

## Research Article



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## Domestic solid waste management practices in an informal settlement: A gendered perspective

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**Abstract**

This study aimed at investigating the practices of men and women in the management of domestic solid waste in Kiandutu Informal Settlement in Kiambu County, Kenya. The consideration of men and women is paramount because a community is made up of the two genders each displaying different characteristics, perceptions and behaviour towards a similar situation. The study was guided by the Social Context Theory and Identity Theory. The findings reveal that gendered socialization processes played a big role in men's and women's daily encounter with domestic solid waste. The domestic solid waste practices exhibited were gendered and being regulated by socio-cultural and environmental factors. Men and women were found to engage in various solid waste management practices but motivated by different factors that had a gender connotation. The study therefore suggests that strategic gendered interventions are a prerequisite to effective management of domestic solid waste particularly in the informal settlement where solid waste management equipment and infrastructure are limited.

**Keywords:** waste, gender, management, participation, socialization

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**Public Interest Statement**

NEMA (2014) asserts that the informal settlements residents lack suitable domestic solid waste management (DSWM). Involving men and women in DSWM is important as it works towards eliminating gender bias in the solid waste management processes. Kiarie (2012) established that being one of the largest heterogeneous informal settlement outside Kenya's capital city Nairobi Kiandutu Informal Settlement (KIS), has 96.9% of the inhabitants unable to manage the domestic solid waste. Further, Koomen (2012), notes that KIS has poor DSWM systems. This study therefore aimed at establishing the participation of men and women in the management of domestic solid waste in Kiandutu informal settlement.

**Introduction**

The urban informal settlements dwellers engage in massive domestic waste generating activities in the households hence, the generation of volumes of domestic solid waste. Its management however, from the household level, has become a challenge for many cities and authorities across the world. This is indicated in studies by Chandra, and Devi, (2009), Alhassan and Mohammed (2013) and UN-Habitat, (2013) in different locations of the globe. Studies by Moghadam, Mokhtarani and Mokhtarani (2009), Al-Khatib, Kontogianni, Abu-Nabaa, Alshami & Al-Sari (2015) and Hilburn (2015) in McAllister (2015) emphasize that urban informal settlements communities in developing countries often turn to domestic solid waste disposal methods that are detrimental to human health and destructive to the environment. These methods include but are not limited to illegal dumping and burning. The domestic waste is illegally dumped into any open space available, the pathways and open trenches some of which are just at their doorsteps. In places where there is some open space, illegal burning of the combustible waste takes place, some of which produce gases that are a risk to humans. Such methods of disposal of solid waste from households can have irreversible and potentially harmful effects on both human health and the environment. The effects of the generated domestic solid waste may be short term or long term, depending on how it is managed.

Being not a neutral concept, domestic solid waste should be understood within the cultural context realizing that within a society and in a particular household, men, women and children may have different perceptions and opinions in regard to the waste (Poswa, 2009). In respect to socialization patterns, within the African context, women are more likely than men to be associated with domestic solid waste involvement and management thereof. Therefore, due to the assigned gender roles in a society, women and girls always find themselves in the context of handling and managing waste from the households (Muhammad and Manu, 2013).

Banga (2013) opines that men and women are shaped by social determinants such as beliefs, culture and values accrued from the host society. Therefore, a practical gender perspective is a prerequisite for collaboration between men and women to take initiative on how to more effectively manage domestic solid waste. Further, Bacanovic (2011) notes that gender filters through the relations between men and women observing that the impact of gender relations in domestic waste management is indisputable. Understanding men's and women's concerns in the management of domestic solid waste facilitates the shaping of different forms of gendered undercurrents that uniquely relate with management of domestic solid waste within their households.

This study therefore sought to assess the participation of men and women within an informal settlement in Kenya through a gender lens.

## Theoretical Framework

This study was guided by two theories, namely Identity Theory advanced by Stryker and Burke (2000) and the Social Context Theory (SCT), propagated by Earle and Earle (1999). According to Identity theory, One's identity or status in the society, has a direct ability and capacity to direct an individual into reflexively responding to a situation presented to him /her in certain different ways. Further, this causes men and women to behave differently due to attitudes associated with one's gender, (Carter, 2014). In this study, domestic solid waste management continued to be displayed according to the societal gender expectations and stereotypes with the already acquired gender socialization perceptions determining how men and women act. According to this theory, the acquired gender socialization precepts supersede the application of rational thought. Hence, individuals act against reason due to socialization. The SCT aims at social integration among community members, by facilitating comprehensive and productive ways of involving individuals in productive activities and social interactions. More specifically, in this study, the SCT sought to address the construction of a social context that can facilitate a basis for activities and social interaction at the household and community levels with regard to domestic solid waste management. The management of domestic solid waste is a social role that requires an active and collaborative participation of men and women and can therefore can be termed as one of the important components in environmental sustainability. When the social forces such as socialization, lack of good education and poverty acts on individuals, particularly in an informal settlement, they affect their behaviour. Responses of men and women within such environments will therefore act in a certain way to the surrounding situations for survival, in this case in reference to DSW. The survival strategies inform them how to cope with DSW and they end up engaging in unconventional methods of managing that waste.

