Chapter

An Investigation of Waste Management Practice in a South African Township: A Case Study of Ekuphumleni Township, Ndlambe Municipality

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Abstract

Solid waste is a global challenge that is more pronounced in developing countries such as South Africa, where its management is a major concern. The government has recently made a concerted effort to engage the public in sustainable waste management practices to resolve the crisis occasioned by the challenge. This chapter investigates waste management practices in the South African Township of Ekuphumleni and relied on a sample of 353 households to obtain some primary data with a questionnaire on the subject matter. The data collected was analyzed using "R," and the results were presented using charts, tables, and figures. Data collected revealed that waste paper, cans, used plastics, and bottles were major waste components generated by the respondents and these wastes were generally stored unseparated domestically in plastic bags and home garbage can. Furthermore, the respondent indicated that the municipality does a door-to-door collection of their waste and they were unwilling to pay for waste collection services. While the waste management practice is in tandem with the municipal system, the study recommends that the respondents must be educated on circularity, which will ensure reducing, reusing, recycling, and recovering waste and further aid economic empowerment.

Keywords: waste, waste management, township, south African

1. Introduction

Waste continues to be generated because of human activities, and as the increase in the human population stimulates urbanisation, it is becoming an issue of global concern [1]. Waste refers to all pieces of objects and items such as garden waste, packing items, vegetables, metals and old paint containers, among others, that owners have no

more use for and they aim to discard [2, 3]. The concern for such items stems from the continuous contamination of the atmosphere, soil and water, which endlessly impacts public health and global degradation [4].

It is important to note that the increasing solid waste generation places additional strain on the already overburdened waste management systems, and if waste is not properly managed, it may cause societal problems with the "Not-In-My-Backyard" mindset anticipated to emerge and prevail [5]. Besides, poorly managed solid wastes can have catastrophic environmental implications, such as becoming a breeding ground for disease-spreading vectors, production of leachates which contaminates groundwater, production of methane gas with its subsequent effects on global warming and climate change and increased fire outbreak, to mention a few [6].

Waste management is simply the collection, transportation, processing, or disposal of waste materials [7]. Chand [8] further described waste management as a procedure to mitigate the waste impact on the environment, health, or aesthetics. However, the poor handling of the procedure in urban and rural areas has been a major problem for human health and existence [9].

As a result of the global impact of waste, at least 12 of the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development, adopted by the 193 UN Member States in September 2015 [10], have a direct association with solid waste management. Furthermore, according to the Global Waste Management Outlook (GWMO), the cross-cutting nature of solid waste management (SWM) and its impact on 12 SDGs emphasise its importance and political priority [11].

Despite the SDG's focus, waste and its management practices remain a major global challenge [12]. Low-income countries' main waste procedures and disposal mechanisms are open dumping and open burning [13]. For example, open littering [14], open dump [15], illegal dump sites [16], and incineration [17], among others, are some of the waste management practices still in practice in developing countries.

While no study as to the practice of waste management in Ekuphumleni Township, Ndlambe Municipality has been conducted, this chapter seeks to present the findings of the current practice and make recommendations towards addressing and raising the level of awareness and knowledge of sustainable solid waste management practices in the low-income neighbourhood of emerging nations.

The subsequent sections present the literature works, the methodology employed, findings and recommendations and conclusions of the study.

2. Waste management practices

Waste is unwanted, useless, and discarded material generated daily by human activities [18]. The E.U. Waste Directive defines waste as any object or substance the owner throws away, implying that it is useless [19]. However, several schools of thought, such as Steenmans and Malcolm [20], Thomas [21], and Hannon and Zaman [22], have argued against this definition as the value of waste is deemed to be subjective as what is waste to a consumer is a resource to another.

As a result, Wiprächtiger [23] argues that there is no such element as final waste because its definition will always depend on the degree of its perceived usefulness to its holder. It is then safe to align with van Ewijk [24] that the definition of waste is always contextual and can depend on the prevailing state of technology, the environment, and political ideology.

