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Peculiarities in household solid waste management in Nigeria: a quick review

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Evidence abounds to indicate the prevalence of indiscriminate disposal of household solid waste as a practice in Nigeria. This practice contributes to green crime and jeopardizes public health. Therefore, the focal point of several academic papers has been household solid waste management. The objective of the current study was to make a rapid review on practices that scholars have recommended for household members to take proper care of their waste made of paper, cellophane, plastic, metal and wooden material and the peculiarities of these recommended practices in Nigeria with implications for waste management practices in developing countries worldwide. The study adopted the systematic review method to explore findings in the available relevant studies that were published within the years 2017 and 2023 to depict the current situations of the study's subject matter in Nigeria. The current study sorted out these findings into themes. The review pinpointed several recommended practices such as zero-waste policy, waste minimization/reduction, and various disposal methods to manage the household solid waste and the major factors responsible for the setbacks these practices have faced. The review further highlighted gaps in existing studies which could form the basis for prospective studies on household solid waste management.

KEYWORDS

green crime, sustainable development goals, public health, household solid waste, waste management practices, socio-cultural factors

1 Introduction

Since the enactment of the Environmental Management Act in 1990 and the National Environmental (Sanitation) Regulations of 2007 in Nigeria, there has been a discrepancy between environmental laws and actual waste management practices, indicating a trend toward green crime in the country. This is exemplified by the illegal dumping of solid waste from health sectors (Afolabi et al., 2018) and households (Ayantoyinbo and Adepoju, 2018; Amusan et al., 2018). Green crime is a category of illegal activity that includes acts that harm the environment, damage living organisms, or disturb natural resources. This type of crime encompasses a range of offenses such as poaching, trafficking, and killing of endangered animals for profit posing major threats to biodiversity. Also, the crime includes illegal deforestation, illegal mining, illegal trade in hazardous waste, oil spillage resulting from oil bunkering (Mai-Bornu, 2024), and indiscriminate disposal of industrial and household waste (Salami et al., 2018).

In the contemporary period, indiscriminate dumping of household-used solid materials considered waste remains a major public health challenge and adds to green crime, in particular in developing countries (Ogunniran, 2019). This situation is evident in the waste

blocking the water channels and littering the residential areas of these countries (Chireshe et al., 2023; Fakunle et al., 2022; Fakunle and Ajani, 2021). Extant indigenous studies have reported similar situations in a number of cities in Nigeria (Opaleye, 2021; Wahab and Olabode, 2018). These studies also expressed concern about an increase in the rate and poor management of household solid waste that is made up of plastic, glass, and wooden materials, as well as polythene of different forms, mostly used as food and drink packages. The concern resulted from the dire consequences of the improper handling of the waste, such as harboring pathogens and affecting environmental sustainability.

In addition to discouraging green crime among people, the dangers of poor treatment of waste have prompted studies to recommend various practices considered suitable to take care of different kinds of waste by household members (Fagbemi et al., 2020; Maiyaki et al., 2019; Salami, et al., 2018; Somorin et al., 2017). Zero-waste policy, a strategy to eliminate waste and to avoid sending waste to landfills or incinerators, is one of the practices. Other practices include waste minimization or reduction behavior, sorting or segregation of waste, using bins, waste storage, household solid waste recycling, and solid waste disposal practices such as waste-to-cash, waste-to-energy, waste gifting, and burning, among others. However, evidence of the practice of indiscriminate disposal of used household items has constituted a premise for behavioral studies to investigate the acceptability of these recommended practices among people in the contemporary period; hence, this study, as a systematic review, was carried out to depict the peculiarities in household solid waste management in Nigeria. In the same vein, the crucial concern about people's pro-environmental sanitation behavior and activities is the main drive of this study.

1.1 The underlying social and research problems driving the review

The social problem that prompted this review was the evidence of widespread improper disposal of household waste in Nigeria, which can have serious environmental and public health consequences. The research problem this review addressed was to identify the waste management practices recommended by existing indigenous studies in Nigeria that are peculiar to the country's cultural context and to explore the implications of these practices for developing countries worldwide.