## Methodology

The study was carried out in Kiandutu Informal Settlement (KIS) in Kiambu County as it is one of the largest heterogeneous urban informal settlements outside Kenya's capital city, Nairobi (Kiarie, 2012). KIS is situated in the south of the outskirts of Thika Town in Kiambu County within Central region Kenya. KIS is divided into ten sub-areas or villages namely Biashara, Mosque, Mutatu A, Mutatu B, Molo A, Molo B, Stage Wariah, Centre Base, Mikinduri and Kianjau. Both Molo-A and Molo-B are seemingly the two largest villages in terms of area and uniquely lie at the south –Eastern region of KIS and occupy almost a third of KIS. These two village also enjoy the longest boarder-line to the non-informal areas. They are also not as populated and therefore not as congested as the rest of KIS. A sizable number of the residents here, especially those at the periphery engage in farming activities at a small scale. Mutatu-A and Mosque are the two smallest villages in area. Biashara (a Kiswahili word for trade or commerce) village is the commercial area where many shops that deal with food stuff, clothes, wood, etc., are located, with an outflow into the Centre-Base. As the name suggests, Centre-Base village lies at the central region of the entire informal settlement. Stage-Wariah village was named so because of a large number the residents being from the Somali community. Mosque village, neighbouring Stage-Wariah village draws its name from a mosque built within it.

The study used multi-stage sampling procedures. First three villages were randomly selected from a total of ten. Second, 264 male and female household heads which is a 10% representative sample of households from 2637 households in the study site was obtained. Based on Census, a proportion of 46% and 54% male and female headed households respectively of the 264 formed the study units distributed as shown in Table 1. In addition, 12 key informants participated in the study.

**Table 1: The sample size: Male and Female household heads**

No.	Name of village	Number of households in selected village	Total households to participate in the study per village	46% of men	54% of women
1	Mutatu A	658	66	30	36
2	Centre Base	903	90	41	49
3	Molo B	1,076	108	50	58
	<b>Totals</b>	<b>2637</b>	<b>264</b>	<b>121</b>	<b>143</b>

This study adopted descriptive research design. The design allowed collection of the desired data from the respondents using guided questionnaire, interview and observation schedules allowing the discovery of relationships and contrasts between variables that cannot be manipulated. This guided the study to address the gaps to establish the participation of men and women in the management of domestic solid waste. Further, the design was ideal for self-reported facts by respondents and their inner feelings, attitudes and opinions (Orodho & Kombo, 2002). The questionnaires were administered to the respondents until the targeted number of both the male headed and female headed household heads was attained for each village. Interview guides enabled data collection from Key informants. An observation schedule was used to capture first-hand information on certain aspects addressing the practices men and women were using in the management of domestic solid waste.

## FINDINGS AND DISCUSSION

### 1. Demographics of the respondents:

#### a) Gender

Table 1 represents the number of men and women that took part in the study. Both genders were represented from all villages considered for study. The differences in number of men and women household heads was due to the actual households in each village. Kimani and Mwikamba (2010) emphasize the importance of gender by stating that one's gender orientation dictates the relations between men and women as well as their involvement in specific engagements of life.

#### b) Marital Status

Marital status defines of power relations within a household and had an influence on the management of the generated household solid waste. In addition, marital status may give a bearing into the nature and amount of domestic solid waste generated within a given household. According to Flood (2009), married people, especially males, exhibit perceptions and attitudes that differ from the unmarried because of their status. Further, the society's expectation is that married men should not engage in the stereotyped household chores like dealing with waste as activities were demeaning to men.

**Table 2: Marital Status of the Household Heads per Village**

Marital Status	Mutatu-A				Centre Base				Molo-B			
	Men		Women		Men		Women		Men		Women	
	n=30		n=36		n=41		n=49		n=50		n=58	
	FC	%	FC	%	FC	%	FC	%	FC	%	FC	%
Married	23	76.7	4	11.1	30	73.2	5	10.2	36	72.0	6	10.3
Single	4	13.3	2	5.6	6	14.6	4	8.2	8	16.0	5	8.6
Separated	2	6.7	18	50.0	-	-	27	55.1	2	4.0	25	43.1
Widowed	1	3.3	12	33.3	5	12.2	13	26.5	4	8.0	22	37.9
<b>TOTAL</b>	<b>30</b>	<b>100</b>	<b>36</b>	<b>100</b>	<b>41</b>	<b>100</b>	<b>49</b>	<b>100</b>	<b>50</b>	<b>100</b>	<b>58</b>	<b>100</b>

(FC – Frequency Count)

The findings of the study as indicated in table 2, showed that across the board, majority of the respondents in the study were married. There were more married male household heads across all the villages in comparison to the cumulative number of women who were married. This signified a male dominated society in family life, denoting that there was an imbalance of power relations between men and women in KIS. The findings indicated that men who were either separated or widowed formed the smallest number of respondents as compared to the total number of women respondents who were either separated or widowed. Further analysis indicated that these women were living with their children. The Social Context Theory advances the importance of family context as one of the factors that determine peoples' attitudes, perceptions and actions. It is within a family set up that values are inculcated and family culture determined. Therefore, type of the family had a bearing on the way men and women managed domestic solid waste in the area of study.