According to the Basel Convention, waste is categorised into two main typologies: hazardous and non-hazardous [25]. While hazardous waste is regulated at the national level, regulating the non-hazardous is within the purview of the regional and or municipal government [26]. The Basel convention documented hazardous wastes as radioactive, industrial, electronic and medical waste, among others, while the non-hazardous are municipal and non-hazardous industrial waste [27].

Mngomezulu [14] and Adeniran [15] identified the typology of municipal waste to include cans, and other metals, paper, bottles, plastics, food remains, old appliances, glass and construction demolition waste, among others.

Hoornweg and Bhada-Tata [6] further identified the types of waste and their sources to be: glass (broken glassware and bottles, coloured glass and light bulbs, among others); metal (foil, cans, tins, appliances and railings, among others); organic (garden/yard waste, food scraps and wood process residues, among others); paper (newspaper, cardboard, paper scraps and boxes, among others); plastic (packaging, containers, bags and lids, among others); and other (leather, textiles, rubber, multi-laminates and other inert materials).

The growth in waste is alarming in metropolitan areas, and this is due to population movements towards these centres [28]. Waste growth tends to rise proportionately with urbanisation, rising income levels, and population expansion [12, 29]. While the global population keeps growing, its changing demographics are quickly evolving, and such areas are witnessing unprecedented levels of urbanisation, with the majority of this growth occurring in small and medium-sized cities in low-income countries [30]. Amaral [31] indicates that the unprecedented population growth has several environmental consequences, including increased urbanisation and municipal solid waste generation, which is expected to reach 3.4 billion tonnes annually by 2050. This waste growth is unfortunately not being matched with appropriate management practices [32].

Waste management is collecting, storing, treating, and disposing of waste materials in a manner that is safe for humans, vegetation, living creatures, ecosystems, and the environment [33].

As practiced in most emerging countries, households dispose of all forms of waste together [34], and the municipal trucks collect them [35] and when and if not collected, the practice of illegal dumping, littering and open burning of waste is practiced [36].

In South Africa, AWARD [37] indicated that over 90% of the collected waste is disposed of into landfills.

The literature highlighted three types of landfills: the open dump, the semi-controlled landfill, and the sanitary landfill [38]. Despite the attendant challenges posed by the open dump practices, it is still the most used method by urban centres in the developing world [12].

Waste collection and landfill activities have significantly contributed to greenhouse gas (GHG) emissions and climate change [39]. However, these poor waste management practices have fallen excessively on the poverty-stricken neighbourhoods with little or no influence on the waste products being illegally dumped near them [40].

A waste management system includes appropriate separation and decommissioning, logistics, storage, worker training and disposal facilities [41].

Adeniran [42] posited that numerous policies had been positioned to tackle waste and pollution in Sub-Saharan Africa. However, [43] argues that it is unclear if these policies are actioned as there is little or no progress towards achieving their

aims and obligations. In addition, UNEP [44] indicated that the inability of many African governments to enforce waste and environmental regulations had fostered an environment of impunity, thus affecting the performance of waste management. According to David [45], the resultant effect is that industry participants are incapable of keeping up with the increasing waste streams and the timely development of strategies and policies to manage them effectively.

Despite their limited capacity for planning, limited resources, operational monitoring, and contract management, local governments are frequently in charge of an effective waste management system, and these limiting factors make sustainable waste management difficult [46].

Globally, various waste handling and disposal systems are in place; however, the major difference between the systems of advanced and emerging economies is waste separation at the collection point [47], which facilitates waste recycling and reuse, recognised as the most beneficial waste management system.

Mir [48] aver that the population must accept a waste management system to be effective, and [49] underscores the importance of ensuring a higher standard of living for future generations, simply defined as sustainability. Hence a solid waste management system must be socially acceptable, economically viable, and environmentally efficient to be sustainable [50].

