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Comparative analysis of household waste composition in Kigali and Lome with a view to sustainable management

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Abstract: This article presents a comparative analysis of the composition of household waste in two African capitals: Lome (Togo) and Kigali (Rwanda). Based on data from characterization surveys and secondary studies, it highlights the dominant types of waste in each city and the resulting dynamics. In Lome, plastic (39%) and glass (28%) waste are the most prevalent, reflecting the widespread use of single-use packaging and the common consumption of bottled beverages. In Kigali, waste is dominated by plastics (32%) and tin cans (29%), reflecting a diet that is more focused on processed and imported products. The low proportion of organic waste in both contexts raises questions about domestic recovery or disposal practices. These results illustrate the impact of lifestyles, levels of urbanization, public policies, and consumption habits on the types of urban waste. The study highlights the need to adapt waste management policies to local realities in order to promote a circular and sustainable economy.

Keywords: *Composition, Household waste, Kigali, Lome, Sustainable management.*

1. Introduction

Rapid urbanization in sub-Saharan Africa is leading to a significant increase in household waste production, testing the capacity of municipalities to ensure sustainable and inclusive waste management [1]. In many cities across the continent, waste treatment remains limited, with uncontrolled landfilling predominating at the expense of recovery strategies, which are crucial from a circular economy perspective [2].

Rwanda and Togo, despite having different economic and institutional profiles, both face these challenges. Rwanda has made environmental protection a pillar of its national strategy, with strict waste management policies, including a ban on single-use plastics and the promotion of selective sorting [3, 4]. Conversely, despite certain initiatives led by local authorities and NGOs, Togo still has a less structured regulatory and operational framework, particularly regarding the organic or energy recovery of waste [5].

The main objective of this study is to analyze the characteristics of solid household waste produced in these two African capitals, with the aim of identifying opportunities for recovery in the agricultural and energy sectors. We hypothesize that the socio-economic, institutional, and cultural differences between Kigali and Lome directly influence the composition of waste, and that this composition largely determines the possible methods of local recovery [2].

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2. Literature Review

2.1. Urban Context and Waste Management in Africa

Sub-Saharan Africa is experiencing rapid urbanization, with an estimated annual urban growth rate of 3.5%, one of the highest in the world [1, 6]. This demographic and spatial expansion of cities is accompanied by a massive increase in municipal waste production, which is putting a strain on the institutional and technical capacities of local authorities [7, 8].

In 2016, Africa generated approximately 174 million tons of municipal solid waste (MSW), a figure that could reach 244 million tons per year by 2025 if 2016 trends continue [1, 9]. However, organized collection covers on average only 44% of the waste produced, leaving more than half of the waste to accumulate in informal dumps or in the environment [10, 11]. The composition of waste in Africa is dominated by organic matter, which accounts for an average of between 50% and 70% of MSW, depending on the urban areas considered [9, 12]. This biological profile offers significant potential for composting and energy recovery, but treatment infrastructure remains largely underdeveloped [13, 14]. For example, only 4% of waste is recycled or recovered in Africa, compared to a global average of 13.5% [9]. The difficulties are amplified by weak regulatory frameworks, lack of funding, and conflicts between municipal services and informal sectors [10, 15]. In most cases, waste management is decentralized without adequate resources, creating an imbalance between the responsibilities assigned to municipalities and their actual means of action [16, 17]. Finally, the impacts of this poor management are manifold: air pollution from open burning, contamination of groundwater and soil, proliferation of vector-borne diseases, and a significant contribution to greenhouse gas emissions [18, 19].

2.2. Waste Management Policies in Kigali

The city of Kigali is often cited as an example of effective urban governance in Africa, particularly in terms of waste management. Since the early 2000s, the Rwandan government has adopted a centralized and proactive approach to addressing urban environmental challenges. This political will has resulted in a series of legal and institutional reforms, such as the establishment of the Rwanda Environment Management Authority (REMA), which is responsible for enforcing environmental policies [2, 20].

One of the country's flagship measures was the ban on plastic bags in 2008, a first in East Africa. This measure was accompanied by strict border controls and a massive public awareness campaign [17, 21]. Since then, Kigali has implemented a system of selective sorting at source, encouraged by local authorities and supported by private companies involved in waste collection and recovery [22, 23].

The regulatory framework is reinforced by community initiatives such as Umuganda, a mandatory monthly community workday during which the cleaning of public spaces is often prioritized. This initiative not only contributes to urban cleanliness but also strengthens social ties and collective responsibility among citizens [3, 24].

In addition, Kigali has relied on public-private partnerships to modernize waste management. Companies such as PikiWash and COPED have been contracted to collect, transport, and treat household waste within a formalized framework monitored by the city council [25, 26]. The city also has transfer centers and composting stations for organic waste, which account for a significant proportion of the total waste stream [20, 27].

Finally, Kigali is committed to a circular economy approach, with efforts to recover plastic and organic waste, although recycling infrastructure remains limited [3, 4, 28]. The government aims to achieve a waste recovery rate of 60% by 2030 [29], reflecting an ambitious environmental strategy at the national level.

2.3. Waste Management in Lome

Solid household waste management in Lome faces multiple challenges, including institutional, technical, and social issues. The city of Lome, capital of Togo and the country's main urban center, produces an average of more than 500 tons of household waste per day, the vast majority of which is

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organic matter [30]. Despite this significant production, collection rates remain uneven across neighborhoods, with notable disparities between the relatively well-served city center and the outlying neighborhoods, where waste is often dumped in illegal dumps or burned in the open air [31, 32].

At the institutional level, the delegation of waste management at the municipal level to public structures such as the National Agency for Public Health (ANASAP) and private operators is still marked by poor coordination and limited logistical resources [2, 33]. Institutional fragmentation between the state, local authorities, and service providers makes it difficult to implement coherent policies at the metropolitan level [34].

Waste management regulations in Togo remain in their infancy, despite the existence of texts such as the framework law on the environment (Law No. 2008-005), which refers to the responsibility of waste producers [35]. However, these texts are rarely enforced, and the recovery of waste, particularly organic and plastic waste, remains marginal due to the lack of an incentive framework and organized channels [36].

