

Article

Indigenous Knowledge Systems of Solid Waste Management in Bushbuckridge Rural Communities, South Africa

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Abstract: Indigenous knowledge systems related to solid waste management in economically marginalized communities have been largely overlooked in the scientific literature, even though the indigenous communities of developing nations struggling to manage solid waste rely on these practices. It is startling that indigenous solid waste management practices are scarcely documented in the scientific literature despite their position as potential alternative disposal methods. This gap persists amid limited municipal budgets, inadequate waste collection services, and poor infrastructure in economically marginalized indigenous rural communities in developing nations. Subsequently, in the discipline of solid waste management, this obstacle impedes the recognition and inclusion of indigenous waste management practices into integrated waste management plans. As a result, this causes a delay in their progress or elevation to the same level of credibility as mainstream scientific knowledge. In the process, this relegates the waste management practices of indigenous communities to the background. Against this background, the current study sought to investigate the indigenous solid waste management practices of rural communities in Bushbuckridge Local Municipality. As such, ten cases that captured the spatial cultural diversity of indigenous communities' practices across Bushbuckridge Local Municipality (BLM) were selected for sampling. Data were collected using ethnographic research methods. Data analysis was carried out using the thematic analysis approach. Inductive logic was used in the interpretation of the current study results. The results of the current study indicate that indigenous communities of Bushbuckridge Local Municipality, in the absence of formal waste management services from the local authority, resort to an indigenous knowledge system to manage solid waste. Waste burning (100%), open-air dumping (100%), and backyard pits (90%) are some of the indigenous waste management practices espoused by the rural communities of BLM. The similarity in practices was corroborated by statistical inferences that revealed that between BLM communities, the amount of indigenous waste management practices is not significant ($p > 0.05$). However, there are concerns that despite the sustainability aspect associated with recycling (<25%) practices, these disposal methods are not common in the rural communities of BLM. This is a setback for an indigenous knowledge system that is supposed to advance environmental sustainability practices.

Keywords: indigenous knowledge systems; solid waste management; indigenous communities; indigenous disposal methods; indigenous solid waste management



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1. Introduction

The generation of solid waste globally presents social and economic as well as ecological problems [1,2]. To an extent, both worlds (developing and developed countries) are grappling with the scourge of solid waste management engendering environmental

challenges [3–5]. According to Godfrey and Oelofse [6], to mitigate the environmental challenges, numerous global waste management strategies have been devised by industrialized countries, mainly European countries, to effectively manage waste. These are conventional waste management methods characterised by the collection, transportation, treatment, and disposal of waste [7,8]. These waste management services have been conveniently indigenized across the globe [9].

However, they are not devoid of challenges. For instance, in developing countries, municipalities that are responsible for the facilitation of these services encounter challenges with effective and efficient execution [10]. That is, the developing countries lack facilities, and this is coupled with insufficient service coverage and improper disposal and treatment methods, which are the cardinal pillars of conventional waste methods [9,11]. Subsequently, this impedes the waste management service delivery. Consequently, this could be the outcome of directly adopting waste management strategies from developed countries without factoring in the local context [12].

Therefore, it is not surprising that in developing countries these indigenized waste management methods encounter challenges of budget constraints, which cause fundamental problems for basic steps such as waste collection [13], especially since the success rate of these conventional waste management methods in developed countries is influenced by the financial muscle. Hence, managing waste effectively remains a challenge for numerous developing countries, to such an extent that these countries only account for 40–60% of their solid waste collection and only properly dispose of 5–30% of this waste [14]. Hence, comparative studies reveal that the average rate of municipal solid waste collection in low-income nations is 55% [15–17].

Africa as a continent is at the lower end given that it is predominantly characterised by low-income countries [18,19]; even the upper-middle-income countries such as South Africa, amongst others, encounter challenges in executing the constitutional obligation of waste management services. This occurs to an extent that according to Godfrey et al. [16], all the African states are battling to provide sufficient waste management services. At the heart of these challenges encountered by countries such as South Africa is the institutional challenge that the line of authority regarding waste services is not delineated, which subsequently results in unreliable waste collection services [20]. This leads to large amounts of waste being dumped illegally.

To this end, Grangxabe et al. [21] acknowledge that waste management services in most African countries are inadequate, to the extent that waste collection services are scarce or nonexistent in poor neighbourhoods and rural villages [22]. Echoing similar sentiments, Rodseth et al. [23] highlight that approximately 3.67 million tonnes of waste are not collected and treated through formal waste collection systems. The continental comparisons of waste collection services indicate that Africa provides 25% to 70% coverage [24]. According to the global waste outlook, this waste collection coverage is by far the lowest when contrasted against other regions. For instance, the communities of Bushbuckridge Local Municipality in South Africa experience a backlog of waste removal service provision [25]; according to Statistics South Africa [26], BLM has about 93% backlog of refuse collection [26]. BLM only collects about 7% of refuse waste, hence it is confronted with a 93% refuse collection backlog [26]. Generally, over 70% of the population lacks access to refuse collection services. Therefore, they are compelled to resort to unaccounted for indigenous waste management practices in the absence of formal services to manage waste.

Therefore, to resolve the backlog of waste collection, marginalized communities that lack formal waste collection services, such as the rural communities of BLM, resort to indigenous knowledge practices. These communities intuitively rely on indigenous knowledge practices. As Brondizio et al. [27] indicate, indigenous communities around the globe use various pathways to manage their solid waste. Indigenous waste management methods are believed to be instrumental in the preservation of the natural environment, and in some instances, they go as far as rehabilitating the natural environment from previous impairment [28]. The indigenous waste management ontology is believed to focus on

the concept of sustainability, in contrast to conventional methods that are centred around getting rid of waste [29].