Affordability denotes that all sectors of society accept the cost of maintaining a clean environment, whereas societal acceptance denotes that the inhabitants agree to the service offered if it meets their needs [51]. Meanwhile, the waste management system must be environmentally friendly by implementing an environmental conservation strategy, structure, and policy.

Simatele [52] documented that South Africa, like other developing countries, has implemented waste management policies, but their application proved inconsistent. Dlamini *et al.* indicated that these policies cover a set of efforts to tackle enhancements for environmental and public health quality. Nonetheless, despite the legal importance and quality, the law's enactment per se does not guarantee improvements in solid waste management [53].

South Africa has 13 pieces of legislation on waste management [54]; the most recent is the National Environmental Management: Waste Amendment Act, 2014 (Act 26 of 2014). The thrust of this legislation is *"to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development"*.

3. Methodology

The data for this paper were collected between 20th and 24th September 2020 between the hours of 10 h00 and 20 h00 to ensure that respondents who had gone to work were given the opportunity as they are expected to have returned by the evening at the latest. The time frame was chosen because residents are expected to have completed their household chores by 10 h00; those who had left home in the morning would have returned for dinner by the late evening. During the collection period, data were collected on various aspects, including household waste management and disposal practices; thus, this study focuses on the waste management practices of Ekuphumleni households. Ekuphumleni township is adjacent to the Kenton on Sea within the Ndlambe Municipality in the Eastern Cape, South Africa. The township is located approximately 130 km from Port Elizabeth on the Port Alfred-East London corridor.

Mean	Decision/Interpretation		
1.00 to 1.44	**Never**	**Very difficult**	**Very Unsafe**
1.45 to 2.44	Rarely	Difficult	Unsafe
2.45 to 3.44	Sometimes	Moderate	Fairly safe
3.45 to 4.44	Often	Easy	Very safe
4.45 to 5.00	Always	Very easy	

Adapted from Sarrafzadeh [56].

Table 1.
Decision rule.

The estimated population of the township was about 1800 households and using a 95% confidence level and a 5% margin of error, 317 households were targeted, but we succeeded in reaching a sample of 353 households using convenience sampling to gather primary data from the willing and available representatives of all households during the fieldwork.

Within the COVID-19 protocol, this study utilised a Likert scale-like questionnaire; because of its simplicity in composition, the Likert Scale was the preferred scaling system for applicable statements/questions as it also allows for the use of hidden perceptions and is expected to yield a high accuracy of measurement [55]. The questionnaire covered a wide range of topics and offered information for developing a local economic strategy as the data collection tool. The data collection was managed by the researchers, who also participated in the data collection, assisted by a team of well-trained field workers. There had been several meetings and consultations between all stakeholders regarding the green village project to be developed within the community prior to administering the questionnaire. Ward Councillors, Community Representatives, and Municipality Officials attended these meetings and expressed their support for conducting the study in the area. After approval, potential participants were approached, informed consent was obtained from them, all the participants were assured of anonymity and confidentiality, and their participation was entirely voluntary.

The data collected was analysed using SPSS, and the adopted decision rule was adapted from [56] and presented in **Table 1**.

4. Findings

4.1 Demography

Demographic data allows us to determine whether there are differences in the answers provided by the respondents based on personal characteristics, and it also assists us in determining if there are gaps in our data, allowing us to ensure that it reflects the subject in question [57].

4.1.1 The population of households by gender

The data collected on the gender makeup of each household is presented in **Figure 1**, and it shows that the 353 participating households have a female population of 748 (57.2%) and a male population of 560 (42.8%). This implies that each