### c) Income:

Income played an important role in shaping the economic conditions of an individual. A study by Hoornweg and Bhada-Tata (2012) revealed that the higher the income level of an individual, the greater the amount of solid waste is generated. One's level of income is also a determiner of the nature of solid waste generated. Table 3 presents the levels of income per month in Kenya shillings (Current exchange rate: 1USD=101 Ksh).

Table 3: Level of income of the respondents across villages

Monthly Income in Kshs.	Mutatu-A				Centre-Base				Molo-B				Total	
	Men		Women		Men		Women		Men		Women		Men	Women
	n=30		n=36		n=41		n=49		n=50		n=58			
	FC	%	FC	%	FC	%	FC	%	FC	%	FC	%		
Below 3000	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
3001-4000	2	6.7	4	11.1	1	2.4	5	10.2	3	6.0	3	5.2	6	12
4001-5000	9	30.0	9	25.0	4	9.8	9	18.4	6	12.0	12	20.7	19	30
5001-6000	8	26.7	7	19.4	3	7.3	7	14.3	11	22.0	19	32.8	22	33
6001-7000	3	10.0	9	25.0	6	14.6	18	36.7	8	16.0	15	25.9	17	42
7001-8000	2	6.7	1	2.8	11	26.8	7	14.3	9	18.0	4	6.9	22	12
8001& above	6	20.0	6	16.7	16	39.0	3	6.1	13	26.0	5	8.6	35	14
	30	100	36	100	41	100	49	100	50	100	58	100	121	143

The differential in the earnings in favour of Centre-Base was occasioned by the fact that majority of the male counterparts owned the key businesses like shops and butcheries while the few women in this earning category were running vegetable kiosks at retail level. Despite these earnings, the residents of Kiandutu Informal Settlement live in deplorable state of poverty. According to Cheru (2005), an individual's financial power dictates what to buy and what not to. This lifestyle activity contributes to the type and amount of waste a household generates.

#### d) Occupation

Both male and female household heads were engaged in different socio-economic activities to earn a living as reflected on Table 4

Table 4: Nature of Economic Engagement Undertaken

Monthly Income in Kshs.	Mutatu-A				Centre-Base				Molo-B				Total	
	Men		Women		Men		Women		Men		Women		Men	Women
	n=30		n=36		n=41		n=49		n=50		n=58			
	FC	%	FC	%	FC	%	FC	%	FC	%	FC	%	N=121	N=143
Formal Employment	1	3.3	0	0.0	0	0.0	0	0.0	2	4.0	0	0.0	3	0
Self-Employment	12	40.0	5	13.9	23	56.1	16	32.7	18	36.0	12	20.7	53	33
Casual Labourer	16	53.3	29	80.6	16	39.0	32	65.3	29	58.0	44	75.9	61	105
Not gainfully engaged	1	3.3	2	5.6	2	4.9	1	2.0	1	2.0	2	3.4	4	5
	30	100	36	100	41	100	49	100	50	100	58	100	121	143

The study revealed that the formal and self-employment engagements for men and women was different. Women indicated that some of their casual labour engagements included household chores - house cleaning and washing of clothes in other estates. Men's main undertakings was also casual jobs that included grass cutting, live fence trimming as well as building and construction across the larger urban location of Thika.

## 2. Domestic Solid Waste Management Practices

The study sought to find out the practices carried out by men and women household heads in the management of domestic solid waste in the area of study. The findings revealed that men and women across the three villages involved themselves in illegal dumping, illegal burning, segregation, reuse and composting as practices in domestic solid waste management (DSWM) as shown in Figure 1. However, the intensity of these practices were varied in the different villages of the study.

**\*Multiple responses allowed**

**Figure 1: Domestic Solid Waste Management Practices by Village and gender**

### a). Illegal dumping

The study sought to establish whether men and women household heads in the area of study engaged themselves in illegal dumping of DSW as a management practice. The results are shown in Table 5.

**Table 5: Illegal dumping of domestic solid waste by village and gender**

Do you dump domestic solid waste						
Response	Mutatu-A		Centre Base		Molo-B	
	Male	Female	Male	Female	Male	Female
	(n=36)	(n=30)	(n=49)	(n=41)	(n=58)	(n=50)
Yes	57.4%	100%	66.2%	100%	78.8%	100%
No	42.6%	0.0%	32.8%	0.0%	21.2%	0.0%
<b>Grand Average</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

Analysis revealed that all female household heads represented at 100% (n=143) involved themselves in illegal dumping while fewer male household heads engaged in the practice with the highest involvement being in Molo-B. These variations between male and female household heads were due to the gendered nature of DSW (Miraftab, 2004). The illegal dumping is done along the road and in the trenches in the villages.

Despite the fact that communities across Africa consider the household chores and dirt handling as a preserve for women, the study found out that an unprecedented number of men engaged in illegal dumping as a DSWM practice. As Table 5 depicts, Molo-B was represented at 78.8% (n=58%), Centre-Base at 66.2% (n=49) and Mutatu-A at 57.4% (n=36).