However, the problem with many, if not all, local governments is to solely focus on indigenized conventional waste management strategies that focus on getting rid of waste as a panacea for all waste management solutions. Guran et al. [30] caution that given that the world population is estimated to reach 9.7 billion by 2050, resulting in increased demand for resources and increased production of waste, the conventional approach to waste management strategies will not be adequate. Therefore, this gap may present a platform for the inclusion of marginalized and overlooked waste management techniques such as indigenous waste management practices that are thought to be strategically aligned with sustainable development objectives to advance waste management. Hart and Vorster [31], as well as Naidoo et al. [32], contend that indigenous knowledge (IK) is one of the single largest resources that is not yet fully mobilized to inform policies and strategies for the management of scarce resources such as waste management.

It is because of this that scholars such as Oyegunle and Thompson [33] blame the colonial system for imposing some unsustainable foreign systems on the knowledge of indigenous peoples, especially because as far as waste management is concerned, indigenized conventional practices are favoured and preferred above indigenous waste management practices despite the latter's environmental sustainability. In light of the above, Siragusa and Arzyutov [1] lament that indigenous waste management practices are typically disparaged, neglected, and denied a voice in the waste management decision-making fraternity. For example, Solomon et al. [34] bemoan how indigenous waste management practices have been overlooked in the field of recycling. The feeling, therefore, is that there is very little involvement and recognition of indigenous communities' practical knowledge of waste management [1], even though long before the advent of indigenized conventional waste management practices, indigenous people had devised and developed ways and means in the form of knowledge and skills of managing waste with respect to their culture and experiences that mitigated the violation of the environment [35]. Akullo et al. [36] maintain that knowledge and skills are derived from humans' daily interactions with the environment, observations, and experimentation. Thus, indigenous knowledge and skills have been fundamental in assisting indigenous communities to culturally manage waste in the most efficient way possible [37,38].

However, there is limited information in the literature that outlines how indigenous communities use their knowledge systems to manage waste, although the act of documenting indigenous knowledge systems has the potential to safeguard cultural heritage and traditional philosophies that are currently threatened with extinction. Documentation guarantees that the invaluable knowledge and philosophies that indigenous communities have amassed over the generations remain preserved. The act of sharing and exchanging indigenous knowledge practices creates and promotes a convenient platform for these knowledge systems to be examined and potentially included in wider initiatives for sustainable development. As a result, this directly inspires innovation and adaptation; the integration of traditional philosophies with contemporary technologies and methodologies has the potential to generate novel concepts and resolutions fundamental to the discipline of waste management. It is for this reason that Senanayake [39] is critical of the tendency to exclusively prioritise modern waste management approaches that have, in some cases, been shown to provide short-term benefits in waste management but that are fundamentally unsustainable in the long term.

To mitigate this problem, it is critical to consider blended waste disposal methods that incorporate both modern and indigenous waste management practices. To achieve this, it is fundamental that marginalized indigenous knowledge practices are brought to the mainstream scientific literature for scrutiny. This is important for South Africa in order to provide insights into solid waste management, especially in marginalized rural communities lacking organised means to control the scourge of waste by the local authority. Thus, the current study aimed to bridge this gap by investigating and documenting

indigenous knowledge systems used for solid waste management in the rural communities of Bushbuckridge Local Municipality, South Africa.

2. Materials and Methods

2.1. Description of the Study Area

This study was undertaken in the rural communities of Bushbuckridge Local Municipality (BLM), a category B municipality that was established in the year 2000 [25]. A category B municipality is a local authority that has a constitutional obligation to deliver solid waste municipal services, amongst other functions [40]. As a result, its prominent cultural diversity status justifies its selection in the current study, which seeks to document the indigenous waste management practices in multiple study areas, as depicted in Figure 1. This municipality epitomizes rural local government authorities confronted with several challenges such as unemployment; high illiteracy (67.4%) of the population, who do not have a matric qualification; a backlog in waste removal service provision; and lack of adequate access to basic services [25]. As a result, according to Statistic South Africa [26], BLM has a 52% unemployment rate. Despite these challenges, BLM is one of the most diverse and rich municipalities in South Africa in terms of culture and language [41,42]. Different ethnicities and language groups may possess and present diverse indigenous knowledge practices of waste management owing to their diverse cultural backgrounds.