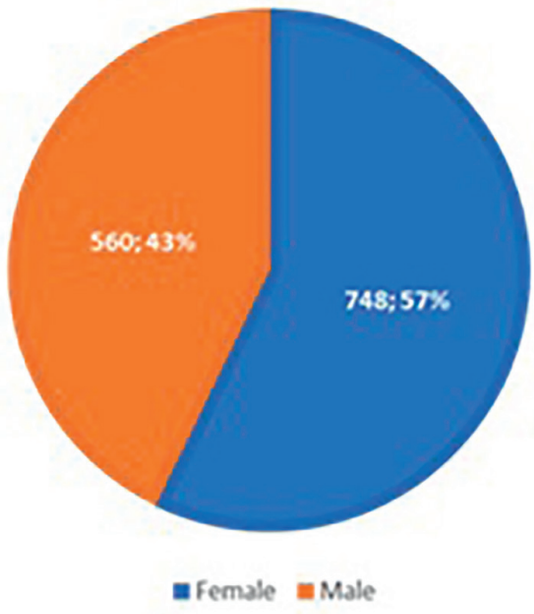

Figure 1.
Population of household by gender.

household has an average of 3.70 people, i.e. the ratio of females to males is 2.12 to 1.58 per household).

4.1.2 Household headship

The questionnaire did not specify how participants should perceive headship, and no question queried what made a household member the head. However, in most households, the person described as the head of the household was the oldest family member.

As shown in **Figure 2**, except for one household with a coloured male respondent head, there are more black female-headed households than black male-headed households across all age groups. According to the frequency distribution in **Figure 3**, the overall mean age of the household head was 46 years.

4.1.3 Education level

Using households that are 20 years and above, **Table 2** shows that 410 respondents representing 93.0% of the household members either did not attend school, had incomplete or complete primary and incomplete and complete secondary school while 17 Nr (3.9%) have certificate and 10 Nr (2.3%) hold diplomas. It is also interesting to note that the 4 Nr (0.9%) with a bachelor's degree are all female. Again, these figures apply to household members (20 years and above) whose highest education qualification was reported.

4.1.4 Household average monthly income

As revealed in **Tables 3**, 244 households (69.1%) live on an average monthly income of less than R6000, while another 46 households (13%) earn no income. 6.2%

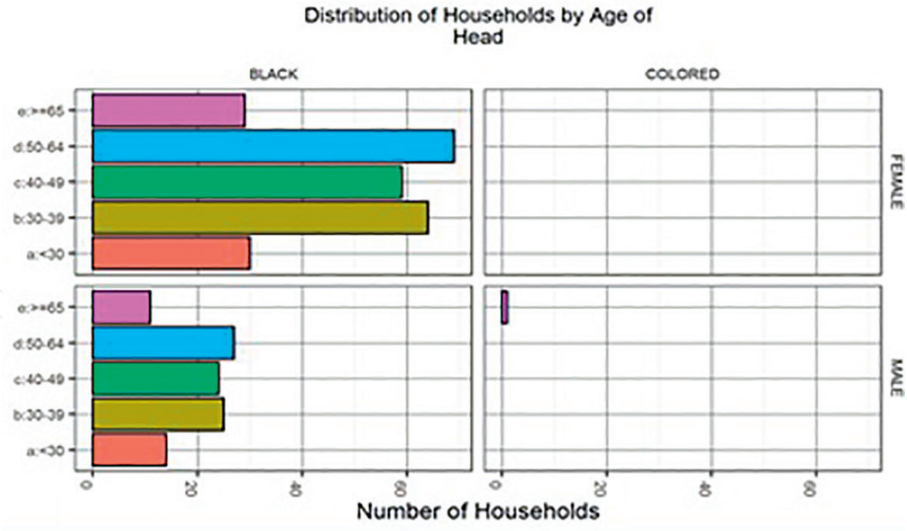

Figure 2.
Age of household head.