A large number of the of male household heads 78.8% (n=58) found to be practicing illegal dumping in Molo-B village did so on the account of being at the periphery of the village with large open spaces and having no other choice, a sentiment also expressed by women. The smaller

number of men engaging in illegal dumping as a domestic solid waste practice was accredited to the entrenched cultural belief that men in the African setting would seldom want to be associated with domestic solid waste management since it was viewed as a preserve for women. According to Mariwah and Yin (2013), women are seen to have a liking of keeping their homes clean in which the responsibility of waste management can be directly or indirectly be related to the apparent internalization of social expectations. Therefore, in most African cultural setups, boys and men are discouraged from engaging with household chores and domestic solid waste management. Hence the household waste is left to be attended to by girls and women. A female household head respondent from Molo-B expressed herself by saying:

*We have nowhere else to throw the garbage from our houses. People throw their waste at the roads. Sisi ni wananchi wadogo (We are insignificant citizens) and nobody cares for us, that is why it is the way it is. (Female household head from Molo B).*

In the same tone a male household head respondent from Mutatu A expressed similar sentiments by specifying that:

*People dump the waste anywhere they want, on roads or trenches, unfinished buildings - anywhere! (Male household head from Mutatu A).*

Although both Molo-B and Mutatu-A had a peripheral boundary which provided more open space that men and women used for illegal dumping their DSW, the unique characteristic of Mutatu-A was the presence of a scrap buying yard which men sold plastics and metal that would otherwise be discarded. Molo-B however, had plenty of open space with residents using such space for illegal DSW dumping.

The study also established that illegal dumping practice was as a result of a care free lifestyle that encouraged a 'dirt culture' among crowded urban populations and lack of other DSW management options. Men and women from the three villages had different reasons for illegal dumping of the household waste on roads, open spaces or trenches. However, a common sentiment expressed by most female household heads across the three villages was,

*There is no garbage collection system within the settlement and we get the garbage out of the house to the heaps along the roads or just throw in the trenches.*

On the other hand, men household heads across the three villages also had a common expression that,

*As long as the waste gets out of the house to leave my house clean, what happens from there is not our concern. There is no one in the house to manage the waste, I organise myself to discard that waste at night.*

This sentiment was strongly informed by the socialization process which clearly defines gender roles from an early age. According to the Identity Theory (Stryker and Burke, 2000), the society has assigned gender roles and has patterns in fulfilling its mandate. Moreover, this theory assumes that gender is static and cannot be altered and therefore the dishonour for men to handle DSW.



This study reflects what Emelumadu, Azubike, and Sidney-Nnebue (2016) postulated that the most common methods used in the management of domestic solid waste within most urban informal settlements is illegal dumping. This study also agrees with Chiroma and Gana (2012) who affirms that women are the recipients of the solid waste generated in homesteads placing them in an awkward position as this activity remains a daily unproductive routine.

### Testing the Null Hypothesis $H_0$ :

In order to statistically determine the relationship between men's and women's practices in illegal dumping of domestic solid waste management, the following hypothesis was tested:

$H_0$ : There is no significant difference of the illegal dumping practices in domestic solid waste between men and women

Independent samples t-test was used to test the hypothesis. Table 6 depicts the result.

**Table 6: Illegal dumping of Domestic Solid Waste**

Independent Sample Test	Paired Differences			t	df	p-value
	Mean	Std. Deviation	Std. Error Mean			
P4 - PP4	0.157	1.633	0.148	1.058	263	0.292

Analyzed data from table 6 shows that,  $t(263) = 1.058$ ,  $p = 0.292$  at 0.05 significance. The study therefore found the result not significant and therefore rejects the hypothesis that there is significant difference between men and women in the illegal dumping practices in DSWM.

### b) Burning

The study sought to establish whether men and women household heads in the area of study engaged themselves in burning of DSW as a management practice. Figure 1 shows that burning was one of the DSW practices carried out in the study area. Further, Table 7 illustrates in percentages the magnitude of involvement of the male and female household heads from the three villages in burning of DSW.

**Table 7: Burning of domestic solid waste – (by village and gender)**

Do you burn the solid waste you generate from your house?						
Row Labels	Mutatu-A		Centre Base		Molo-B	
	Male	Female	Male	Female	Male	Female
	(n=30)	(n=36)	(n=41)	(n=49)	(n=50)	(n=58)
Yes	45.0%	37.4%	21.9%	16.3%	55.4%	41.9%
No	55.0%	62.6%	88.1%	83.7%	44.6%	58.1%
Grand Average	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

The study established that both male and female household heads in the three villages involved themselves in burning of DSW as a waste management practice. This practice was found to be carried out along the roads or open spaces some of which were too close to the dwellings. The study found out that among the male household heads across the villages, Molo-B had the highest

representation while Centre-Base the lowest representation of those who engaged in burning of DSW. Further analysis revealed that comparatively, the female household heads engage less in burning of DSW as compared to the male household heads. However, although more men than women in general engaged more in burning household solid waste than women (Table 7), the study found out that the major initiators of the fires for burning DSW were women. This situation portrays men as being less purpose driven in regard to DSWM, depicting them also as less active players in the management of domestic solid waste and as those who want to live in secrecy in regard to DSWM.