1.2 The review objective

The primary objective of this study was to conduct a rapid review of existing research on household waste management practices recommended by scholars for Nigeria, with the aim of identifying the peculiarities of these practices and exploring their implications for developing countries worldwide.

1.3 The novelty of the study

While extant literature on household solid waste management is abundant, particularly with regard to its global and developing country contexts, this study provides a focused examination of household solid waste management in Nigeria. The research revealed the hitherto

understudied but crucial role of culture in influencing people's participation in waste management, while also underscoring the prevailing emphasis on economic, technological, and engineering factors.

1.4 Theoretical underpinning

The current review adopted one of the propositions of social constructionism of Luckmann and Berger who are the major proponents of the theory (Steve and Steven, 2006). A proposition of social constructionism theory is that people socially construct their reality as they create it through their daily interactions within their general way of life. Therefore, people reject or jettison any practice that they consider unfit for their way of life. In relevance to the current study, the theory asserts that the way people construct their reality and daily activities influences their acceptance of the recommended practices. This assertion implies that taking proper care of the generated household solid waste begins with embedding the recommended practices for household solid waste management in the way of life and daily activities of each household member.

The assertion, however, further implies that the way people construct their reality might not favor their acceptance of the recommended practices as a result of several factors. Therefore, the current review set out to identify the recommended practices and their peculiarities in Nigeria via the existing studies. The review further highlighted the gaps in existing studies to form the basis for prospective studies on the concerned subject matter.

2 Methods

The current study utilized several steps that Arksey and O'Malley (2005) recommended for systematic review. These steps included pinpointing research questions, searching and identifying relevant studies, selecting the relevant studies, mapping out the data in the identified studies, and finally gathering, summarizing, and reporting the results. The origin of the research question for this review is traceable to the reality that indiscriminate disposal of household solid waste made of plastic, cellophane, and metal is observable in many urban centers of Nigeria, and this reality has constituted a social problem.

The basic germane question that prompted the current study was, "What have the existing indigenous studies found on household solid waste management?" To answer this primary question, the review began with identifying the relevant studies, which is the first step of the review that Arksey and O'Malley (2005) recommended. The current study utilized the purposive sampling method to search for and select relevant previous studies via database searching. The search included several relevant keywords, phrases, and topics such as "household solid waste in Nigeria," "waste management practices in Nigeria," "influence of socio-cultural factors on household solid waste management in Nigeria," "solid waste management framework in Nigeria," and "roles of culture in household solid waste management in Nigeria." Diverse sources of scholarly journals with a high standard of peer review among academic luminaries were explored to get the targeted relevant academic works. A number of academic papers appeared; however, only 350 papers with relevant titles were downloaded.

The review then proceeded to the selection of the relevant studies. The criteria for the selection included being a published academic

paper in a peer-reviewed reputable academic journal; the year of publication must be from 2017 to 2023; the study population of the included existing studies for the review must be Nigerians; and the articles must focus on issues around household solid waste in Nigeria, except for the paper that emphasized an important issue or concept that is germane to the current study's subject matter. Only 28 articles met all these criteria and were qualified for the review. The current study utilized a review matrix of the selected articles for the last two steps, which were mapping out the data, gathering, summarizing and reporting the results. The review matrix was carried out in line with the subject matter of the study, the years of publications of the previous studies, the study methodology, and the limitations of the studies. Eventually, the review explored only 28 indigenous academic papers, Arksey and O'Malley (2005), with a textbook (Steve and Steven, 2006) for the theoretical framework, making an aggregate of 30 publications. The iterative systematic review was carried out thematically according to the focus of the existing studies (Figure 1).