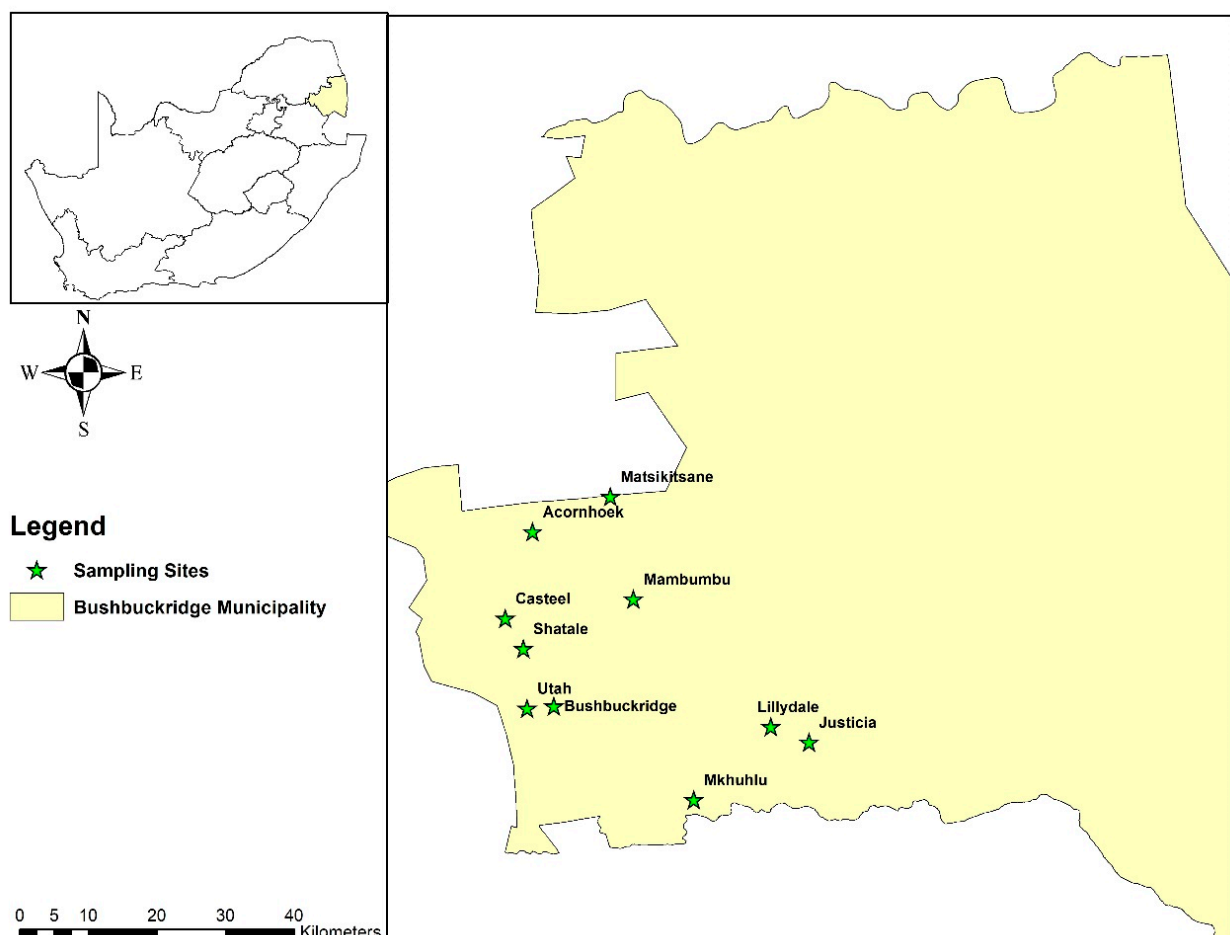


Figure 1. Map of Bushbuckridge Local Municipality showing indigenous communities which were sampled in Mpumalanga province, South Africa.

The municipality is made up of two former apartheid homeland governments, Lebowa and Gazankulu, which were historically divided according to ethnic groups [43]. Lebowa was exclusive to Mapulana-speaking people, whilst Gazankulu was exclusively allocated

for the Shangaan and or Tsongas-speaking tribe [44]. As a result, there are three distinct indigenous groups inhabiting BLM, i.e., the Vatsonga, the AmaSwati, and the Mapulana tribe, which uses a Sepedi-speaking tribe [44,45].

2.2. Research Design

Given that the current study sought to understand the indigenous disposal methods of solid waste management practised in the rural communities of Bushbuckridge Local Municipality, ethnographic action research (EAR) was the most appropriate qualitative research methodology. In this context, the application of EAR was fundamental since this research study revolved around studying and understanding the cultural practices of a specific community [46,47]. The EAR qualitative research methodology is known for being useful in a research study where there is not much known about a phenomenon. Its application and relevance in the current study were motivated by the lack of existence whatsoever of investigated and documented indigenous solid waste management practices in BLM communities.

2.3. Sampling Methods

The selection of participants in this research study was consistent with the concept of sampling units in BLM. In BLM, the sampling units were members of the population from which data were gathered [48,49]. The members of the population originated from environmental organisations that formed part of the focus groups from indigenous communities, not individual persons or houses. This sampling unit is like the one employed by Mwai et al. [50]. In the current study, a total number of ten environmental focus groups that were based in Justicia, Matsikitsane, Shatale, Mambumbu, Lilydale, Bushbuckridge, Mkhuhlu, Acornhoek, Casteel, and Utah were selected to characterise the cases of the rural communities of Bushbuckridge Local Municipality. Bushbuckridge Local Municipality was used as the gateway to these indigenous communities. That is, the database that comprises all environmental groups within the BLM jurisdiction was requested from the local authority. The BLM database contained all the names of the environmental groups and their contact details, as well as their geographical location. The Google Earth map was used to select cases that would capture the spatial cultural diversity of indigenous communities. From the Google Earth map, the indigenous communities of BLM were divided into strata. From the selected strata of indigenous communities, the purposive nonprobability sampling technique was used to sample the focus groups of interest. The focus groups were selected because they are purposive. The sample size of the study population in Bushbuckridge was determined using Slovin's formula as prescribed by Tejada and Punzalan [51] to determine the sample size as presented below:

$$n = \frac{N}{1 + Ne^2}$$

This formula guarantees a 95% confidence interval with a margin error of 0.05%, where n denotes a sample size, N = total population, and e = 0.05%.