Some local initiatives are nevertheless seeking to improve the situation. NGOs and associations, such as ENPRO and WASCAL Togo, are developing pilot projects for sorting at source or community composting, often in partnership with pre-collection cooperatives [31, 37]. Nevertheless, these participatory approaches face difficulties related to a lack of awareness, low citizen involvement, and a lack of sustainable financial support [32, 38].

Finally, poor urban planning in Lome limits the integration of waste management services into development projects, thereby exacerbating the environmental vulnerability of many neighborhoods [1, 2]. A more integrated reform, focused on decentralization, training local actors, and developing recovery channels, appears to be an essential condition for sustainable waste management in Lome.

2.4. Comparative Approaches in Waste Management Studies

Comparative approaches have become essential for better understanding the contextual determinants of household waste management at the urban level, particularly in developing countries. Comparing two cities, two policies, or two systems makes it possible to identify the levers for success as well as structural obstacles, while promoting the dissemination of best practices [10, 12].

In the African context, several studies have highlighted the importance of these cross-sectional analyses, particularly in shedding light on the impact of regulatory frameworks, household behaviors, and governance models on the quality of waste management services [39]. For example, a comparison between Accra (Ghana) and Dar es Salaam (Tanzania) showed that waste collection performance was linked to effective decentralization, the mobilization of community actors, and the ability of municipalities to contract with private operators [40].

Waste composition is another relevant angle of analysis in comparative approaches. It reflects not only consumption habits but also the recovery opportunities specific to each urban context [41, 42]. In predominantly organic cities such as Kampala or Ouagadougou, recovery through composting is more appropriate, while in cities with a high proportion of plastic or paper, industrial recycling models are preferable [9]. Furthermore, the comparative approach is particularly useful in a peer-learning context, especially through city networks [43]. These initiatives make it possible to identify transferable solutions while taking into account the cultural, economic, or institutional constraints specific to each territory.

Finally, comparative studies must be conducted with methodological rigor: consistency in the categories of waste analyzed, precision in geographical boundaries, and temporal consistency of data are essential to ensure the validity of the results [16]. With this in mind, this study compares Kigali and Lome, two African capitals facing common challenges but with contrasting management trajectories. To do so, a set of methods and tools is used.

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3. Materials and Methods

3.1. Study Area

This comparative study focuses on Lome, the capital of Togo, and Kigali, the capital of Rwanda. The Autonomous District of Greater Lome (DAGL) is an administrative entity located in the Maritime region, in southern Togo. This territory, comprising 13 municipalities, is home to more than 2 million inhabitants [17] and is the political, economic, and institutional hub of the country. It is home to the main national infrastructure: an autonomous deep-water port, an international airport, universities, large companies, the headquarters of public institutions, etc. [44].

These many assets make Greater Lomé a magnet for rural populations, leading to rapid urbanization, continuous population growth, and, as a result, increased household waste production. This poses significant challenges in terms of waste collection, treatment, and recovery in the context of the transition to sustainable management.

Kigali, the capital of Rwanda, is located in the center of the country and has a population of approximately 1.63 million, or about 14% of Rwanda's population [45]. The city is internationally recognized for its cleanliness, which results from a proactive policy on waste management and sustainable urban development [46].

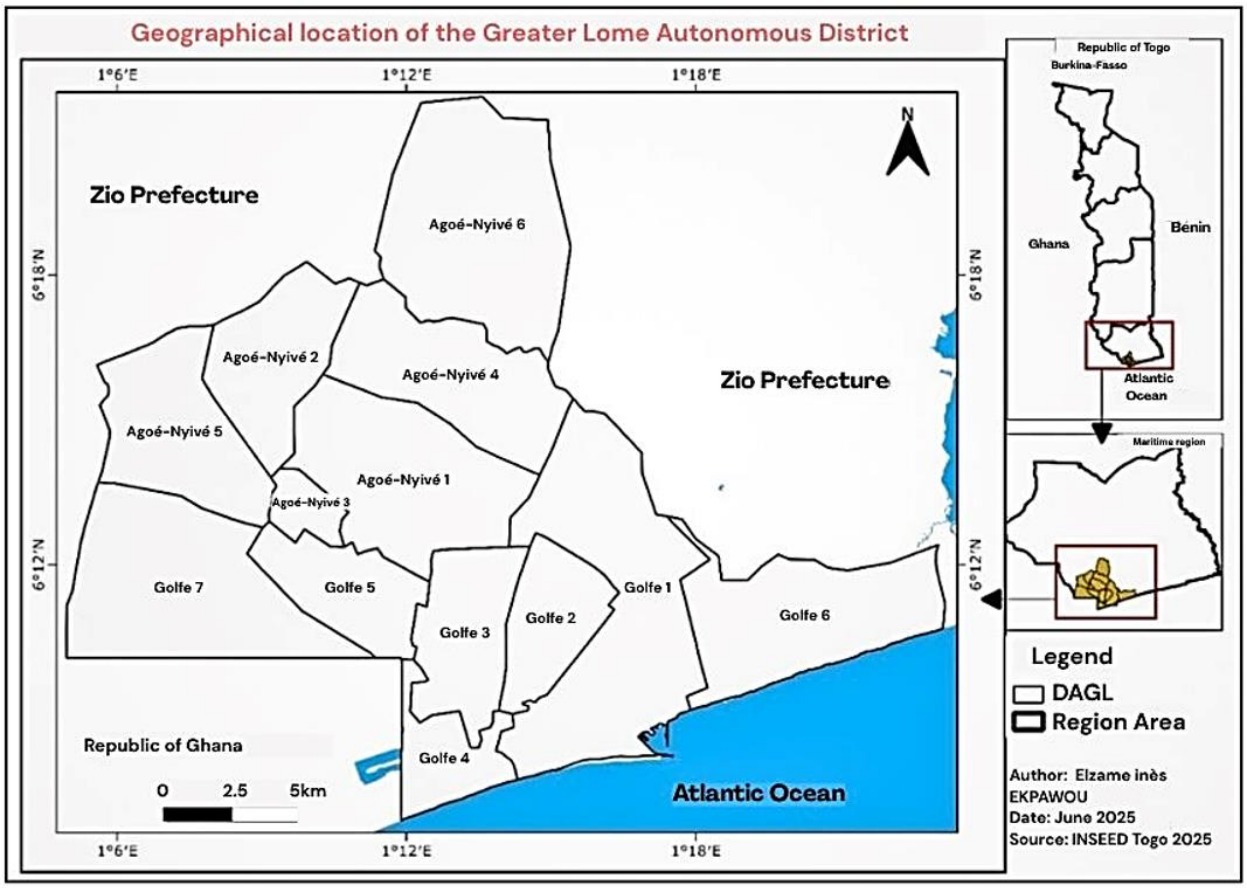

Figure 1.
Geographic location of Lome – Created by Elzame Ekpawou 2025.
Source: INSEED.