3 Results and discussion

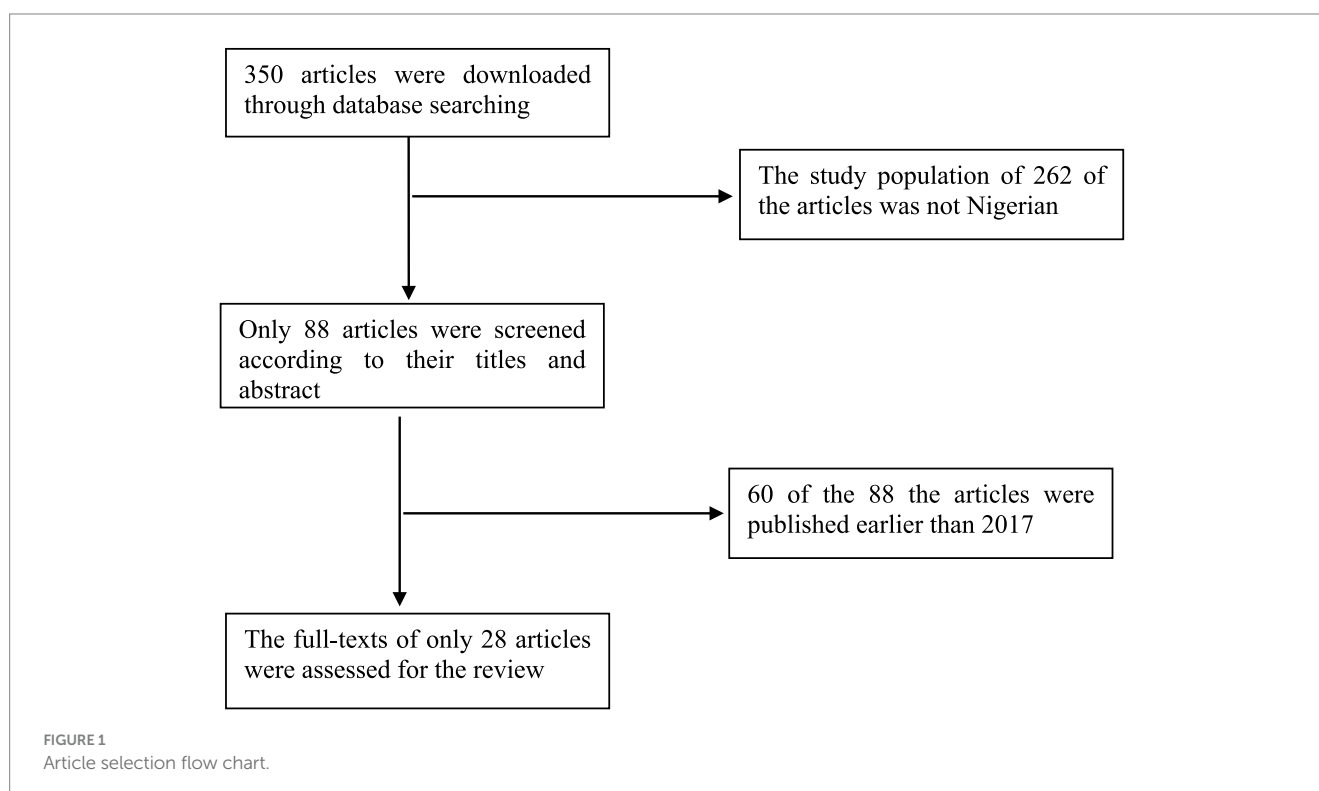
The results of the review are thematically presented and discussed below.

3.1 Zero-waste policy and waste minimization/reduction behavior

As a practice for household members, zero-waste refers to the complete avoidance of generating waste. Waste minimization, or waste reduction, on the other hand, refers to the act of reducing

waste generation as much as possible. One of the most suitable strategies to manage household solid waste is to minimize or avoid generating solid waste, for in the near future, mere collection of household solid waste as a waste management method will be ineffective (Fakunle et al., 2022). Adoption of the practice of general reduction in household solid waste quantity serves as an alternative means of effective management of the waste with minimal costs involved (Ufua et al., 2019). Moreover, on the significance of waste reduction practice by households, this practice prevents the occurrence of the main life stages of organic waste, which are waste making, gathering, sorting, recycling, and disposal (Ufua et al., 2019). Therefore, literature has proposed a total proscription of the use of materials that are not easily decomposable, such as plastic bags and nylon, among others, for good packaging by the manufacturers of household items and utilities (Stanley and Owhor, 2018; Onuminya and Nze, 2017).