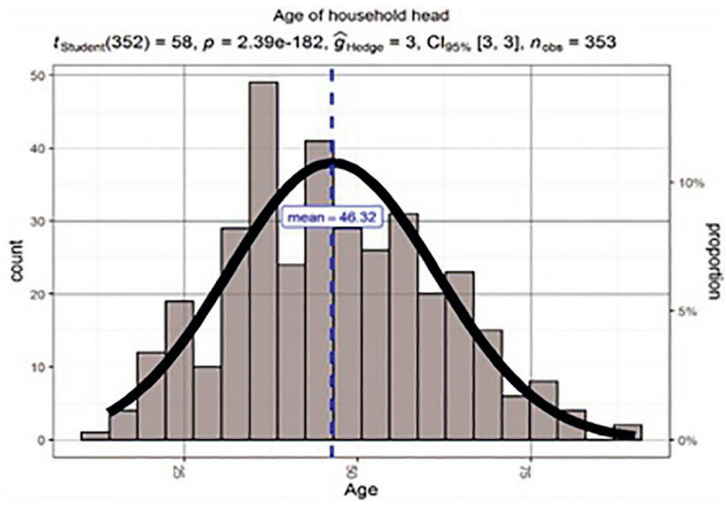

Figure 3.
Distribution of age of household head.

earn an average monthly income of between R6000 and above R20000, meaning they are in the mid to high-income strata.

4.2 Waste management practices in Ekuphumleni township

4.2.1 Types of waste generated and frequency

Taking a cue from **Table 1**, as seen from **Table 4**, waste paper, cans, used plastics, and bottles rank first, second, third and fourth with mean scores of 3.13, 3.00, 2.95, and 2.92, indicating that the respondents sometimes generate these materials as waste. On the other hand, food remains, old clothing, old appliances, human waste, hazardous waste and oil are rarely generated as their mean scores ranged between 1.45 and 2.44; decision rule from **Table 1**, the respondents never generate other types of waste with a mean score of 0.32. With a composite mean of 2.09, there is a sign that waste is rarely generated in the township.

Response	Female		Male		Total	
	Nr	%	Nr	%	Nr	%
No schooling	30	6.8	25	5.7	55	12.5
Incomplete primary	59	13.4	44	10.0	103	23.4
Complete primary	12	2.7	17	3.9	29	6.6
Incomplete Secondary	72	16.3	59	13.4	131	29.7
Complete secondary	54	12.2	38	8.6	92	20.9
Certificate	13	2.9	4	0.9	17	3.9
Diploma	5	1.1	5	1.1	10	2.3
Bachelors' degree	4	0.9	0	0.0	4	0.9
Total	249	56.5	192	43.5	441	100

Table 2.
Household members' highest educational qualification.

Income band (Rands)	Number of households	Per cent
1 to 1999	114	32.3
2000 to 3999	108	30.6
4000 to 5999	22	6.2
6000 to 9999	9	2.5
10,000 to 12,999	5	1.4
13,000 to 15,999	6	1.7
16,000 to 20,000	1	0.3
>20,000	1	0.3
Unspecified	4	1.1
None	46	13.0
	353	100

Table 3.
Household average monthly income.

4.2.2 Waste storage material and frequency

Plastic bags with a mean score of 3.45 is often used as storage material by the respondents, as shown in **Table 5**, and it ranks first. Home garbage cans (MS, 2.11) and cardboard boxes (MS 1.68), ranking second and third respectively, are often used, while municipal plastic drums (MS 1.43), biodegradable sacks (MS 1.20), nearby municipal dumpster (MS 0.92) and into unused open plots (MS 0.75) are never used. With a composite mean of 1.65, there is an indication of general apathy towards storing waste in materials.

4.2.3 Waste separation

Table 6 reveals that 323 respondents representing 91.5%, indicated that they do not separate their wastes, while 19 Nr (5.4%) stated that they do and 11 Nr (3.1%)

Types of waste	Response								
	A	O	S	R	N	U	Total	MS	R*
Wastepaper	110	70	56	29	49	39	353	3.13	1
Cans	91	79	59	29	53	42	353	3.00	2
Used plastics	74	85	73	35	45	41	353	2.95	3
Bottles	71	77	83	40	40	42	353	2.92	4
Food remains	38	23	92	59	101	40	353	2.20	5
Old clothing	20	37	71	67	111	47	353	2.00	6
Old appliances	14	15	59	130	91	44	353	1.86	7
Human waste	45	20	26	22	148	92	353	1.63	8
Hazardous waste	14	11	50	55	149	74	353	1.48	9
Oil	22	11	25	40	208	47	353	1.46	10
Others	7	4	10	3	26	303	353	0.32	11
Composite Mean Score = 2.09									

Key: A = Always; O = Often; S = Sometimes; R = Rarely; N = Never; U = Unspecified; MS = Mean Score; and R = Ranking.*

Table 4.
Types of waste generated and frequency.