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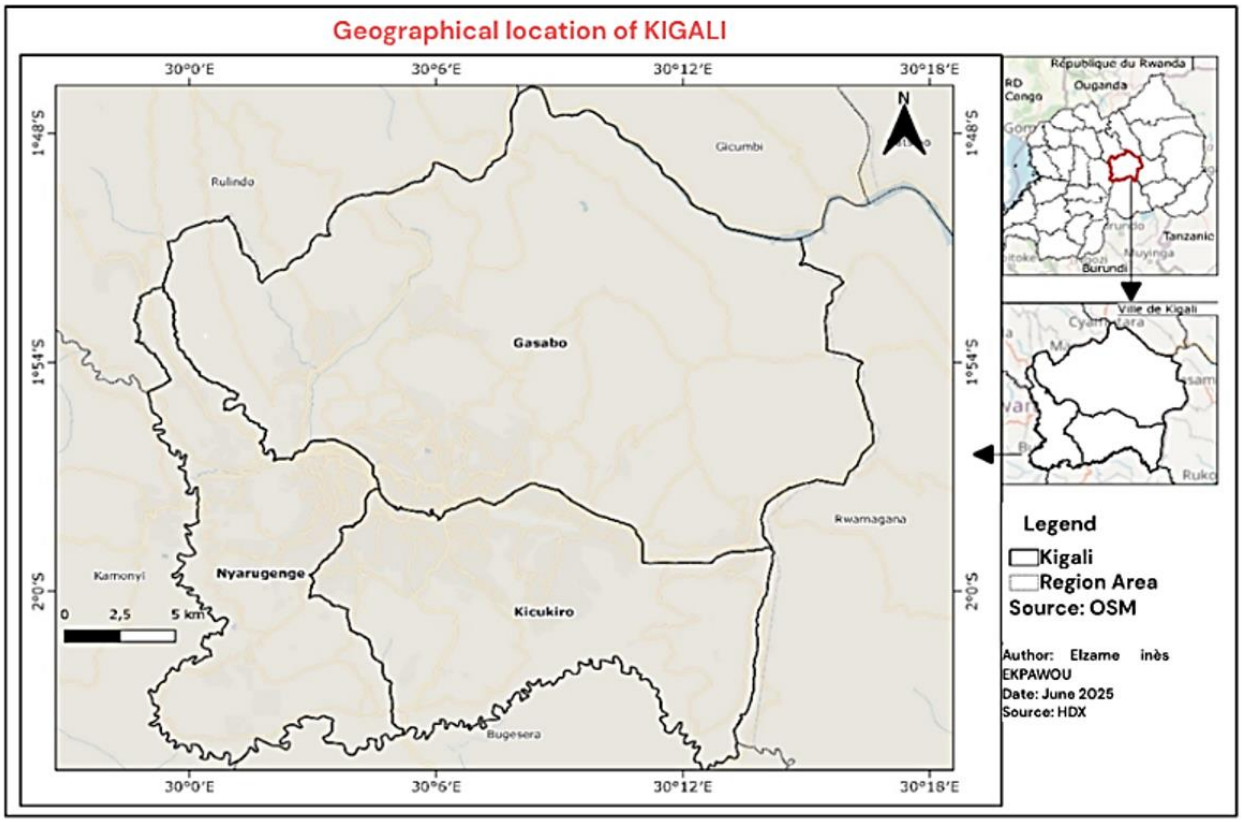

Figure 2.
Geographic location of Kigali – Created by Elzame Ekpawou 2025.
Source: HDX.

3.2. Sampling Methodology and Data Used

3.2.1. Data Used

This study draws on both secondary and primary data. Documentary research was conducted to gain a better understanding of the territorial and institutional dynamics specific to Lome and Kigali, as well as the waste management systems implemented there. These investigations drew on several sources, including the Humanitarian Data Exchange (HDX) platforms for Rwanda and spatial datasets available via the Rwanda Data Portal and INSEED for Togo, which provide detailed information at the district level. These resources made it possible to map the study areas, identify the relevant administrative subdivisions, and shed light on local governance approaches to waste collection.

However, although the existing data were essential for constructing the analytical framework, they did not provide comprehensive answers to the specific objectives of this research, particularly regarding the composition of household waste. For this reason, a primary data collection phase was deemed necessary, based on rigorous sampling of households in the two capitals studied.

3.2.2. Sampling

For this comparative study, simple random sampling was used to ensure the statistical representativeness of households in the two capitals studied. This method is based on the assumption that each household in the target population has an equal probability of being selected, thus allowing for an unbiased estimate of the proportions related to the different waste fractions.

The sampling was stratified according to the most relevant local administrative divisions in each urban context, namely the communes for the city of Lome and the districts for the city of Kigali. This

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choice is based on functional equivalence: in both cases, these are levels of local governance directly involved in the planning and management of waste collection services. Such stratification better reflects the socio-spatial disparities within each capital city and ensures balanced territorial coverage.

In Lomé, the administrative reform that took place in 2019 led to the creation of seven municipalities, which now share responsibility for waste management: Golfe 1, Golfe 2, Golfe 3, Golfe 4, Golfe 5, Golfe 6, and Agoè-Nyivé 1. According to data from the General Population and Housing Census of Togo [47], the combined population of these municipalities is 1,387,701.

In Kigali, the three districts of Gasabo, Kicukiro, and Nyarugenge have a combined population of 1,745,555, according to the Rwanda National Census [47]. These subdivisions were therefore selected as primary sampling units.

The sample size for each city was determined using Cochran's formula, adjusted for proportions, with a confidence level of 95% (Z = 1.96), a margin of error of 5% (e = 0.05), and an estimated proportion of 0.5 to maximize variance. This calculation resulted in a sample of 384 households per city, considered sufficient to obtain robust and comparable estimates.

The distribution of this sample within the subdivisions was carried out in proportion to the population of each municipality or district, according to the principle of proportional sampling. Thus, the most populous administrative units are associated with a larger number of households surveyed, which limits the risk of over- or under-representation of urban areas.