Current trend of population explosion in urban centers has indicated that the increase in number of people will result in inadequate waste disposal sites in the near future (Babasaba et al., 2023; Merem et al., 2018). Therefore, the trend lends credence to the significance of enlightening the people about the reduction in the quantity of waste generated and the likely challenges that mismanagement of waste tends to generate, in particular, in megacities of developing countries (Obiora and Tochukwu, 2019). The synopses of the extant studies on waste reduction and zero-waste practices were that these practices have gained little attention among the residents of many countries. In reality, the policy as a practice for waste management is still unpopular in the majority of developing countries, in particular Nigeria (Ajani and Fakunle, 2021a; Fakunle and Ajani, 2021). A significant gap observed in the existing studies is the dearth of data on the rationales behind the poor acceptance of this practice,



particularly in relation to cultural factors, in most of the developing countries.

3.2 Sorting or segregation of waste

Waste sorting, or segregation, is the practice of grouping waste according to its texture, characteristics, and general properties (Stanley and Owhor, 2018). This practice includes treating wastes according to their grouping. Waste sorting, or segregation, is a practice to properly handle household-generated solid waste (Ajani and Fakunle, 2021a). Sorting or segregating waste helps in determining the appropriate methods to be adopted to treat a particular group of waste. Moreover, this practice discourages indiscriminate dumping, tends to encourage recycling of the used organic materials, and prevents incurring the costs involved in waste disposal, which in turn promotes pro-environmental behavior to maintain environmental sanitation (Agbaji and Ejemot-Nwadiaro, 2019). On factors militating against waste sorting as a practice to manage the generated household solid waste, for instance, people's low level of understanding of the significance of their involvement in households' solid waste segregation hampered the wide acceptance of these methods (Fakunle et al., 2022; Opaleye, 2021). Therefore, these scholars explored factors influencing the level of understanding, utilizing a model of planned behavior theory, and found that cultural factors such as past behavior, behavioral control, and subjective norms, coupled with the socioeconomic and demographic characteristics of the people, significantly influenced their participation in waste sorting and segregation. The study advocated the formulation and implementation of policies that are capable of influencing people's behavior to promote their involvement in waste segregation.

Reports have also indicated low participation of people in developing countries in waste segregation and sorting (Sampson and Ojoye, 2017). This outcome further corroborated the reports on low involvement of people in waste recycling (Fakunle et al., 2022; Olukanni and Nwafor, 2019), as waste segregation precedes recycling to preclude contamination and reduce the quantity of recyclable waste that people indiscriminately dispose of. In Nigeria, the physical compositions of the types of waste that are found in both legal and illegally designated dumpsites and landfills have indicated that waste segregation is not popular (Ajani and Fakunle, 2021a; Ogheneriere and Chukwunenye, 2017; Sridhar et al., 2017). Dumpsites and landfills are suitable only for used materials that are not easily decomposed and are not recyclable (Fakunle et al., 2022). These scholars observed that all sorts of solid waste are noticeable in the dumpsites and landfills in the country. The outcomes of these studies indicated another research gap, which is the need to conduct empirical studies on the rationales behind the poor participation of people in sorting or segregating their household solid waste and means of encouraging wide acceptance of the practice, particularly in developing countries.

3.3 Using bins and storage

Refuse bins are containers that are designed for dumping solid waste and for rubbish disposal. Refuse bins are also used to facilitate waste storage and separation. For instance, different colors are assigned to differentiate the purpose of a particular refuse bin from a

particular color (Fakunle et al., 2022). For medical waste, containers labeled "brown" are for pharmaceutical and chemical waste, yellow bins are for infectious waste, and black containers are for general waste. For households and offices, a refuse bin in gray or green is for waste that is not recyclable; a refuse bin in brown is for food and garden waste; and a bin in blue is designated for recyclable waste. Besides being of different colors, refuse bins are also of different forms; these include plastic bins, metal bins, and glass bins.

The different household sizes are among the major factors that determine the size of the refuse bin as a storage facility possessed by different households (Olukanni and Nwafor, 2019). Provision of public refuse bins or municipal containers by the concerned communities and governments at different levels is suggested as one of the ways to maintain a clean environment (Agbaji and Ejemot-Nwadiaro, 2019). The availability of municipal containers tends to promote pro-environmental behavior among households.