Waste storage material	Response								
	A	O	S	R	N	U	Total	MS	R*
Plastic bags	200	32	20	8	12	81	353	3.45	1
Home garbage can	110	17	14	17	52	143	353	2.11	2
Cardboard boxes	45	21	55	26	68	138	353	1.68	3
Municipal plastic drums	49	20	14	27	85	158	353	1.43	4
Biodegradable sacks	27	16	24	27	100	159	353	1.20	5
Nearby municipal dumpster	8	12	22	35	100	176	353	0.92	6
Into unused open plots	2	9	16	29	116	181	353	0.75	7
Composite Mean Score = 1.65									

Key: A = Always; O = Often; S = Sometimes; R = Rarely; N = Never; U = Unspecified; MS = Mean Score; and R = Ranking.*

Table 5.
Waste storage material and frequency.

were not specific. The respondents who indicated that they separate the waste, however, stated that they separate them into components of bottles, glasses, plastics, cans, boxes, cardboard and papers.

4.2.4 Waste disposal system and frequency

Table 7 shows that the disposal of waste into the Municipal waste truck with a mean score of 4.26 is often used as the means of waste disposal, while community bins (MS 1.82) are rarely used, and others such as recycling facilities, empty plots, landfill sites, abandoned houses and others are generally never used as their mean score is between 0.54 and 0.82. Besides, the composite mean of the waste disposal location stands at 1.58.

Separate waste	Number of households	%
No	323	91.5
Unspecified	11	3.1
Yes	19	5.4
Total	353	100.0

Table 6.
Waste separation.

Waste disposal location	Response								
	A	O	S	R	N	U	Total	MS	R*
Municipal waste truck	261	41	9	1	5	36	353	4.26	1
Community bins	87	8	18	31	59	150	353	1.82	2
Recycling facilities	5	9	23	27	105	184	353	0.82	3
Empty plots	3	9	6	27	116	192	353	0.68	4
Landfill sites	1	10	8	24	119	191	353	0.67	5
Abandoned houses	5	5	4	12	136	191	353	0.62	6
Others	0	0	1	1	14	337	353	0.54	7
Composite Mean Score = 1.58									

Key: A = Always; O = Often; S = Sometimes; R = Rarely; N = Never; U = Unspecified; MS = Mean Score; and R = Ranking.*

Table 7.
Domestic waste disposal system and frequency.

When further asked about the frequency of the collection, as revealed in **Table 8**, the respondents indicated that the municipality is the main waste collector with 344 Nr (97.5%) indicating such while 5Nr (1.4%) indicated other and 4 Nr (1.1%) was unspecified.

4.2.5 Waste collection point and frequency of collection

From the mean score ranking as presented in **Table 9**, door-to-door collection (MS 2.91) ranked the first in waste collection types, followed by community waste collection point (MS 1.95), while the collection of waste anywhere it is dumped (MS 0.70) and others (MS 0.20) ranks third and fourth respectively.

Collector and place	Number of Households	%
Municipality	344	97.5
Other	5	1.4
Unspecified	4	1.1
Total	353.0	100.0

Table 8.
Waste collector.

Collection type	Frequency								
	D	W	F	M	N	U	Total	MS	R*
Door-to-door collection	5	241	7	1	15	84	353	2.91	1
Community waste collection point	2	155	8	6	22	160	353	1.95	2
Collect waste anywhere it is dumped	4	36	6	9	48	250	353	0.70	3
Other	0	12	3	2	9	327	353	0.20	4

Key: D = Daily; W = Weekly; F = Fortnightly; M = Monthly; N = Never; U = Unspecified; MS = Mean Score; and R = Ranking.*

Table 9.
Waste collection point and frequency of collection.