The study found out that contrary to Molo-B village which had plenty of space and being in the periphery, Centre-Base was more congested and centrally placed village within Kiandutu Informal settlement. Therefore, there were less open spaces and therefore, the environment prohibited both male and female household heads from engaging in burning of DSW as compared to Molo-B. The study findings indicated that majority of both men and women from Centre-Base refrained from burning of DSW because of the eminent danger of fires breakouts that is common within informal settlements. This shows that population characteristics such as congestion of households as well as the population density has a bearing on the way individuals' consideration on the choice of the DSWM practice.

Commenting to why burning is carried out by the residents of Kiandutu Informal Settlement, a Community Health Extension Worker said that:

*Both men and women engage in the practice of burning the waste from their households but, burning waste within the human dwellings poses several dangers including severe health implications, fire outbreaks and pollution of the environment. (Interview with CHEW)*

Responding to why they preferred engaging in burning the solid waste from their households, a female headed household from Centre-Base responded and said:

*Burning is an easy way of getting rid of the waste from our houses. The only dangerous thing is to burn the waste very near the houses as it may cause a fire outbreak. (Female household head from Centre-Base).*

This statement describing why the female household head engages in burning of the solid waste from her household is occasioned by a belief passed on to her. She is careful to note the 'benefits' of burning the waste. In another response to the same enquiry, a female household head from Molo-B replied by saying,

*Burning of the waste helps in keeping away rats and snakes from our houses, although it sometimes brings a lot of smoke and bad smell into our houses. (Female household head from Molo-B).*

This sentiment from a female household head is a representation of the how women are inclined to caring for their immediate environment. It points to the fact that women are in the forefront in the management of domestic waste. Although the method deployed here is not favorable, it paints a picture that women are more inclined than men to environmental consciousness. However, a male household head from Molo-B village was of different opinion and said.

*Some men especially the unmarried want to conceal what they purchase and consume and therefore throw what they desired to burn in a fire they find near their dwelling. (Male household head from Molo B).*

Majority of the male household heads were of different opinion from women as to why they engage in burning of domestic solid waste. A common sentiment from the men was,

*People burn waste they generated in their houses and any other that is at the place we burn waste from although not everyone does it. Burning kills flies and cockroaches and chases away rats and snakes. Snakes are attracted by the rats as it is their food. (Male household head from Molo).*

A male village elder from Centre-Base expressed in an interview that;

*In some instances, I have seen men take garbage to the place where there is a fire. I have never started a fire on my own to burn garbage but I sometimes see women struggling to kindle one. This is the fire that we use to burn our waste. (Male Village Elder, Centre Base)*

Burning of domestic solid waste however posed danger of fire breakouts because this was carried out near the dwellings many of which were wooden. Moreover, the study findings revealed that the men found to be engaged in burning of DSW were not the originators of the fires, rather they threw their waste to burn in the fires already started by women.

The study findings agree with Al-Khatib, *et.al.* (2015) and Hilburn (2015) in McAllister (2015) underscore that urban informal settlements communities in developing countries often turn to burning of domestic solid waste in open spaces or along the roads. Similarly, Chapungu, *et.al.*, (2015) and Mukama *et.al.*, (2016) observed that among the practices used for managing domestic solid waste in informal settlements includes illegal burning.

Although with clear gender roles, men are socialized to stay away from the household chores, new social behaviours can be established by creating a new norm to challenge the existing social structures. This is argued by Social Context Theory which embraces the dynamics of societal modifications.

### Testing the Null Hypothesis $H_{0_2}$

In order to statistically determine whether there were significant differences between men's and women's practices in burning of domestic solid waste. The following hypothesis was tested:

$H_{0_2}$ : *There is no significant difference of the practices (in burning) of domestic solid waste management between men and women*

Independent samples t-test was used to test the hypothesis. Table 3 depicts the result.

**Table 8: Burning of domestic solid waste**

Independent Sample Test	Paired Differences			t	df	p-value
	Mean	Std. Deviation	Std. Error Mean			
P5- PP5	-0.623	1.172	0.145	-5.759	263	0.000

Analyzed data from Table 8 shows that,  $t(263) = -5.759, p = .000$ . The study therefore found the result not significant and therefore rejects the hypothesis that there is significant difference in the burning practices between men and women. Therefore, both men and women were found to engage in burning as a DSW practice. Contrary to the social norm that women should have the larger share in DSW management due to socialization, more male than female household heads engaged in burning of DSW.

### c). Segregation

The study sought to establish whether men and women household heads in the area of study engaged themselves in segregation of DSW as a management practice. The men and women household heads involved in the study were required to answer the question 'Do you segregate domestic solid waste?' in order to indicate whether they indeed carried out this practice. Table 9 shows the result.

**Table 9: Domestic solid waste management segregation practices**

Do you segregate domestic solid waste?														
Response	Mutatu-A				Centre-Base				Molo-B				Total	
	Men		Women		Men		Women		Men		Women		Men (n=121)	Women (n=143)
	n=30		n=36		n=41		n=49		n=50		n=58			
	FC	%	FC	%	FC	%	FC	%	FC	%	FC	%		
Yes	11	36.6	16	45.5	4	9.8	15	30.6	15	30.0	23	39.6	25.5%	39.0%
No	19	63.3	20	55.5	37	90.2	34	69.4	35	70.0	35	60.3	74.5%	61.0%
<b>Total</b>	<b>30</b>	<b>100</b>	<b>36</b>	<b>100</b>	<b>41</b>	<b>100</b>	<b>49</b>	<b>100</b>	<b>50</b>	<b>100</b>	<b>58</b>	<b>100</b>		

The study revealed that both male and female household heads involved themselves in the segregation of DSW indicating that more female than male household heads were participating in domestic solid waste segregation.