In an empirical study to investigate people's perception of students toward waste disposal, Opaleye (2021) established that poor storage of the generated solid waste, facilitated by a lack of suitable refuse bins for collection, formed the bedrock of the major challenges in waste management. The study further found that the majority of the concerned households were unable to convey their solid waste to the designated places for collection. The study emphasized the significance of refuse bins with sizes and specifications that are commensurate with the sizes of the concerned households to facilitate the management of the generated household solid waste in the high-density residential area of the location.

In the same vein, in Lagos metropolis, Southwestern Nigeria, the availability of adequate dust bins that were accessible to people in the community tended to promote discriminate disposal of solid waste generated (Ayantoyinbo and Adepoju, 2018; Merem et al., 2018). Onuminya and Nze (2017) also established that the high accessibility of the dust bins and other waste storage facilities in the study location enticed people with apathy toward waste management to be involved, and this tended to reduce the volume of responsibilities saddled on the Lagos State Waste Management Agency. One of the recommendations deduced from these scholars was that the role of governments at different levels is to provide waste storage facilities such as refuse bins and to formulate and, to a large extent, implement appropriate incentive policies to enhance community involvement in waste management. To corroborate the government's role, rewarding people encourages their involvement in properly managing household solid waste, while sanctioning discourages the practice of indiscriminate disposal of the waste, in particular in informal settlements. However, among the gaps observed in the studies above were their reliance on quantitative methods of data collection and the exclusion of cultural influences as among the challenges of waste management.

3.4 Household solid waste recycling

Recycling, as one of the practices to properly take care of household solid waste, refers to the conversion of used, old, or discarded materials that have recyclable value into new materials to serve the purpose of the old materials or a purpose that is entirely different from that of the old materials (Olukanni and Nwafor, 2019). Forms of recycling include primary recycling, secondary recycling,

and tertiary recycling (Fakunle and Ajani, 2021). The primary form of recycling involves the conversion of a used material to its new form to serve the same purpose as its old form; for instance, the conversion of an old plastic bottle to a new plastic bottle. The secondary form involves the conversion of an old material to an entirely new form; for instance, the conversion of an old plastic bottle to a plastic plate. Tertiary recycling involves a form of compound conversion. This form of recycling involves breaking down the chemical composition of an old, discarded, or used material to manufacture an entirely new material with different chemical compositions.

In Nigeria, a number of used solid materials that the majority of households discard are recyclable (Fakunle et al., 2022; Onuminya and Nze, 2017). Such recyclable materials include plastic and iron materials. Recycling the relevant organic waste reduces the cost of waste disposal and prevents environmental degradation. This practice is a means of reducing the cost of managing waste for the household and enhancing environmental sanitation. Therefore, studies have advocated incorporating informal sectors in solid waste recycling (Fakunle and Ajani, 2021; Sampson and Ojoye, 2017). However, empirical studies in Nigeria have reported the poor attitude of the majority of households toward the process (Fakunle et al., 2022; Ogunniran, 2019). Household solid waste recycling without economic incentives was not popularly accepted in the country and poor attitudes of the residents toward realizing a hygienic environment constituted a major setback in waste management behavior (Ogheneriere and Chukwunenye, 2017). Therefore, the significant role of people's environmental attitudes in the proper handling of household solid waste is important as an individual's involvement in caring about realizing a hygienic environment is evident in the individual's engagement in the waste management. Fakunle et al. (2022) established that household solid waste that is made up of metal and plastic materials mostly encourages people to get involved in recycling practices. According to these scholars, the interest resulted from the monetary benefits the people got from the practice.

