integrating spirituality into treatment: Resources for practitioners* (pp. 3–18). American Psychological Association. <https://doi.org/10.1037/10327-001>
- Mugambe, R. K., Nuwematsiko, R., Ssekamatte, T., Nkurunziza, A. G., Wagaba, B., Isunju, J. B., Wafula, S. T., Nabaasa, H., Katongole, C. B., Atuyambe, L. M., & Buregyeya, E. (2022). Drivers of solid waste segregation and recycling in Kampala slums, Uganda: A Qualitative Exploration Using the Behavior Centered Design Model. *International Journal of Environmental Research and Public Health*, 19(17), 10947. <https://doi.org/10.3390/ijerph191710947>
- Muiruri, J., Wahome, R. and Karatu, K. (2020) Study of residents' attitude and knowledge on management of solid waste in Eastleigh, Nairobi, Kenya. *Journal of Environmental Protection*, 11, 779-792. <https://doi.org/10.4236/jep.2020.1110048>.
- Nyampundu, K., Mwegoha, W.J.S. & Millanzi, W.C. (2020) Sustainable solid waste management Measures in Tanzania: An exploratory descriptive case study among vendors at Majengo market in Dodoma City. *BMC Public Health* 20, 1075 (2020). <https://doi.org/10.1186/s12889-020-08670-0>
- OECD (2020). OECD Accession Review of Costa Rica in the Fields of Environment and Waste. Summary Report. <https://one.oecd.org/document/ENV/EPOC%282019%2918/FINAL/en/pdf>
- Ogola J. S., Chimuka L. & Tshivhase S. E. (2011). Management of municipal solid wastes: A case study in Limpopo Province, South Africa. <https://doi.org/10.5772/18655>
- Ouma, B. N., Okoth, M. W. & Muthama, J. N. (2021). Knowledge, attitudes, and practices synthesis of waste



- management among horticultural processing MSMEs in Kenya. *East African Journal of Science, Technology and Innovation*, 2, 1-16.
- Rhodes, J. E., & DuBois, D. L. (2008). Mentoring relationships and programs for youth. *Current Directions in Psychological Science*, 17(4), 254–258. <https://doi.org/10.1111/j.1467-8721.2008.00585.x>
- Røpke, I. (2009). Theories of practice — New inspiration for ecological economic studies on consumption. *Ecological Economics*, 68(10), 2490–2497. <https://doi.org/10.1016/j.ecolecon.2009.05.015>
- Santos, S. P. D., Belton, V., & Howick, S. (2008). Enhanced performance measurement using OR: A case study. *Journal of the Operational Research Society*, 59(6), 762–775. <https://doi.org/10.1057/palgrave.jors.2602397>
- Sebudde S., Kabagambe R, Muganwa G & Margaret. (2014). Hygiene and sanitation in public eating places in one municipal health system of Uganda. 1. 1-8.
- Sharholly, M., Ahmad, K., Mahmood, G., & Trivedi, R. (2008). Municipal solid waste management in Indian cities – A review. *Waste Management*, 28(2), 459–467. <https://doi.org/10.1016/j.wasman.2007.02.008>
- Suttibak, S. & Nitivattananon, V. (2008). Assessment of factors influencing the performance of solid waste recycling programs. *Resources, Conservation and Recycling*. 53. 45-56. 10.1016/j.resconrec.2008.09.004.
- Tchobanoglous, G., & Kreith, F. (2002). *Handbook of Solid Waste Management*. McGraw Hill.
- Tsiboe F, Asravor, J. & Osei, E. (2019). Vegetable production technical efficiency and technology gaps in Ghana. *African Journal of Agricultural and Resource Economics*, 14 (4), 255-278.
- UNDP (2022). The sustainable development goals in action. *The United Nations Development Program*. <https://www.undp.org/sustainable-development-goals>
- UNEP (2022). Solid waste management – Cities. *The United Nations Environment Program*. <https://www.unep.org/explore-topics/resource-efficiency/what-we-do/cities/solid-waste-management>.
- United Republic of Tanzania (2018). The National Solid Waste Management Strategy. Prepared by the Department of Chemical and Mining Engineering University of Dar es Salaam, Tanzania. [https://wedocs.unep.org/bitstream/handle/20.500.11822/31292/NWMS\\_Tanzania.pdf?sequence=1&isAllowed=y](https://wedocs.unep.org/bitstream/handle/20.500.11822/31292/NWMS_Tanzania.pdf?sequence=1&isAllowed=y)
- Viljoen, J. M. M., Schenck, C. J., Volschenk, L., Blaauw, P. F., & Grobler, L. (2021). Household waste management practices and challenges in a rural remote town in the Hantam Municipality in the Northern Cape, South Africa. *Sustainability*, 13(11), 5903. <http://dx.doi.org/10.3390/su13115903>

- Warde. A (2005). Consumption and theories of practice. *Journal of Consumer Culture* 5(2), 131-153.
- World Bank Annual Report 1999 (English). Washington, D.C.: World Bank Group. <http://documents.worldbank.org/curated/en/282291468321230375/The-World-Bank-annual-report-1999>
- World Health Organization. (2020). Water, Sanitation, Hygiene, and Waste Management for the COVID-19 Virus: Interim Guidance, 19 March 2020. <https://apps.who.int/iris/handle/10665/331499>
- The World Bank, (2022). Solid Waste Management. Washington DC: World Bank Group. <https://www.worldbank.org/en/topic/urbandevelopment/brief/solid-waste-management>
- Zafar, S., & Zafar, S. (2022, March 18). Medical waste management in developing countries. BioEnergy Consult. <https://www.bioenergyconsult.com/medical-waste-management>.