However, the three villages differed in their involvement in segregation of DSW each of the villages being motivated to do so by different triggers. Both male and female household heads from Mutatu-A engaged in segregation upon motivation of the presence of a selected waste buying yard within the village.

Further, the analysis revealed that only (4) 9.8% of the male household heads from Centre-Base involvement themselves with DSW segregation as compared to their female counterparts represented at (15) 30.6%. This was attributed to their involvement with their businesses. The higher women's involvement in the practice was attributed to the fact that comparatively more male household heads at 56.1% (23) as compared to female household heads at 32.7% (16) were self-employed as depicted on Table 4. Therefore, women engaged in sorting all form of domestic solid waste in order to sell for a living.

Further, study also noted that across the villages, (86)71.1% n=121 of the male household heads and (129) 90.2% n=143 of the female household heads were earning less than Ksh.8000 per month as shown in Table 3. These low income levels had a bearing on segregating and selling of any salvaged

domestic solid waste. Such items include plastic containers of assorted sizes, metallic items for example *sufurias* (aluminum cooking pots) as well as pieces of metal of any nature including nails. This level of income is far below the gross monthly per capita income in Kenya which stood at Ksh 14,508 in 2018.

On the other hand, the study revealed that although there were some male household heads from Centre-Base involved in segregation, they did so to recover anything they could sell at their businesses. An elderly female household head from Mutatu-A articulated her satisfaction in segregation of DSW and said:

*Segregation is driven by one's need of food to feed the chicken and goats. The nonfood waste is sorted and dumped in open spaces. (Female household head, Mutatu-A)*

In the same tone, a sentiment expressed by a male household head from Centre-Base was:

*Trying to separate waste is a waste of time. I would rather be at my business making money than do that. That waste you are talking about from our houses, we bundle it together and throw it away in at the roads. (Male household head from Centre-Base).*

These two sentiments were a representation of the expression of the gendered nature of DSW. However, both the male and female household heads from Molo-B expressed similar opinions as to why they engaged in the management of DSW. Unlike the women from Mutatu-A, women from Molo-B gave their reasons for segregating the DSW as feeding the animals and composting.

The study established that one's placement within Kiandutu Informal Settlement, for example in Molo-B village which is at the periphery, or living further inside the village or like Centre-Base, dictated what the segregated waste was used for. The study found out that women living at the periphery in Molo-B mainly segregated their DSW for the purpose of feeding their animals which included pigs chicken and goats. Some women who did not own any livestock also segregated their DSW for food stuff to sell to those who owned livestock. Others did so for a different purpose of making compost for vegetable growing.

The findings of this study are in tandem with the those of Regassa *et al.*, (2011) who affirmed that segregation of DSW is an essential component of solid waste management. Likewise, a study by Bulle (1999) as cited in Bauchi (Nigeria) by Gani *et al.*, (2012) affirmed that through segregation of DSW, women demonstrate that they are more responsible than men in the maintenance of the living conditions and health situation in homesteads. This is because of the socialization that defines the gender roles of men and women.

According to Social Context Theory (Earle and Earle (1999)), individuals in a social context are expected to get involved in productive activities and social interactions that are beneficial and those that can eventually help shape the societal structures, social processes that ultimately form a common pattern of social behaviour.

This study therefore sees one's gender as having a strong effect in the segregation of domestic solid waste as a management strategy. Men and women had different reasons as to why they engaged in the practice of segregating the domestic solid waste. This study finding concurred with NEMA (2014) that established that in Kenya, very few households segregate waste at the household level. This waste eventually clogs the waste stream unnecessarily. If men and women would take responsibilities and segregate the DSW, there would be ease in managing the municipal waste,

much of which is generated by households.

### Testing the Null Hypothesis $H_0$ :

In order to statistically determine whether there were significant differences between men's and women's practices in composting of domestic solid waste, the following hypothesis was tested:

$H_0$ : There is no significant difference of the practices (in composting) of domestic solid waste management between men and women

Independent samples t-test was used to test the hypothesis. Table 5 depicts the result.

**Table 10: Statistical Test of the composting of domestic solid waste**

Independent Sample Test	Paired Differences			t	df	p-value
	Mean	Std. Deviation	Std. Error Mean			
P6 - PP6	-0.165	0.373	0.034	-4.875	121	0.000

The analyzed results in Table 10 shows that there was a significant difference between male and female household heads reasons for segregating the solid waste generated within the households before disposal;  $t(121) = -4.875, p=.000$ . Thus the hypothesis was rejected.

### d). Reuse

The study sought to establish whether men and women household heads in the area of study engaged themselves in reuse of DSW as a management practice. The men and women household heads involved in the study were required to answer the question 'Do you reuse domestic solid waste?' in order to indicate whether they indeed carried out this practice. Table 11 shows the result.