Also, informal sectors for recycling solid waste from household members are mainly composed of informal waste workers that wander from one geographical location to another in search of households that possess used solid material to be disposed of (Sampson and Ojoye, 2017). The informal waste workers, according to Sampson and Ojoye (2017), search dumpsites and street sides for any available used and disposed solid materials and make the gathered reusable waste available to buyers who sort these materials and sell them back to the companies as raw materials. The inference here is that the informal waste workers, or waste pickers, and the middlemen earn from these material-tagged wastes. The transporters that convey these materials earn via the service they render, while the manufacturers obtain the raw materials at a cost. Also, the significant roles that the informal waste workers play in the recycling process and being another means of employment opportunity are among the major reasons for government intervention. In their investigation of the challenges that the informal waste workers encounter while on duty as one of the processes involved in recycling solid waste, that the condition of being recyclable of the used and disposed materials is considerably reduced when the materials are already at the dumpsites. Hence, the informal waste workers sell these used materials at ridiculous prices, and these conditions tend to discourage the waste pickers from doing their duties.

Also on the challenges that informal waste workers encounter in the recycling process, Stanley and Owhor (2018) explained that the informal waste workers are exposed to life-threatening situations as their work environment and working conditions are

not hygienic. These scholars also found that community-made strict rules and regulations constitute a factor that prevents informal waste workers from accessing households in such communities to pick up waste. Hence, the suggestion here is the need to carry out studies to devise means of dealing with the challenges that informal waste workers encounter in the process of waste recycling. However, in all of the studies reviewed in this section, the exclusion of people's cultural influences on their participation in recycling as a practice to take care of is also observed, and this has constituted another gap.

3.5 Solid waste disposal practices (waste-to-cash, waste-to-energy, burning, and employing waste collectors' service)

Waste disposal is the act through which people get rid of their used and unwanted materials. There are several practices through which people dispose of their household solid waste. These practices include burning (Fakunle et al., 2022), using the services of waste collectors (Olukanni and Nwafor, 2019), dumping (Ogunniran, 2019), landfilling and burying (Merem et al., 2018), waste-to-cash (Sampson and Ojoye, 2017), and waste-to-energy (Ogunjuyigbe et al. 2017). Waste-to-cash refers to the process of converting solid waste into resources or raw materials that could be converted into cash by making the resources available to the buyers or manufacturers that need them, and waste-to-energy refers to the process of converting solid waste into a source of energy. Both waste-to-cash and waste-to-energy approaches, as solid waste management practices, translate to perceiving used materials as resources that could be used for other purposes than the originally intended purpose, instead of seeing them as refuse. For instance, wood materials that are considered waste could be used for fire-making while cooking food (Fakunle et al., 2022).

The importance of exploiting suitable technology to turn waste into energy translates into creating a means of replacing other means of taking care of waste generated in urban centers, lending credence to developing waste-to-cash and waste-to-energy concepts. Studies have suggested an attitudinal change from viewing used household solid materials as waste to turning them into cash (Ogunniran, 2019). Therefore, these studies have advocated incorporating waste-to-energy sectors into waste management systems in urban centers. Moreover, employing the services of waste collectors is among the ways people get rid of their household solid waste (Olukanni and Nwafor, 2019; Onuminya and Nze, 2017). Waste collectors are the workers in the public sector or privately owned organizations that are saddled with the main responsibility of collecting household waste for discriminatory disposal. The involvement of privately owned organizations in solid waste management is among the solutions to the deplorable state of waste as a result of the inadequate resources that are available to the government (Olukanni and Nwafor, 2019). Employing the services of waste collectors at a subsidized rate at the grassroots in all communities is envisaged to enhance effective management of the solid waste generated by households. This kind of service, in most instances, involves a public-private partnership where both the government and private individuals have significant roles to play.

The quantity of solid materials that households consider waste and thereby dispose of has compounded the challenges that governments at different levels in the country encounter in environmental management (Fakunle and Ajani, 2021). As the quantity of waste has overstressed the available facilities for proper management of the waste,

open dumping of the waste is one of the most widely accepted forms of solid waste disposal in Nigeria. For instance, reports have indicated that the attitude of dumping household refuse in water channels in readiness to be carried away when it rains and vacant lands for decomposition is also rampant in the country (Babasaba et al., 2023; Fagbemi et al., 2020; Ogunniran, 2019). Moreover, these studies individually reported that poor economic conditions of people, a low level of awareness of the adverse effect of open dumping, a lack of training, and a poor attitude of people toward utilizing other waste management strategies such as reusing, recycling, and employing waste collectors' services were among the factors that accounted for the wide acceptance of open dumping to get rid of their waste. However, the reports excluded the influences of people's culture on their participation in open dumping as a means of getting rid of the waste, and this has constituted another gap.