2.4. Data Collection

In the current study, focus group discussions were used to collect data. The adoption of focus group discussion in BLM was encouraged by the ability of focus group discussion to create an atmosphere that is conducive to sharing detailed information at a deeper level. Focus group discussions on indigenous knowledge research are prevalent and have been previously adopted by numerous scholars [52–54]. This is mostly because focus group discussions inspire interaction between participants rather than between the researcher and the participant, as observed in interviews [55]. Subsequently, the interaction between the participants presents the researcher with the opportunity to analyse subtext and observe body language for more insight regarding the discussed topic. A focus group discussion guide was used to elicit complex information from BLM communities regarding personal

experiences, ideas, perceptions, and attitudes [56] that are associated with indigenous solid waste management practices. The focus group discussion guide contained a list of discussion points that were tabled during the focus group sessions [54]. In the current study, the guide included points of discussion such as the most produced waste in households and the subsequent methods used to manage it. Whilst there are different types of focus groups as elaborated by Nyumba et al. [53], the current study used the single focus group data collection procedure. The fundamental element that characterises a single focus group in contrast to others is that it involves a participatory type of dialogue on a topic by all participants and a team of facilitators as one group in one location. This is the most typical and traditional focus group discussion format [53]. The focus group discussions were recorded using an 8 GB digital voice recorder device. The digital recorder used for data collection was fitted with a one-touch voice recording function that supports voice-operated recording. This device allows ultra-long-time recording, with continuous recording of up to 72 h, that is, three days and three nights uninterrupted.

2.5. Validity and Reliability

To ensure compliance with the validity of the collected data, the participants were reminded about the nature of the EAR research design. The points of discussion were reviewed and approved by experts in the discipline of waste management prior to their use in the field. Furthermore, before being administered in the field (pretests), the points of discussion were administered to a group of six people to assess how participants would approach the discussion. In this instance, the feedback from the small group assisted the researcher in adjusting accordingly the points of discussion. These points were administered to the participants on two occasions within a three-week interval to determine validity. The intervals between testing and retesting were prolonged to prevent participants from memorising the points of discussion as well as the broad discussion responses. The results were compared with the previous findings to establish validity. However, to ascertain the reliability of the discussion outcome, Cronbach's alpha was calculated. An acceptable satisfactory Cronbach's alpha of 0.76 was obtained from the pilot study.

2.6. Data Analysis

The current study used mixed analysis techniques to analyse the qualitative data collected in the rural communities of BLM. Given the qualitative nature of the research data that were collected from BLM, the current study mostly used qualitative coding to analyse the in-depth discussion data from BLM communities. The application of qualitative data analysis leads to significant findings that can contribute to theoretical knowledge and practical use, as postulated Burnard et al. [57]. In line with this observation, it is suggested that in an instance where the data are qualitative, the first part of the mixed analysis will be qualitative and the data will be translated to a quantitative form or quantified at a later stage [58]. Therefore, to identify, organise, and categorise themes within the datasets of the current study, thematic analysis was employed to analyse focus group discussions. The thematic analysis process was combined with inductive logic. Analysis was iterative and reflexive, proceeding through phases. As such, the coding framework was developed based on the themes that emerged from the focus group discussions data. The analysis then proceeded via an inductive and iterative process of listening, reflecting, and coding, and as new themes emerged, the coding framework was progressively expanded. As the process of coding advanced, several codes were modified, and more codes were discovered and introduced to encompass the complete spectrum of themes found in the data. Once the coding process was completed, data were reviewed and synthesised across discussions, looking for patterns, similarities, and differences.

Subsequently, the data were transformed into numerical codes that could be analysed statistically. This was achieved through a frequency count. That is, in this step, the number of times each code or theme appeared across all discussions was counted. Subsequently, the occurrences of a particular theme discussed by the focus group were captured in percentage

format. This was a fundamental process to highlight percentages, frequencies, and cross tabulations. This was indispensable in order to depict the common and frequent indigenous practices of solid waste management amongst the rural communities of Bushbuckridge Local Municipality. Consequently, the exploratory data analysis was integrated to present the data in the form of visual models. It is through this process that a schematic framework illustrating the elements of indigenous solid waste management practices was produced to aid in organising and relating various themes. The simple descriptive statistics analysis was later integrated into the current study. All the qualitative data were transcribed in Microsoft Excel 2019. Figure 2 below summarises the data collection process in the rural communities of BLM.