**Table 11: Reuse of domestic solid waste**

Do you reuse domestic solid waste?								
Response	Mutatu-A		Centre-Base		Molo-B		Total	
	Male	Female	Male	Female	Male	Female	Male	Female
	(n=30)	(n=36)	(n=41)	(n=49)	(n=50)	(n=58)	n=121	n=143
Yes	22 (74.5%)	27 (75.0%)	38 (91.7%)	41 (83.3%)	47 (94.6%)	56 (96.2%)	107 (88.4%)	124 (86.7%)
No	8 (25.5%)	9 (25.0%)	3 (8.3%)	8 (16.7%)	3 (5.4%)	2 (3.8%)	14 (11.6%)	19 (13.3%)
<b>Average</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

The study established that majority of both male and female household heads across the villages (Table 11) reused the domestic solid waste from various motivations and for different purposes.

This result indicated that the residents of the study area were passionate in the reuse of DSW among it being cloths, plastic papers and plastic containers.

In as much as this finding indicate intense reuse of DSW, it is not commensurate to the way the DSW is managed and disposed. The sections 2 (a) and (b) discusses illegal dumping and burning respectively, indicating that all female household heads from the three villages represented at 100% (n=143), involved themselves in illegal dumping while the highest male household heads' involvement was in Molo-B represented at 78.8% (n=58). In regard to burning, the study established that all the three villages in the study also involved themselves in burning of DSW as a waste management practice.

The study found out that both men and women household heads predominantly used the old clothes for dusting the dirt off their household ware for example furniture. The houses are of poor standard and have earthen floor and therefore dust is prevalent. Further enquiry revealed that cloth waste was used in different ways with some uses being unique to women and others to men. The male household heads for example were found to use cloth waste as pillow while women household heads across the villages indicated that they used some of their cloth that they do not put on for wrapping the cloths for protection against dust. This practice was common among women as they are traditionally seen as the home keepers by maintaining the cleanliness of the whole family. Women too are obliged by the society to be smartly dressed especially on special occasions like weddings and those associated with it like dowry and *kamweretho* sessions. A common sentiment expressed by those who carried out this practice was:

*When there are special occasions like weddings or 'kamweretho', we have to dress well. We wrap our special clothes in older cloths that we don't use to keep the dust away, (Female household head, Centre-Base)*

From the preceding sentiment, this study found out that this is one of the significant ways in which women reuse their old cloths differently from men. It shows that women are more conscious of cleanliness than men and they would do anything possible to fit within the social class or group in their society. Any woman who may appear unpresentable before the others especially during special occasions like *kamweretho* is deemed irresponsible and may be ridiculed, fined or forbidden from participating in particular women groups within the society. On the other hand, men are not as keen as women and such predicament that befalls women are unlikely to befall men.

Abdullahi, (2011) cited in Muhammad & Manu (2013) sees domestic solid waste as a resource in the wrong place, thus reusing that which is substantial is an added value those who generate since the practice helps in both keeping the environment clean as well as a money saving channel. According to UN-Habitat (2010), reuse of waste, and in this case DSW prevents pollution and helps to sustain the environment. Reuse is one of the highly recommended options to reducing DSW.

These findings affirm Wachira (2013) that the management of solid waste and in particular plastic papers in most urban informal settlements and peri-urban areas in Sub-Saharan Africa countries was a big challenge. Similar sentiments are advanced by Mukama, *et.al.* (2016) who cautions that there is need to manage the plastic papers in a sustainable way and warns that unless stringent measures are taken on the management of plastic papers, the environmental damage will be too great to repair.

According to Social Context Theory, advanced by Earle and Earle (1999), the gendered social environment, shapes an individual to fit into the social realities of the place one is living in.

Therefore, gender is significant in determining what men and women engage with in the waste stream, and how they look, think and act on a particular waste item. Majorly, the societal structures and processes determine the social behaviour which eventually develops in men and women to have value for a waste item.

However, according to Zaman and Lehmann (2011), Townend (2010) and Greyson (2007) in Cole (2011), reduction of waste and an eventual elimination, through behavioural change strategy is a better option than generating and reusing since not all waste is reusable. This scenario is justified by Identity Theory (Stryker and Burke, 2000) which assumes that gender roles serves both to fulfil a mandate as well as to advance a social norm.

### Testing the Null Hypothesis $H_{0_2}$ :

In order to statistically determine whether there were significant differences between men's and women's practices in reusing of domestic solid waste, the following hypothesis was tested:

$H_{0_2}$ : *There is no significant difference of the practices (in reusing) of domestic solid waste management between men and women*

Independent samples t-test was used to test the hypothesis. Table 11 depicts the result.

**Table 11: Statistical test for reuse of domestic solid waste**

Independent Sample Test	Paired Differences			t	df	p-Value
	Mean	Std. Deviation	Std. Error Mean			
K4 - KK4	0.050	1.521	0.138	-0.359	263	0.721

As indicated on table 7, there was a significant difference between men and women household heads who perceived that household solid waste contributed to heaps of garbage and environmental degradation;  $t(263) = -0.359$ ,  $p=0.721$ . The study therefore failed to reject the hypothesis on this variable.