Table 1.
Distribution of the 384 households by municipality in Lome.

Municipality	Estimated population	Percentage	Households surveyed
Agoè-Nyivé 1	323 000	23.3 %	89
Golfe 1	218 000	15.7 %	60
Golfe 2	178 000	12.8 %	49
Golfe 3	160 000	11.5 %	44
Golfe 4	175 000	12.6 %	48
Golfe 5	175 000	12.6 %	48
Golfe 6	158 701	11.4 %	44
Total	1 387 701	100 %	384

For example, in the city of Lome, the municipality of Agoè-Nyivé 1, which accounts for approximately 23.3% of the total population, is associated with 89 households surveyed, while the less populated municipality of Golfe 3 has only 44 households in the sample. Similarly, in Kigali, the district of Gasabo (50.4% of the population) alone accounts for 194 observation units, compared to 82 for Nyarugenge.

Table 2.
Distribution of the 384 households by district in Kigali.

District	Estimated population	Percentage	Households surveyed
Gasabo	880 874	50.4 %	194
Kicukiro	491 731	28.2 %	108
Nyarugenge	372 950	21.4 %	82
Total	1 745 555	100 %	384

This approach ensures balanced coverage of urban areas and limits selection bias. The surveys were conducted in accordance with ethical principles, including the free and informed consent of participants, data anonymization, and transparency regarding the purposes of the research. This sampling phase is an essential step in ensuring the validity of inter-urban comparisons and providing a solid empirical basis for subsequent analyses.

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3.3. General Approach of the Study

This study adopts a comparative approach between two African capitals, Lomé and Kigali, regarding the characterization of household waste. The primary methodological objective was to establish links between the socio-economic profiles of households (marital status, occupation, household size) and the composition of the waste they produce, to better understand the underlying dynamics of waste generation and management in these two distinct urban contexts. To this end, an approach based on the use of quantitative data was adopted. Information was collected through field surveys, including direct observations, questionnaires sent to households, and systematic records of waste produced. The analysis focused on both the volumes and types of waste collected, classified into broad categories: plastic, glass, cardboard, paper, tin cans, and food waste.

3.4. Data Processing and Coding

The data collected was entered into a structured database and then cleaned to eliminate duplicates and outliers. Each record was associated with sociodemographic variables, linking household characteristics (size, marital status, occupation of the head of household) to the types of waste produced. This structure made it possible to create a multi-entry analysis matrix, facilitating cross-referencing of the results.

Particular attention was paid to the coding of waste types to ensure comparability between the two cities studied. The categories were defined consistently and exclusively, avoiding redundancies and overlaps. Thus, each type of waste collected in the field was classified into a main category, even in cases of mixed composition.

3.5. Comparative Analysis Using Pivot Tables

The core of the analysis is based on the use of pivot tables, a powerful tool for exploring correlations between qualitative variables. These tables made it possible to establish clear relationships between the profiles of respondents and the proportions of each type of waste generated.

First, cross-tabulation tables were constructed to analyze the distribution of waste types according to marital status. The objective was to determine whether social groups (single, married, widowed) differed in their consumption habits and, consequently, in the waste they generate.

Secondly, the respondents' occupations were cross-referenced with the types of waste produced. The aim was to examine whether the type of professional activity influenced the nature of the waste generated.

Finally, an analysis based on household size was carried out to understand how the quantity and nature of waste varied according to the number of people living under the same roof.

4. Results

4.1. Waste Composition

4.1.1. Waste Composition in Lome

Analysis of waste composition in Lome reveals a clear predominance of plastics, which account for 39% of the total. This overrepresentation can be explained by the high consumption of single-use packaging, particularly plastic bags and bottles, in a context where sustainable alternatives remain limited. Glass, the second most important component at 26%, reflects significant consumption of packaged beverages but poses challenges in terms of recovery and reuse due to the lack of a structured deposit system.

Cardboard (18%) also accounts for a significant proportion, linked to commercial and domestic packaging. On the other hand, food waste accounts for only 9%, suggesting a relatively low rate of food waste or domestic recovery (animal feed, informal composting). Finally, tin cans (4%) and paper (3%) appear in small proportions, reflecting either their rarity in use or their recovery upstream of the collection system.

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This overall structure, dominated by inorganic waste that is difficult to biodegrade, highlights the challenges posed by sustainable waste management in Lome.