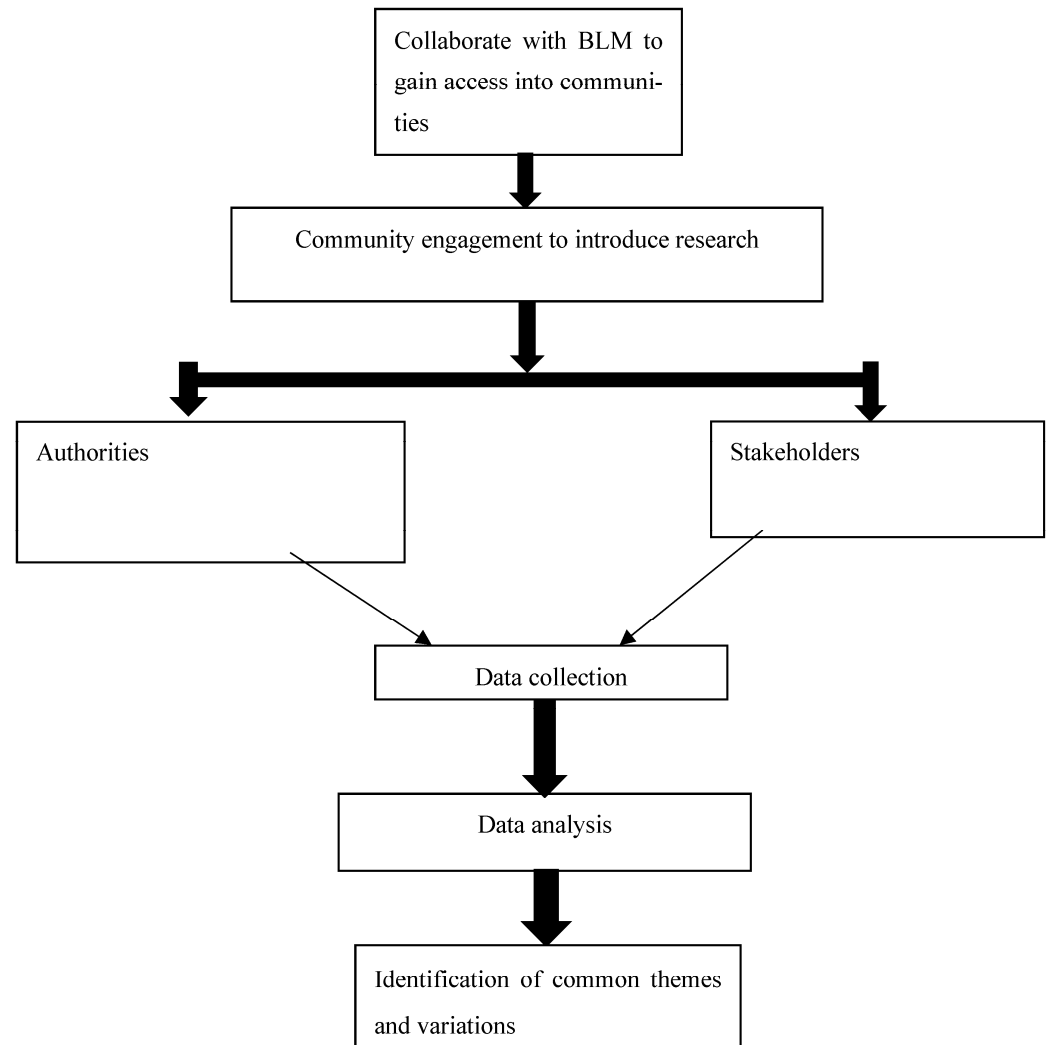


Figure 2. Simplified methodology diagram outlining the process of data collection in rural communities of BLM.

3. Results and Discussion

From time immemorial prior to colonization, indigenous waste management practices were instrumental in preventing, reducing, and reusing waste material within indigenous communities [59]. Before the introduction of mainstream sciences through colonial means, Wahab [60] postulates that indigenous waste management practices were always at the centre of sanitation, holding together sustainable environmental health practices within rural communities. In indigenous communities, the practices associated with waste management are not exclusively designated to certain agencies given that funding for waste management in indigenous communities is severely lacking [61]. The indigenous communities across

BLM are cognizant of the impacts and risks of inadequate waste management practices in their surroundings. To mitigate the impact and risks associated with exposure to waste management, the communities have become proactive and take it upon themselves to use indigenous knowledge to address these issues [59].

Therefore, within indigenous communities, it becomes the responsibility of every individual to manage waste effectively [62]. In line with this view, Figure 3 presents the indigenous solid waste management practices of ten communities that are within the jurisdiction of Bushbuckridge Local Municipality. It is evident from the results presented in Figure 3 that communities of Bushbuckridge Local Municipality, in the absence of formal waste management services from the local authority, delve into indigenous knowledge to manage solid waste. Furthermore, the results indicate that the number of indigenous waste management methods which the local communities of BLM use for solid waste management amount to thirteen ($n = 13$), as presented in Figure 3. However, there is inconsistency across the number of disposal methods used across the BLM communities. For instance, the individual communities of Mkhuhlu and Lilydale best illustrate this phenomenon. In this context, Lilydale accounts for 85% of the indigenous waste management methods used, which is the highest by far, whilst Mkhuhlu, in contrast, accounts for a mere 38% of the indigenous methods applied to manage solid waste in BLM (Figure 3). The statistical inferences indicate that overall, the communities around BLM espouse on average eight indigenous waste management methods, with a standard deviation of 1.77. However, the Mkhuhlu community is an exception, as it has recorded below-average ($n = 5$) indigenous disposal methods in contrast to other communities.

	Reuse	Recycling	Waste picking	Communal labour	Informal Waste collection	Composting	Waste trade	Backyard pits	Taboos	Waste sorting	Animal feed	Dumping	Burning
Mkhuhlu	0	0	0	0	1	0	1	1	1	1	0	0	1
Casteel	0	0	0	1	0	1	1	1	1	1	1	0	1
Bushbuckridge	0	0	0	0	0	0	1	1	0	1	1	0	1
Acornhoek	1	1	1	0	0	1	1	1	1	1	0	0	1
Lilydale	1	1	1	1	0	1	0	1	0	1	1	1	1
Justicia	1	0	1	0	0	1	1	1	0	0	1	1	1
Uthah	0	0	0	0	0	1	0	1	1	0	1	0	1
Shatale	0	0	1	1	0	1	0	0	1	1	0	1	1
Mambumbu	0	0	0	0	0	1	1	1	1	1	1	1	1
Matsikitsane	0	0	1	0	1	1	1	1	1	0	1	1	1

Figure 3. The discrepancy of indigenous solid waste management practices of BLM indigenous communities (1 = applicable; 0 = not applicable).

This is a demonstration that, indeed, indigenous knowledge practices are unique and geographically confined [63–65]. This discovery is congruent with Robinson et al. [66], who discovered various indigenous knowledge practices from different communities within the same region. However, the comparison of the sum of methods amongst the other communities proved to be relatively comparable. Hence, according to the statistical inferences between BLM communities, the number of indigenous waste management practices used is not significant ($p = 0.18$).