Status	Number of households	%
No	333	94.3
Unspecified	9	2.5
Yes (government help)	5	1.4
Yes (no government help)	6	1.7
Total	353	100.0

Table 10.
Pay for waste removal.

4.2.6 Pay for waste removal

As shown in **Table 10**, the number of respondents who indicated that they do not pay for waste removal is 333 (94.3%), and 9 (2.5%) respondents did not specify. Of the number that said that they do pay for waste removal, 5 Nr (1.4%) indicated that the government helps them, and 6 Nr (1.7%) stated that they receive no help from the government.

5. Discussion of findings

From the findings, it can be generally inferred that the respondents practice effective waste management in line with the provision of the local municipality and the municipality also fulfils its responsibility of waste collection.

To underscore the representativeness of the study, the findings show that both genders of females and males participated in the study, although the data stated that there were more women than men, and this is supported by Knoema [58], who indicated that there are more women than men in South Africa, with a ratio of 97 men to 100 women. Also, this finding is supported by data from UNDP [59] on South Africa, which states that 51.5 per cent are female, and 48.5 per cent are male. Furthermore, Arcgis [60] stated that the average South African household size in 2019 was 3.3 people, whereas the study revealed an average of 3.70 persons per household, a size within the same range, reiterating the validity of the findings. Literature has, however, indicated that the generation of waste which in turn dictates the waste

management practice, is affected not only by the number of people but also by other factors like population structure or way of living and female to male ratio [61].

The survey identified that female household headship was in the majority, and literature indicates that female headship has been on the rise in South Africa, as recorded by the 10-yearly census data on female headship and income [62]. This assertion of [62] gives credence to the finding of this study. Furthermore, Posel [63] observed that the average age of South African heads of households was between 44 and 51 years and the average age of the participants from Ekuphumleni township was 46.32 years. While Anbazu [64] indicate that household heads influence the choice of waste management practice, Uma [65] further observed that many female-headed households utilise informal refuse disposal systems rather than male-headed households.

Using household members that are 20 years and above, the study observed that 12.5% of the respondents indicated that they have no schooling, but the finding of the waste practice showed that they have a good practice in consonance with Chikowore [66]. This finding is also supported by the observation of Mngomezulu [14] that the level of education has no association with waste management practices, but environmental education and a lack of information do.

The study observed that over 60% of the respondents are earning below R4000, putting them in the low-income strata of society. There is much scientific literature on the association of socioeconomic indices such as income with solid waste generation, but there are inconsistencies in the other literature findings. For example, Khan [67] stated that income significantly influences solid waste generation and management. Porpino [68] concluded that low-income households generate more waste, while Omolayo [69] concluded that higher-income households generate more waste than lower-income ones. Machate [70] observed that the causative factor is income, and that waste generation increases as income increases. Namlis [71] posited that the association was dependent on the development stage of a country and hypothesised that as income rises in emerging nations, so would solid waste generation; however, as income increases in advanced economies, waste generation significantly reduced. From the preceding, as expected, the waste generation in this community depended on other influencing factors asides from income.

Waste paper, cans, used plastics, and bottles were the major waste components generated in the township, and these wastes are recyclable. According to Chen [72], estimating the waste types generated and their management method can be useful for predicting future waste management trends. Nineteen case study of municipal solid waste in developing countries, as documented by Troschinetz [73], produces by average recyclable content of 55%. Such organic content includes food waste, paper and paper materials, human waste, bio-degradable plastic, and landscape and pruning waste, among others [9]. The data collected aligns with the literature on the typology of waste generated in developing countries and can be used to predict future trends and waste management systems.