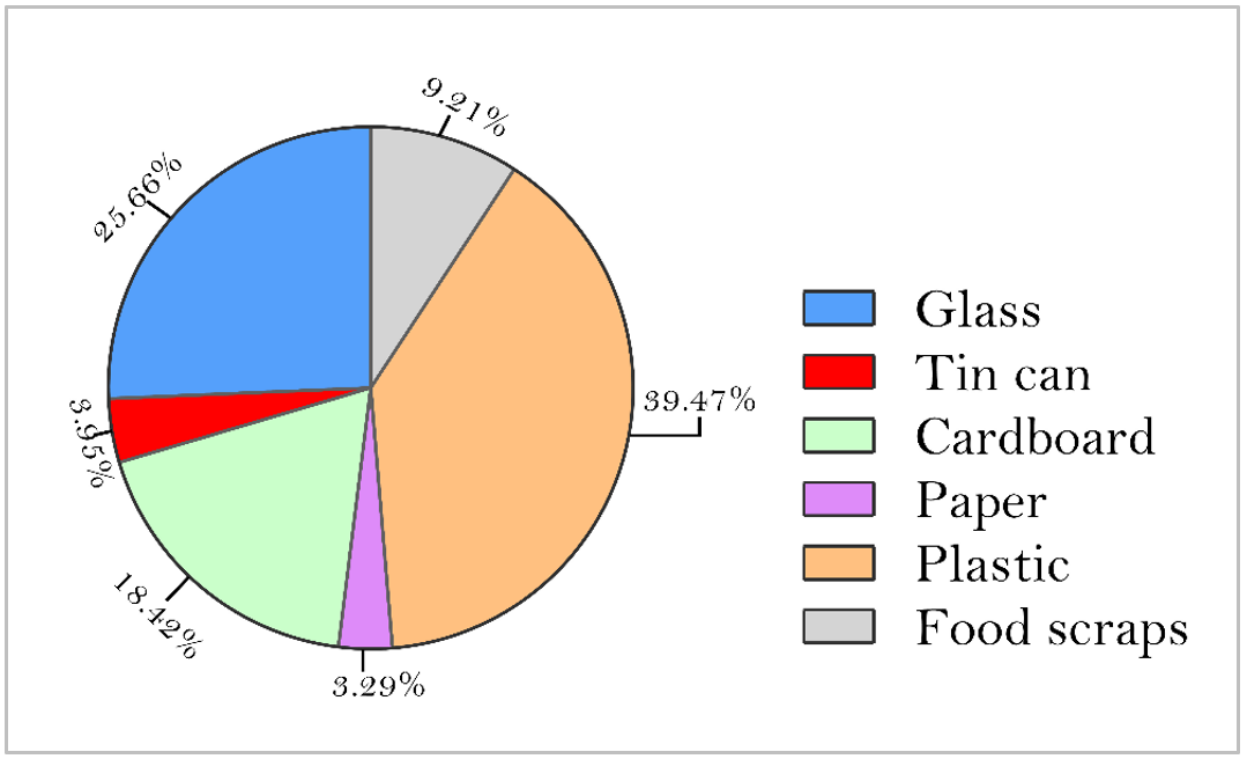

Figure 1.
Waste composition in Lome.

4.1.2. Waste composition in Kigali

In Kigali, plastic waste accounts for the largest share of waste, at 32% of the total, confirming a heavy reliance on single-use packaging, as in Lome. However, second place here goes to tin cans, which account for 29%, marking a notable difference with Lome, where this category is very marginal (4%). This prevalence may reflect more widespread consumption of packaged products or different waste management practices related to processed foods.

Food scraps account for 14%, a higher rate than that observed in Lome (9%), which may indicate either greater food waste or more systematic collection of organic waste. Glass (12%) and cardboard and paper (6% each) complete the composition. Unlike Lome, where glass accounts for 28% and cardboard 18%, these fractions are smaller here, suggesting different consumption habits or better reuse of these materials.

Kigali and Lome thus present two distinct profiles: although plastic dominates in both cities, Kigali is characterized by a high presence of tin cans, while Lome is marked by a high rate of glass and cardboard. These differences reflect not only specific consumption habits but also logistical, economic, and cultural choices in the distribution chain and waste management.

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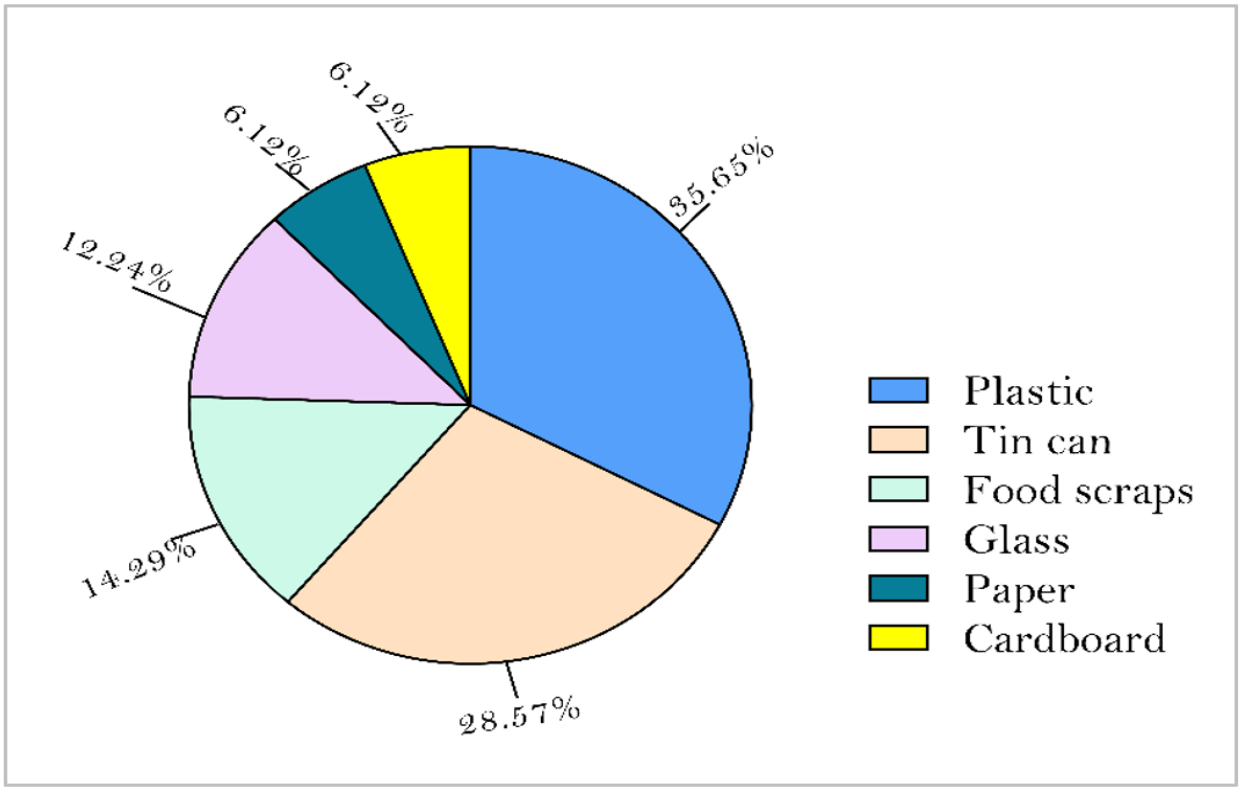

Figure 2.
Waste composition in Kigali.

4.2. Analysis of Waste Type Distribution According to Marital Status

4.2.1. Analysis of the City of Lome

Table 3 below illustrates the distribution of different types of waste according to the marital status of respondents in Lome. It shows that married people contribute more than 70% of the total volume of waste collected in the city. This category is particularly prominent in plastic waste, which accounts for 30.92% of total production, as well as in glass waste, with a share of 16.45%. Conversely, single people account for around 24% of waste, with their most significant contribution being in the glass waste category, which amounts to 9.21%. As for widowers and widows, their waste production is relatively low, accounting for only 4.61% of the total.