Furthermore, Figure 4 below shows the frequency of use of the indigenous waste management methods of BLM communities. This comes as a result of the inconsistency across the number of indigenous waste management practices which communities of Bushbuckridge Local Municipality employ, as observed in Figure 3. Apparently, the burning of waste is referenced as the fundamental method that informs indigenous waste management practices in the rural communities of BLM. This is a common method (100%) across the communities of BLM. This finding is not surprising given that 100% of the waste generated in the indigenous communities is estimated to be burnt [67]. Reyna-Bensusan et al. [68] posit that the burning of waste is widespread in many developing countries.

This practice has been observed among various developing nations including South Africa, Nigeria, India, Ghana, Ethiopia, Kenya, and Brazil [69–74]. The estimation is that 92% of rural households, relatively, burn their waste material.

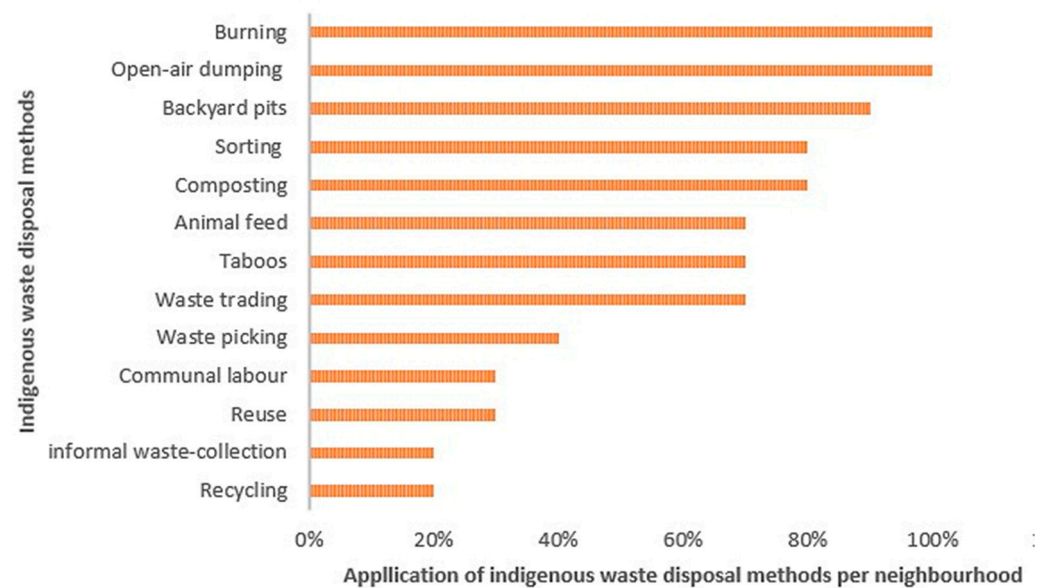


Figure 4. Indigenous waste management methods of Bushbuckridge Local Municipality rural communities.

In essence, multiple studies from rural indigenous communities are congruent with this observation given that burning is deemed as the most practical and convenient practice for waste disposal within these communities. Appendix A (Figure A1) shows waste being burned in the evening in one of the study areas. Similarly, a study conducted by Tshivhase and Mashau [75] discovered that in the rural villages of Limpopo, the burning method is frequently preferred as a convenient, strategic management option by residents. Likewise, a study undertaken in the rural villages of Zikhotheni and Zombodze Emuva in Swaziland discovered that burning of waste material is agreed upon socially as one of the readily available strategic methods of solid waste management. Mihai et al. [76] corroborate that in rural communities, it is common practice that an amount of generated waste is frequently managed at the household level through burning practices. Consequently, Dlamini et al. [77] estimate that because of these practices, the amount of burnt waste material in rural villages amounts to 71,452 tonnes per year.

It is for this reason that Triassi et al. [78] maintain that there is a direct bearing between the burning of waste material and the absence of formal collection services for municipal solid waste. Similarly, Hoffer et al. [79] corroborate that the burning of waste is a pervasive practice in developing nations where waste collection is a major issue for local municipalities. Moreover, another common practice that informs indigenous solid waste management in BLM communities is open-air dumping. Similar to burning, open-air dumping (100%) is an equally popular practice in the explored rural communities of Bushbuckridge Local Municipality. This is not surprising given that this practice is reportedly common in indigenous communities of developed countries [80,81]. It is important to note that in BLM communities, the open-air dumping practice is extensively associated with the indiscriminate dumping of diapers amongst others. To this end, Khanyile et al. [82] highlight that diapers are commonly found along river bodies of KwaZulu-Natal due to indiscriminate dumping. This practice is similar to that of BLM indigenous communities that dump diapers in river basins, as demonstrated in Appendix A (Figure A2).

According to Ntekpe et al. [83], indiscriminate dumping of disposable diapers is a popular practice which is not limited to indigenous communities. However, within the South African context, this practice is said to be worse in rural areas where diapers are indiscriminately dumped in rivers and open areas [84]. Apostol and Mihai [85] are con-

vinced indiscriminate dumping of diapers in such areas is motivated by the lack of service delivery associated with formal waste collection services. Likewise, Kordecki et al. [86] cite the lack of municipal waste management services as the main source of indiscriminate dumping of these diapers in rural communities. However, indigenous communities cite the evolution from reusable napkins to diapers as the main factor contributing to open-air dumping. Likewise, Zagozewski et al. [87] corroborate that a similar concern has been raised within the indigenous communities of Canada. The traditional inheritance of indigenous knowledge systems presents a significant obstacle in this regard. In this particular case, it is possible that the predecessors who held IK were unable to impart sound practices for managing disposable diapers to the current generation as reusable napkins were the norm at the time.