Burning is another widely accepted means of getting rid of solid waste among households in Nigeria (Fakunle et al., 2022; Maiyaki et al., 2019). The practice of marking a particular place in people's residence's premises for burning the used materials is common in the country (Ogheneriere and Chukwunonye, 2017). Moreover, Fakunle et al. (2022) reported that a larger percentage of their study participants were fond of dumping and burning their household solid waste on any vacant land that does not belong to them, as long as the rightful owner of the land has not sounded the warning to stop using the land as a dumpsite. The study noted that the constituents of the solid waste that most households burn are re-usable and recyclable. Therefore, these scholars expressed concern that the disposal of reusable and recyclable household materials such as plastic bottles has reached a level that has attracted grave concern. Lack of information on the role of culture in adopting burning as a means of waste disposal is observable in these reports and also constitutes another research gap.

Studies have established that making partnership arrangements between the waste collectors and each household to properly manage solid waste generated by the households is a means of attaining a hygienic environment (Ajani and Fakunle, 2021b). The studies asserted that the partnership arrangements covered the means of sourcing funds for the cost of collecting the waste and the time for the regular arrival of the waste collectors. However, reports have shown that the majority of households in Nigeria refused to consider the need for waste collectors to manage their solid waste as a result of the monetary cost of accessing the waste collectors' services, and these households believed they could properly manage their solid waste (Amusan et al.,

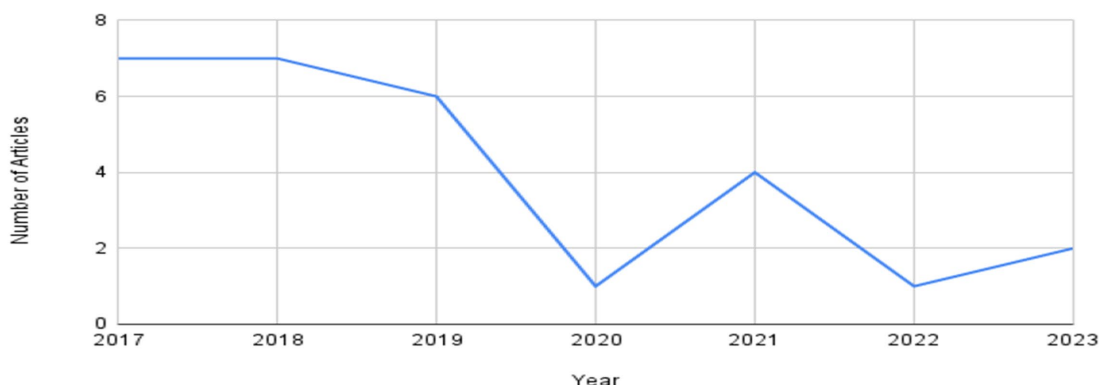
2018; Wahab and Olabode, 2018; Onuminya and Nze, 2017). A noticeable common feature in these studies on waste collection as a practice to manage household solid waste was the failure to consider the cultural factors of the concerned key actors, in particular the household members, in their participation in utilizing this kind of method. While Ogheneriere and Chukwunonye (2017) considered cultural factors in their study in Port Harcourt, the study left out several significant cultural factors such as values, customs and symbols and focused on mere belief, norms and practices. The exclusion of these factors further widened the existing gap in the relevant previous study.