Plastic bags and home garbage cans are indicated to be mostly used by the respondents as domestic storage materials, and according to the documentation of Yoada [74], the two most common storage items for domestic solid waste in Accra, Ghana, were plastic bins, baskets polythene bags, paper boxes and old buckets. Gumbi [75] also indicated that residents' major types of containers to dispose of waste collected by the municipality ranged from plastic bags to metal bins and plastic bins. The findings of this study show that plastic bag is the popular waste storage material in the township and aligns with other works of literature.

With over 90% indicating that they do not separate their waste, this finding aligns with the general apathy towards waste separation in developing countries where waste separation is uncommon, as observed by Ferronato [12]. According to Babaei [76], while initiatives to strengthen solid waste management in emerging economies have primarily focused on cost-effective practices such as separation, source reduction and recycling, their implementations have experienced social opposition because of low awareness and willingness to participate. Matete [77] also indicates that separation at source, among other things, is not yet accorded a top priority in line with regulatory and legal requirements in South Africa. Hence, it can be inferred that the respondent does not practice waste separation as part of their waste disposal practice.

The municipal waste truck always collects the waste from the respondents weekly from door-to-door as indicated by the respondents. According to the South African legislative provision, the municipality is responsible for solid waste management [78]. This agrees with literature from developed or emerging economies, such as Indonesia [79], Ghana [80], Colombia [81], Turkey ([82], South Africa [52], USA [83] and the United Kingdom [84] among others where the municipal truck is the main collector of waste, but the difference is the frequency and efficiency. The finding of this study, where residents indicated that municipal truck comes to remove their wastes, confirms what the literature indicates.

However, Statistics South Africa [85] observed a lack of SWM services in South Africa, with only 66% of the population receiving waste collection services from municipalities or private companies through municipal contracts. With this background, Hlahla [86] indicated that South Africa has a variety of waste collection systems designed to accommodate the unique conditions of a peri-urban community, one of which is door-to-door collection by municipal truck, which is the collection practice in Ekuphumleni.

With over 94% of the respondents stating that they were not willing to pay for waste management services, the study aligns with Omolayo [87], who observed that socio-economic factors such as income level affect households' willingness to pay for waste management in South Africa. Therefore, the respondents' household income level could be inferred to be why the respondents are unwilling to pay for such services.

6. Conclusion and recommendations

The United Nations'2030 target continues to prioritise environmental sustainability. As a result, various levels of government in South Africa have implemented various waste disposal avenues for the populace, but there have been reported inefficiency of these program(s) in many parts of the nation. As a result, we investigated waste management practices in the South African township of Ekuphumleni using primary data.

The descriptive statistics findings show an average of 3.70 people (the ratio of females to males is 2.12 to 1.58) per household, and the average household head age of 46 years was recorded. In addition, about 87% of the household heads had formal education and over 60% with a monthly income estimated at below ZAR4000/USD200. The findings further identified that most of the waste generated by the township is recyclable, and that the main disposal method is storing the waste at the household level with some form of plastic material, which is collected weekly at their doors by the municipal truck. Many households perceive littering and the dumping of refuse anywhere as an environmental problem that requires drastic measures for its control or eradication.

Recycling has a mean score of 0.82, indicating the need for sensitisation programmes and incentives to increase household participation in recycling waste products.

Almost none of the respondents pay for waste, which can be attributed to some or all the socioeconomic factors, particularly household income.

The study's findings imply that the waste management practices of the residents of Ekuphumleni township do not fully align with the sustainable waste management practices of reducing, reusing, recycling and recovering, although a high volume of their waste is recyclable. The waste collected by the municipal trucks end up in landfills, thus contributing to greenhouse gas emission and pollution of the groundwater system.

Therefore, this study concludes that there is a need for sustainable waste management practices in the township. This is achievable by raising awareness and educating the residents on the need for sustainable waste management practices of reducing, reusing, recycling and recovering towards a circular economy. Towards this, the South African government must intensify its efforts on poverty alleviation interventions to improve the socioeconomic status of households and environmental sensitisation programmes through adequate citizen education to facilitate the achievement of zero waste.

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Conflict of interest

The authors declare no conflict of interest.

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