The third highest practice following the tie between open-air dumping and burning in indigenous waste management practices is backyard pits, as demonstrated above in Figure 4. Backyard pits in indigenous communities are considered the bedrock of indigenous waste management practices following the burning of waste [88,89]. These backyard pits, according to Zagozewski et al. [87], are designed for but not limited to the disposal of household and construction waste, just to name a few types of waste (Figure A3). Bharadwaj et al. [90] highlight that backyard pits are convenient indigenous waste management methods for controlling generated solid waste. When the backyard pits reach the end of their life span, which in most cases is when maximum capacity is reached, communities shut them down. Eventually, they decide to cultivate vegetables in the area because they believe the buried waste has slowly decomposed, thus enhancing the quality of the soil.

This aligns with the practice of composting as one of the fundamental indigenous waste management methods, as illustrated in Appendix A (Figure A4). The practice of composting biodegradable waste, i.e., food waste, is an ancient method that has proved to be effective in managing solid waste material in indigenous communities [59]. Thus, within indigenous communities, it is identified as the alternative sustainable means to manage solid waste. Ayilara [91] believes the composting of organic material has the potential to reduce the amount of solid waste destined for burning or for the backyard pits. Composting reduces the waste volume in rural communities by 50–85% [92]. Furthermore, in addition to composting, another important practice that is associated with sustainability is waste sorting, which is employed by 80% of the BLM population. In line with the observations of Lian et al. [93] and Ma et al. [94], waste sorting in the rural communities of Bushbuckridge Local Municipality means that a minimal amount of waste material is designated for backyard pits, while a significant amount is for composting.

This eventually minimizes the amount of waste material destined for backyard pit burial [95] while increasing the volume of waste to be composted and of waste intended for animal feed. Animal feed (70%) as a waste management strategy is an old practice that many indigenous communities have exercised [96–98]. The waste is purportedly produced throughout the stages of consumption and preparation. Many households in BLM feed animals such as chickens, pigs, and dogs this excess food that would otherwise go to waste. Chickens are mostly fed food leftovers, dogs are fed bones, and the mixture of food waste that is unsuitable for both species is reserved for pigs. Viljoen et al. [99] reported a similar observation in the rural indigenous communities of Northern Cape Province, South Africa. This disposal method is widely regarded as a social norm for most rural communities.

Moreover, the use of food waste no longer intended for human consumption is recognized as one of the progressive strategies for the food waste minimization hierarchy [100]. It is incorporated as the third tier of food recovery hierarchy strategies [101]. This waste is accountable for 82% of the total feed that is presented to pigs, making it a major feed source [102]. This is very important especially since subsistence animal farming is an important livelihood source for many indigenous communities [103]. Thus, feeding animals food waste within indigenous communities is acknowledged as fundamental for sustaining livestock production given the cost of processed animal feed [10].

Essentially, the process of sorting waste throughout BLM indigenous communities makes it possible to designate animal feed. Sorting waste has a significant benefit, in addition to others, in the sense that it allows for the recovery of a greater amount of material for recycling. As a result, indigenous communities in BLM engage in waste sorting; in so doing, they distinguish recyclable materials from normal waste in order to sell recyclable waste to buyback facilities that specialise in recycling. The different types of waste that are sorted by the indigenous communities of BLM intended for waste buyback centres are shown in Figure 5. These are waste materials that contribute to the circular economy [104]. The circular economy is associated with multiple sustainable development goals such as economic growth as well as sustainable consumption and production [105]. Furthermore, sorting waste from the source reduces the visibility of waste piling in the community. Shen et al. [106] confirmed that sorting household waste is the most efficient method for reducing the issue of excessive waste dumping in rural neighbourhoods, as most of the waste is designated for the circular economy.

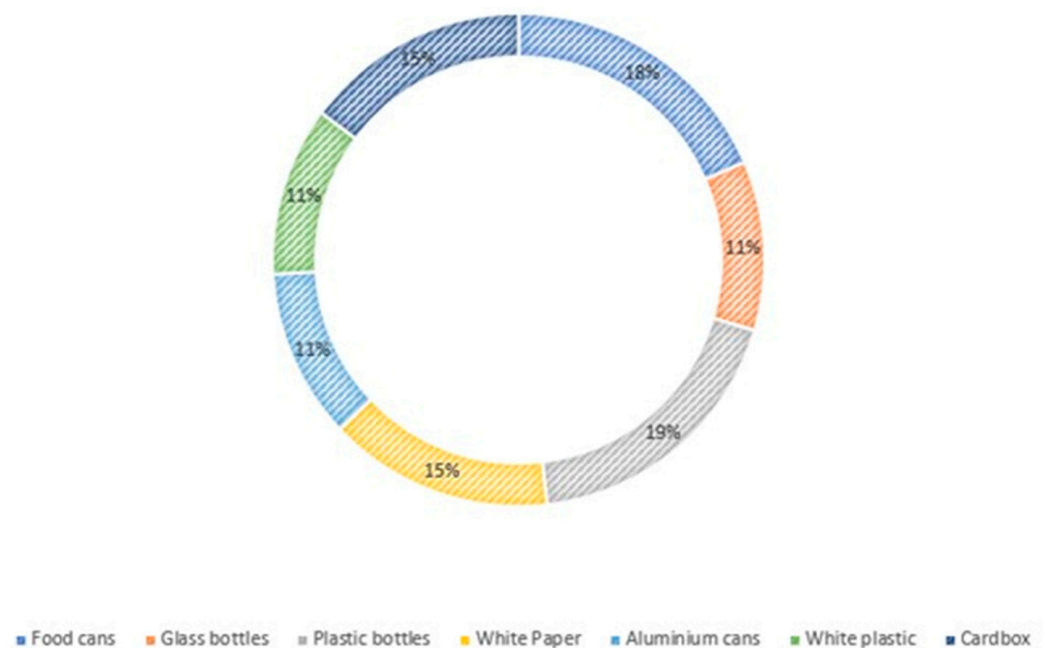


Figure 5. The quantity of solid waste material sorted in BLM indigenous communities destined for recycling buyback centres.