This distribution can be explained in particular by the larger size of married households, which are often multigenerational. As a result, these households tend to consume a wider range of products and therefore generate a higher volume of waste. The diversity and quantity of waste produced by married couples also reflect more extensive consumption habits compared to those of single people or widows/widowers.

Table 3.
Analysis of waste distribution by type according to marital status in Lome

Type of waste/Marital status	Tin Can	Cardboard	Paper	Plastic	Food scraps	Glass	Total
Single	1.97%	3.95%	0%	5.92%	2.63%	9.21%	23.68%
Married	1.97%	13.16%	3.29%	30.92%	5.92%	16.45%	71.71%
Widowed	0%	1.32%	0%	2.63%	0.66%	0%	4.61%
Total general	**3.95%**	**18.42%**	**3.29%**	**39.47%**	**9.21%**	**25.66%**	**100.00%**

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4.2.2. Analysis of the City of Kigali

In contrast to the situation observed in Lome, the results for the city of Kigali indicate that single people generate the majority of waste, accounting for 75.51% of the total. This significant contribution is particularly evident in the categories of plastic waste and tin cans, each accounting for 22.45% of overall production. In comparison, married households are responsible for only 24.49% of waste. Additionally, glass waste (12.24%) and food waste (14.29%) also constitute a significant proportion of the waste composition in Kigali. This configuration could reflect a more individualistic lifestyle specific to this city or a high concentration of single-person households in dense urban areas, where consumption of packaged products is higher. These factors suggest specific socio-economic and spatial dynamics that directly influence waste production profiles.

Table 4.
Analysis of waste distribution by type according to marital status in Kigali.

Type of waste/Marital status	Tin Can	Cardboard	Paper	Plastic	Food scraps	Glass	Total
Single	22.45%	6.12%	6.12%	22.45%	6.12%	12.24%	75.51%
Married	6.12%	0%	0%	10.20%	8.16%	0%	24.49%
Total general	28.57%	6.12%	6.12%	32.65%	14.29%	12.24%	100.00%

4.3. Analysis of Waste Distribution by Occupation

4.3.1. Situation in Lome

Analysis of waste distribution by occupation reveals significant differences between socio-professional categories. Workers in the informal sector stand out for their substantial waste production, mainly in the plastics and cardboard categories. This trend probably reflects commercial or craft activities involving the use of packaging and various materials.

In contrast, civil servants generate a higher proportion of paper and glass waste, which is consistent with administrative practices and the professional environment where document processing and the consumption of packaged beverages are common. As for unemployed people or those in undeclared occupations, they produce relatively little waste, but with high variability across categories, which may reflect heterogeneity in lifestyles and consumption behaviors.

These results highlight the correlation between occupation, consumption habits, and domestic practices, which directly influence the composition and quantity of waste produced.

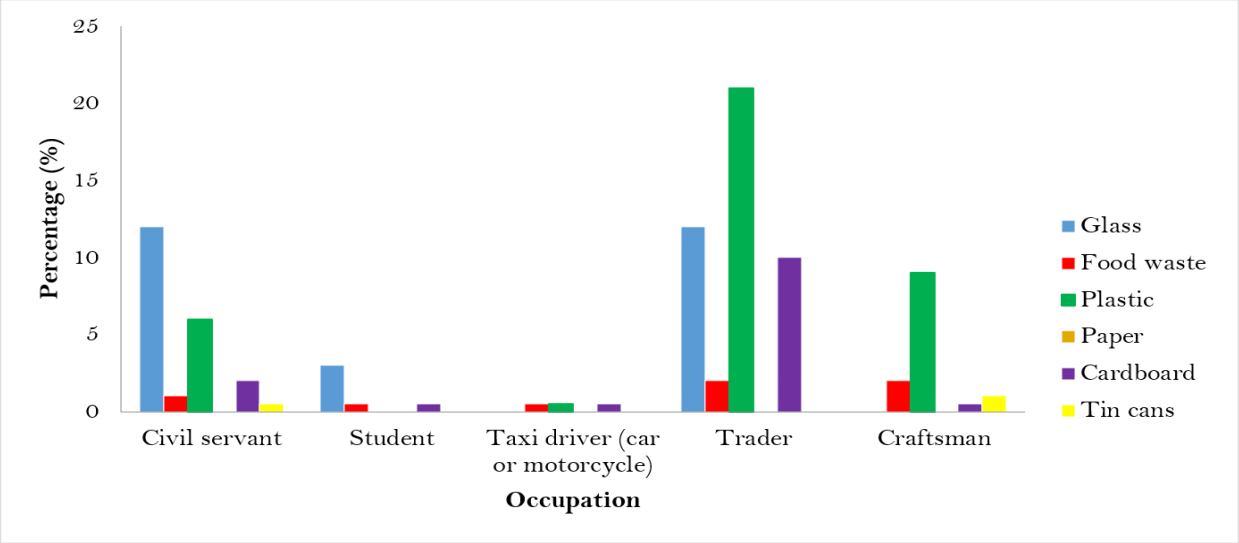

Figure 3.
Distribution of waste by type and occupation in Lome.

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4.3.2. Situation in Kigali

The results obtained for the city of Kigali show that employees in the formal sector mainly produce plastic waste and food waste, reflecting consumption patterns related to meals and packaged products. In addition, small traders generate more cardboard and glass waste, which can be explained by the frequent use of packaging for the storage and marketing of goods.

As for workers and other manual professions, although they are less numerous in the sample, they generate a variety of waste, with no particular category predominating. This diversity could be linked to the variety of activities carried out in this socio-professional group.