### e). Composting

The study sought to establish whether men and women household heads in the area of study engaged themselves in composting of DSW as a management practice. Composting is a process of putting the biodegradable material together to have it decay so as to use the product - compost mature, to improve soil quality for higher crop yield. The men and women household heads involved in the study were required to answer the question 'Do you compost domestic solid waste?' in order to indicate whether they indeed carried out this practice. Table 12 shows the result.



**Table 12: Composting as a domestic solid waste practice by village and gender**

Responses	Do you compost domestic solid waste?					
	Mutatu-A		Centre Base		Molo-B	
	Female (n=36)	Male (n=30)	Female (n=49)	Male (n=41)	Female (n=58)	Male (n=50)
Yes	(1) 2.8%	(2) 6.7%	(2) 4.1%	(1) 2.4%	(7) 12.1%	(4) 8.0%
No	(35) 97.2%	(28) 93.3%	(47) 95.9%	(40) 97.6%	(51) 87.9%	(46) 92.0%
<b>Total Percentage</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

The study established that composting of DSW as a management practice was not common among both the male and female household heads across the villages involved in the study. All male and female household heads across the villages (except female household heads from Molo-B) had over 90% of them not involved in composting practice in DSWM. Only a small percentage of both men and women engaged in this practice with Molo-B village being the highest represented. This practice was a choice taken by a few men and women who lived in the periphery in Molo-B village. Women engaged in composting aimed at using the generated compost manure for growing kales, a food plant with large green leaves locally known as *sukuma-wiki*, which is one of the staple accompaniment foods in Kenya. They did so with an intention to feed their families and the surplus sold to members of the community. A female household head living in the periphery of Molo-B expressed herself and said;

*I have a small hole behind my house that I compost waste in. I also ask neighbours from our plot to put their food left overs, and vegetable related waste there. I use compost in the garden to grow sukuma wiki to feed my family. (Female household head from Molo-B)*

From this statement, it is clear that women make an extra mile to provide for their families besides depending on men. This is one of the triple roles of women. On the other hand, a male household head from Molo-B commented as to why he does not engage in composting,

*Composting is a dirty job because you will keep on turning rotting and smelly waste. (Male household head from Molo-Base)*

This could be construed to mean that there was lack of adequate systems DSW practices and management. The findings of this study correspond well with a study by Guerrero, Maas and Hogland (2013) who found out that composting as a domestic solid waste management strategy was not a preferred practice for domestic solid waste especially by urban residents.

#### **Testing the Null Hypothesis $H_0$ :**

In order to statistically determine whether there were significant differences between men's and women's practices in composting of domestic solid waste, the following hypothesis was tested:

**$H_0$ :** *There is no significant difference of the practices (in composting) of domestic solid waste management between men and women*

Independent samples t-test was used to test the hypothesis. Table 13 depicts the result.

**Table 13: Composting of domestic solid waste**

Independent Sample Test	Paired Differences			t	df	p-value
	Mean	Std. Deviation	Std. Error Mean			
P1 - PP1	0.116	1.226	0.111	1.038	263	0.301

Analyzed data from table 12 shows that,  $t(263) = 1.038$ ,  $p = 0.301$ . The study therefore found the result significant and fails to reject the hypothesis that there is significant difference between men and women in the composting of DSW.

### Conclusion

These findings indicated that both men and women involved themselves in different methods of DSWM namely illegal dumping, burning, segregation, reusing and composting. However, although members of either gender engaged in these DSW practices, the point of divergence was their engagement magnitude that was influenced by their demographics which had a bearing on the choice of practice. Men from Centre-Base for example, segregated their DSW depending on the wastes' economic value and use within their business premises. On the other hand, some men and women from Molo-B segregated their DSW so as to get feed for their domestic animals while in Mutatu-A, the men engaged in segregation for economic gains after selling their selected assortments to a waste buying centre within their locality. Further, different from the Centre-Base, men and women from Molo-B dumped and burned some of their DSW because there were open spaces within the village and the fact that the village enjoyed a large periphery boundary to open land. Centre-Base was highly congested and their illegal dumping was done into the trenches and the roads. This study concludes that Gender reflects the true nature of the management of domestic solid waste within household. There is therefore need for creation of a collaborative solid waste management knowledge base through gendered sensitization, education, gender sensitive policies and partnership with both Local and National governments agents to address the health and environmental challenges and alleviate poor management of domestic solid waste.

## Recommendation

Based on the findings and the conclusions of the study, the following recommendations were drawn so that they can be put into consideration for the enhancement of better domestic solid waste management practices within households. The County Government of Kiambu (CGK) and the National Environment Management Authority (NEMA) should engage in awareness raising on best practices in the management of domestic solid waste through:

- i. Supporting the Village Elders, and other community leaders to, with a gender locus, use the locally available social platforms such as women's *chamas* as channels for sharing the appropriate knowledge on DSWM aimed at modifying their perception and build consciousness and awareness of DSW generated within their households.
- ii. Investing in the village leadership at the local community with adequate knowledge on domestic solid waste management practices and empower them in communication skills so as to cascade information to the target community using their *language (a particular way of communication)*.
- iii. Targeting men so that they can collaborate with other family members in the management of domestic solid waste. This creates and strengthens family bonds.
- iv. Mobilizing systems and activating frameworks that will have men and women equipped with skills by developing gender sensitive SMART policies.

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