Furthermore, in contributing to the circular economy, the communities in BLM practice indigenous waste trading as a means of generating a passive income. Waste materials such as glass bottles (as shown in Figure 5) are traded for a certain fee in these communities. In some cases, such as that of the Bushbuckridge community, glass bottles are traded for a pack of bananas. Other communities such as Justicia participate in trading food waste destined for animal feed for mixed portions of pork. This practice advances the reduction of waste dumping in these communities. Moreover, 70% of the indigenous communities in Bushbuckridge to date still incorporate indigenous tools such as taboos to manage waste. A common taboo is that it is prohibited to sweep waste and take it outside the house at night. This taboo, according to numerous communities, is upheld to ensure that waste is not indiscriminately disposed of at night. Sayi [107] agrees with the hidden meaning behind this taboo. This taboo encourages people to wait till dawn to appropriately dispose of waste in designated areas.

Likewise, Ghana has used taboos to encourage managing waste, where studies discovered that “an important taboo observed by the people, and which helps in managing solid waste is the foda or nkyida. Foda or nkyida is an institutionalised day within the week where it is forbidden for people to go to farm (farming is the major occupation in the rural

municipalities). It is taboo for people to visit their farms on this day as there is the belief that the gods rest on this day. Failure to do so is believed to bring curses and sometimes death to those that disregard it. As a result of this sacrilege, people used to take advantage of not working on their farms to embark on cleaning their surroundings" [4].

In addition to the above methods, Figure 4 indicates that informal waste collection (40%), communal labour cleaning campaigns (30%), waste picking (30%), and recycling (20%) as well as reusing (30%) are infrequently used indigenous waste management practices that are at the bottom of the pecking order in terms of application in BLM communities. To that effect, indigenous informal waste collection practices do not include formal services from the municipality. However, they include independent waste service providers, which residents pay for on a weekly basis to collect their waste and dispose of it at a dumping site. This practice is very common around Mkhuhlu given their advanced socio-economic status in contrast to other communities, whilst in another community (Shatale), these services are only limited to the collection of diapers. This is evidence that socio-economic differences not only influence per capita waste generation rates but also extend to indigenous waste management practices [59].

One other interesting finding is that indigenous communities that actively engage in communal labour cleaning also practice waste picking. Communal labour cleaning requires community members to converge and clean their living environment. This practice has been incorporated to deal with the issue of diapers in valleys. For example, members of the community converged to remove diapers from the valleys and requested a skip bin from the Bushbuckridge Local Municipality. Kosoe et al. [4] confirm that communal labour is one of the common indigenous waste management practices that in years past would be integrated within indigenous communities to advance waste management issues [62]. The practice of waste picking essentially contributes to recycling, as only recyclable waste is picked up. This practice is consistent with the findings of Martínez et al. [108], who posit that waste picking is common within poor indigenous communities. This method indirectly contributes to recycling. For instance, Lilydale in BLM is involved in recycling as indicated in Figure 3. The concept of recycling waste material is not a new practice; it has been practised for centuries by indigenous communities [35].

As a matter of fact, even in recent times, indigenous recycling practices have been put forward as a means to resolve waste management issues within indigenous communities [109]. Indigenous recycling caters to waste material derived from metals such as aluminium, zinc, copper, and many others which have been discarded as no longer useful or required after the completion of a process. However, recycling within indigenous communities is not only limited to metal waste but includes, amongst others, the recycling of paper, glass, and plastic and the recycling of organic solid waste into compost [110–112]. This observation is no different from that made in the Lilydale indigenous community. Today there is a well-known recycling centre that manufactures beads from waste glass bottles and food cans. In addition to recycling, Lilydale reuses some of its waste glass bottles for decorations, whilst a high volume of the bottles is recycled to produce beads.

4. Conclusions

From time immemorial prior to colonization, indigenous waste management practices have been instrumental in environmental sociology by preventing, disposing, reducing, and reusing waste material within indigenous communities. Before the introduction of mainstream sciences, indigenous waste management practices were always at the centre of sanitation, holding together sustainable environmental health practices within rural communities. It is for this reason that the current study aimed to investigate and document indigenous knowledge systems used for solid waste management in the rural communities of Bushbuckridge Local Municipality, South Africa. The current study discovered that indigenous communities across BLM are cognizant of the impacts and risks of inadequate waste management practices in their surroundings. To mitigate the impact and risks associated with exposure to poor waste management, the communities have become proactive

and take it upon themselves to use indigenous knowledge to address contemporary waste management issues. Thus, within indigenous communities, it is the responsibility of every individual to manage waste effectively. To this end, to date, communities indulge in common indigenous waste management practices such as the open dumping of waste, backyard pits, reusing of food waste for animal feed, and the burning of waste material. Given the pervasive practices of these indigenous waste disposal methods in BLM rural communities, there is a need to evaluate their risks as well as the benefits associated with them in line with a sustainable development framework, especially because in numerous places, indigenous knowledge is conceptualized as the knowledge systems that promote sustainability. This aspect of accounting for sustainability in the waste management practices of the communities of BLM is indispensable, especially if these practices are to be merged into integrated waste management plans that inform the integrated development plans of rural municipalities in the long run.

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Appendix A



Figure A1. An example of waste material being burned in the evening.



Figure A2. Indiscriminate disposal of diapers in river basins in BLM.



Figure A3. Disposal backyard pit.



Figure A4. Composting piles of food waste.

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