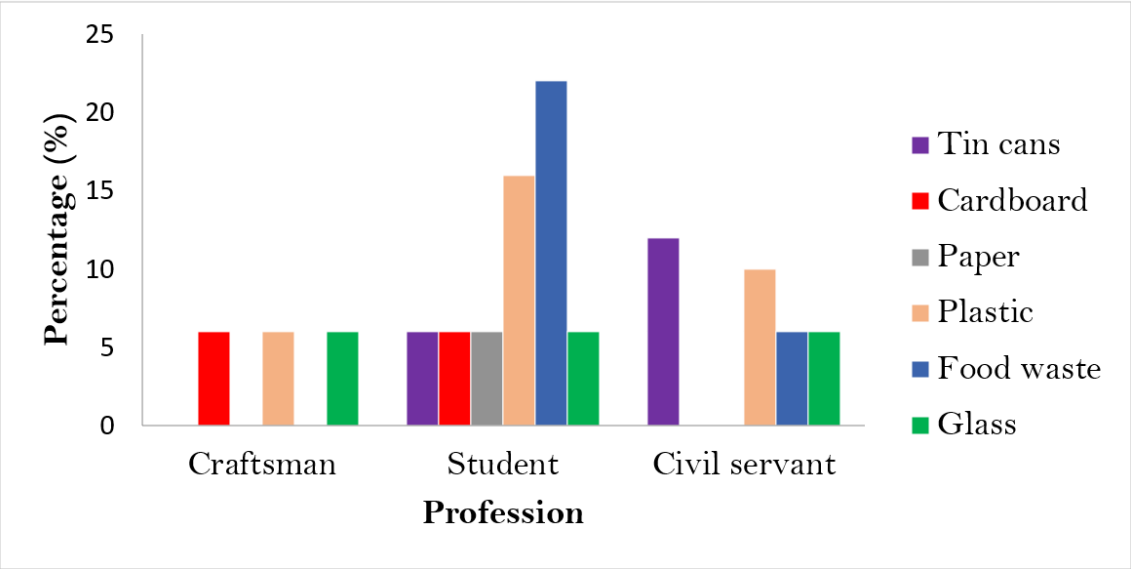

Figure 4.
Analysis of waste distribution by type and profession in Kigali.

4.4. Analysis of Waste Distribution by Household Size

4.4.1. Analysis of Lome

Analysis of waste production by household size reveals that large households, consisting of six or more people, are the main producers of waste, particularly in the plastics and food waste categories. In contrast, small households, consisting of one to two people, generate less waste, mainly concentrated in the plastic and paper categories.

There is thus a clear and progressive trend: as household size increases, so does the quantity and diversity of waste produced. This trend reflects the growing consumption and waste production needs associated with the size of family units.

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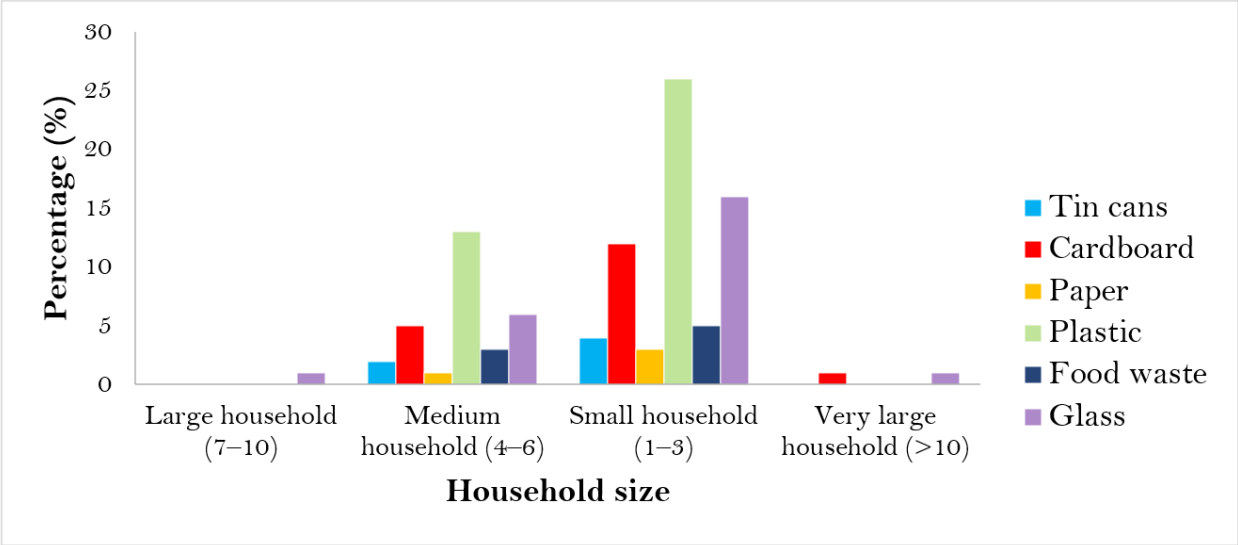

Figure 5.
Distribution of waste types by household size in (%) in Lome.

4.4.2. Analysis of Kigali

Unlike the situation observed in Lome, waste production in Kigali does not follow a linear progression based on household size. In fact, medium-sized households, composed of three to five people, generate the largest amount of waste, mainly in the categories of plastics and tin cans.

This peculiarity can be explained by the urban lifestyles specific to Kigali, where collective consumption habits, such as eating out or shared meals, significantly influence the nature and volume of waste produced.

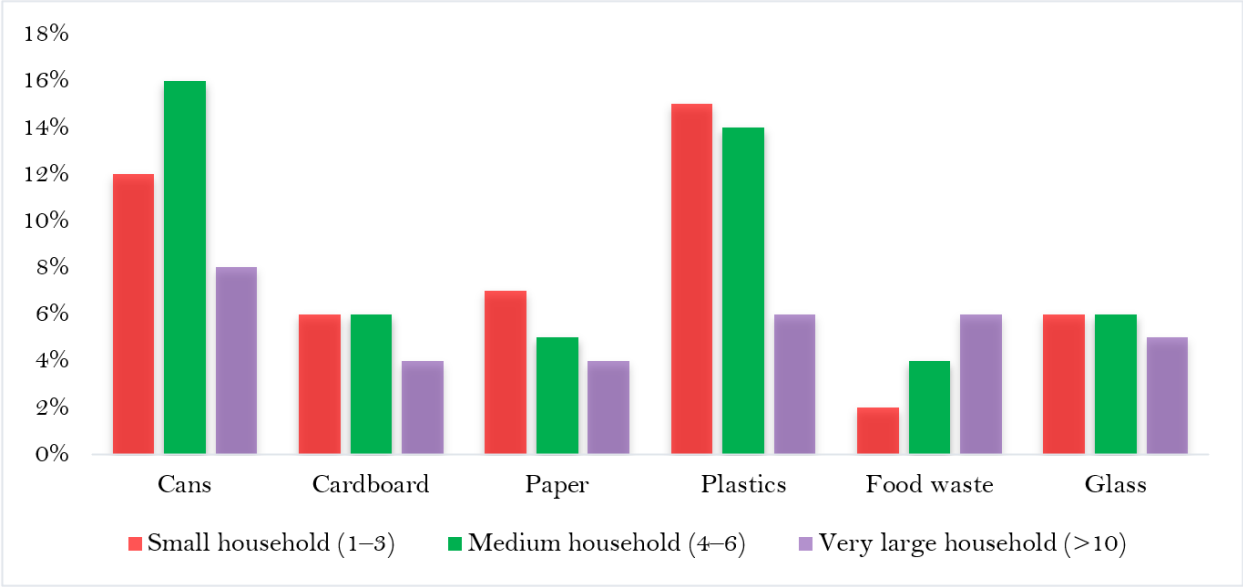

Figure 5.
Distribution of waste types by household size in (%) in Lome.