3.6 Policy formulation and law implementation on suitable practices to manage household solid waste

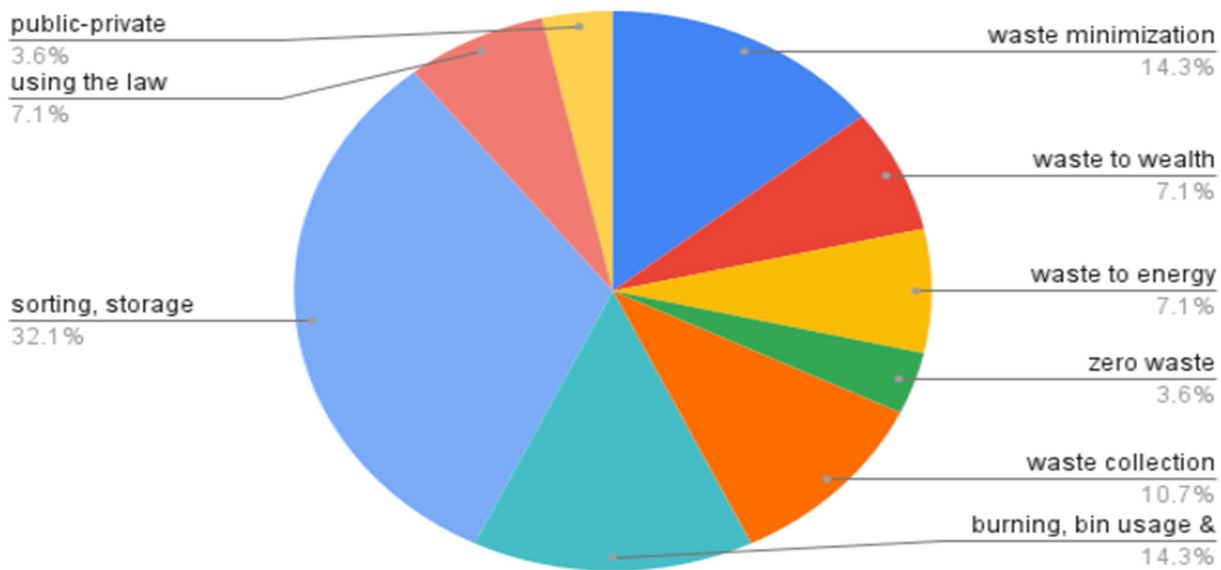
Policy formulation refers to planning and enforcing a series of suitable actions targeted at enhancing development or addressing a particular phenomenon in the interests of the citizens. On indiscriminate disposal of household solid wastes, in Nigeria, as far back as 1990, there has been the Environmental Management Act, a Nigerian federal law that addresses environmental protection in the country. The Act includes regulations on waste management in general. Therefore, the imposition of stern penalties on the violators is in line with the constitution of the country. Studies have suggested pay-as-you-throw as a policy to encourage people's participation in proper ways to take care of their household solid waste to maintain environmental sanitation (Fakunle, et al., 2022; Maiyaki et al., 2019; Sridhar et al., 2017). In the same vein, the enactment and imposition of laws that totally ban open-dumping are adduced to ensure effective management of solid wastes (Nabegu and Naibbi, 2017). The success and effectiveness of such laws requires ensuring that adequate private and public waste bins, facilities for waste collection, and legally designated and appropriate dumpsites are readily available. However, as culture influences people's actions in their social environment (Fakunle and Opadere, 2023), an important issue to consider for the success of these practices is the role of cultural factors, as these influence people's lifestyles. Therefore, there is a need for empirical studies on the influence of cultural elements on the effectiveness of the law formulated to encourage people's participation in proper ways to take care of their solid waste.

3.6.1 Graphical presentation of the review

Number of Articles and Year Published



Number of Articles and Recommended Practices for HSWM



4 Conclusion

The conclusion of the current review is that there have been a variety of practices that existing studies have recommended to prevent indiscriminate disposal of household solid waste made of plastic, metal, wooden, and cellophane materials. These practices include zero-waste policy, waste minimization or reduction behavior, sorting or segregation of waste, using bins and storage, participation in the reusing and recycling process, waste-to-cash, waste-to-energy, burning, employing waste collectors' service, and formulation and implementation of rules and regulations on proper ways to take care of the waste. Also, the review concluded that these recommended practices have suffered setbacks in Nigeria as a result of attitudinal, economic, technological, and institutional factors, while there is only partial attention to exploring the role of cultural factors in these recommended practices, which constituted a gap in the previous studies. Therefore, the current study advocates conducting extensive empirical studies on the role of cultural elements in each of these recommended practices, based on the premise that culture constitutes the main underlying factor that influences people's activities in their society.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

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