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5. Discussion

The comparative study conducted in Lome and Kigali highlights notable differences in the composition of household waste, revealing the socio-economic, cultural, and political dynamics specific to each city.

These results, obtained from a cross-analysis of field data using pivot tables, reveal structural trends in waste production according to marital status, occupation, and household size. These observations are part of a broader issue of sustainable urban waste management in sub-Saharan Africa, where cities are facing rapid urbanization, changes in consumption patterns, and often unevenly structured public policies.

The results show that plastic is the most common type of waste in both Lome (39%) and Kigali (32.65%). This predominance of plastic, which is widely documented in the literature on urban waste in Africa, underscores the need for targeted waste management strategies in these cities [38, 42] reflects a growing dependence on single-use packaging, exacerbated by the absence of strict regulations or their ineffective implementation.

Several African countries have introduced policies banning plastic bags, such as Rwanda in 2008, with results considered exemplary [17].

However, the data from this study show that despite this ban, plastics still account for a significant proportion of waste in Kigali, suggesting either the persistence of informal uses or substitution by other forms of plastic not covered by the initial legislation.

In Lome, on the other hand, the high proportion of glass (25.66%) and cardboard (18.42%) highlights domestic consumption geared towards products packaged in bottles or rigid packaging. This compositional structure is partly explained by the configuration of distribution channels, marked by a strong presence of beverages packaged in glass bottles and the absence of an effective deposit system, but also by collective consumption habits. In Kigali, glass accounts for a smaller share (12.24%), while tin cans (29%) occupy an important place.

This contrast reflects a more marked orientation towards processed and packaged food products, a phenomenon also observed in other African capitals undergoing tertiarization [48].

Analysis based on marital status also reveals structural differences. In Lome, married people are responsible for more than 70% of waste, particularly plastic and glass.

This situation can be explained by the often-large size of married households, which are sometimes multigenerational, leading to higher collective consumption.

This finding is consistent with the observations of Medina et al. [49] who emphasize that the composition of waste in cities in the Global South is strongly influenced by family structure and domestic practices. In Kigali, on the other hand, single people account for more than 75% of total waste production, particularly in the plastic and canned food categories.

This configuration is indicative of more individualized lifestyles and a higher proportion of single people in densely populated and modern areas of the city. It can also be interpreted in the light of Rwandan urban planning policies, which have encouraged the emergence of high-rise neighborhoods and individual housing for young working people [50].

Occupation also influences the type of waste produced. In Lome, civil servants are the main producers of paper and glass, which can be explained by professional practices and administrative organization, while workers in the informal sector generate more plastic and cardboard. This result is consistent with the observations of Wilson and Velis [10], who note that formal and informal economic activities generate different types of waste depending on the materials used and management practices. In Kigali, formal sector employees produce more plastic and food waste, while small traders generate larger quantities of glass and cardboard.

This distribution seems to be linked to local commercial practices, where small shops distribute bulk packaged products.

Finally, household size appears to be a discriminating variable, but with dynamics specific to each city.

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In Lome, large households produce a greater quantity and diversity of waste, particularly plastics and food scraps, confirming the correlation between household size and consumption intensity. In Kigali, on the other hand, waste production peaks in medium-sized households (3 to 5 people), with no linear trend in relation to size.

This difference may reflect differences in urban configuration and cultural norms: in Kigali, small households may live in housing that is more modern with more direct access to processed products, while in Lome, large households maintain collective lifestyles closer to traditional structures.

These results call for differentiated adaptation of waste management policies in each context. In Lome, the challenges are more focused on recycling glass and cardboard, as well as reducing plastic waste in large households. In Kigali, it appears necessary to strengthen strategies for reducing canned goods and improve sorting at source in single-person households and intermediate households.

In both cases, sorting practices are still very limited, and selective collection remains in its infancy. The introduction of community sorting programs, the promotion of deposit-refund systems, and the formalization of informal recovery channels could help improve the sustainability of waste management.

6. Conclusion

The comparative analysis of household waste composition in Lome and Kigali highlights the socio-economic, cultural, and structural specificities that influence consumption patterns and waste production dynamics in the two African capitals. While the two cities share a common set of issues related to urban growth, rapid urbanization, and inadequate solid waste management, the very nature of the waste produced reveals different patterns.

In Lome, the predominance of plastic (39%) and glass (28%) waste reflects a consumption model heavily focused on packaged products and industrial beverages, often distributed in single-use formats, in a context where recycling systems remain in their infancy. In contrast, Kigali has a slightly different structure, with a significant proportion of tin cans (29%) and plastics (32%), suggesting a modernization of the diet through imported and processed products, but also a transition to more "Westernized" consumption habits.

The low proportion of organic waste in both contexts, particularly food scraps (9% in Lome and 14% in Kigali), raises questions about domestic recycling practices and access to formal collection systems. It may also be a sign of controlled food waste or the diversion of organic waste for other purposes (animal feed, informal composting).

These results call for a reconfiguration of public policies around waste management through localized approaches. The fight against plastic waste in Lome must be reinforced by stricter regulations on the production and distribution of single-use plastics, accompanied by increased public awareness. In Kigali, where a ban on plastic bags has been in force since 2008, efforts must continue to manage metal packaging and establish sustainable recycling chains.

In both cities, strengthening the sorting, recovery, and treatment of organic waste appears to be an essential lever for limiting pressure on landfills and promoting the circular economy.

Ultimately, a better understanding of the composition of waste is essential for developing management strategies that are adapted to local realities and consistent with sustainable development goals, particularly SDGs 11.6 and 12.5, which relate respectively to reducing the environmental impact of cities and preventing, reducing, and recycling solid waste.

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Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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