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(RESEARCH ARTICLE)

Household waste management in the cities of Guinea: Case of the city of Kamsar – Republic of Guinea – West Africa

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Abstract

Household waste management in Kamsar is a major challenge, with more than 70% of waste not collected. This turns public spaces into real dumping grounds, thereby harming the environment and the inhabitants' quality of life. In the face of rapid urbanization, local authorities requested assistance from SMEs and the Compagnie des Bauxites de Guinee (CBG) to develop a sustainable waste management strategy. In this context, the company SONARC was engaged in August 2024 to improve sanitation in the city. Nevertheless, despite these initiatives, the collection systems do not cover all the districts of Kamdar. To better assess the situation, a study was carried out combining documentary research, direct observation and field surveys, which included interviews with managers of the structure involved in waste collection and surveys of households.

The results reveal that 67% of the households surveyed are subscribed to SONARC, but many adopt non-conventional practices. The collection frequency varies, and 33% of the non-subscribed households throw their waste in inappropriate areas such as railway tracks, vacant spaces, illegal dumps and mangroves. Moreover, CBG produces industrial waste, some of which residual materials may be hazardous. The study also highlights disparities in waste collection, revealing a duality between the wealthy districts (the "cite" quarters) and those of lower status (the rest of the city), underscoring the urgency of sustainable solutions to ensure a healthy environment in Kamdar.

However, several assets exist to improve the waste management system, such as the willingness of many households to pay for waste collection, the involvement of women, as well as a high youth and education rate in the population.

Keywords: Household Waste; Kamsar; Sustainable Management; Pre-Collection; Illegal Dumps

1. Introduction

The term "waste" historically refers to a material or object of zero or negative value to its holder; etymologically derived from the French verb decrier, it implies degradation to the point of unitability (Pichat, 1995). Legislation such as the EU Waste Framework Directive defines waste as any residual material from production or use, emphasising producer responsibility (Goulard and Legendre, 2003). From a spatial-geographical viewpoint, waste raises critical issues of management and environmental impacts, including conflicts over land use for storage or treatment, and deterioration of public space quality and image. Waste management itself encompasses collection, transport, treatment, reuse and disposal of human-generated waste, with the objective of minimising impacts on health, environment, aesthetics and local life quality (Gouhier, 2005).

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Worldwide, and especially in developing countries experiencing rapid urbanisation, waste management has become a major environmental concern. In Africa, urbanisation has accelerated dramatically—from 14% in 1950 to 40% of the population living in urban areas today—and West Africa reached an urbanisation rate of 45% by 2011 (UN-Habitat, 2014; Hadjali and Knebelmann, 2018). The population of urban Africa grew from 27 million in 1950 to 567 million by 2020 (Saker and Alkama, 2020). One of the most troubling consequences of this growth is the increase in household waste: Sub-Saharan Africa's waste generation is projected to triple by 2050 unless collection and treatment systems expand accordingly (World Bank, 2018). The problem is compounded by lifestyle changes, inadequate policy frameworks and insufficient infrastructure in many African cities (Saker and Alkama, 2020).

In Guinea, numerous studies (Bangoura 2004/2006/2017; Guinean Ministry of Hydraulic and Sanitation, 2019; Balde et al., 2022; Fofana et al., 2022; Gbilimou et al., 2022/2024; Bangoura et al., 2024) have addressed waste issues. Many cities suffer deficient waste management systems that harm public health and the environment. A recent example is the collapse of the Miniera landfill in Conakry in August 2017, which killed at least nine people and underlined the urgency of improving waste evacuation and management.

The present study focuses on the city of Kamsar, where waste management policies have shown limited effectiveness despite interventions by local authorities. In many households waste is dumped in illegal sites along railway tracks or burned openly. The presence of the bauxite-mining company CBG (Compagnie des Bauxites de Guinée) worsens the situation: its mining and export operations generate industrial residuals, some hazardous. Significant inequalities exist in waste collection: since the creation of CBG in 1973, workers' housing neighbourhoods receive partial collection services, whereas peripheral and downtown districts—home to the majority of the population—are left without service. This duality echoes the colonial dichotomy between "white town" and "indigenous town" described by Fanon (2002).

Rapid population growth, inadequate road infrastructure in underserved districts, and undefined or uncontrolled public spaces have contributed to the conversion of public areas into waste dumps. Streets, market zones, railway edges and coastal spaces become clandestine dumping sites. In most such districts collection is absent or poorly organised, and waste that is collected is not separated before being transported to the sole existing illegal landfill. The lack of proper transit facilities and the public-health and environmental nuisances are poorly controlled by local authorities.

Various initiatives have been launched: a 2019 tender opened financing to SMEs for city sanitation; in 2024 the company SONARC was engaged after contracts between CBG and the municipality; CBG has also set up specific circuits for industrial and biomedical waste. Despite efforts, waste management remains highly problematic due to significant demographic growth and the expansion of population and industrial activities. Presently, collection covers only the main roads and two city districts. Given these shortcomings, this study asks: why does an industrial city such as Kamsar face such difficulties in household-waste management? How did this situation evolve? The objective is to evaluate the current collection system and propose a sustainable management model tailored to the city's specific needs.

2. Material and methods

2.1. Presentation of the Study Area

The town of Kamsar, originally a small fishing village, has evolved into a dynamic urban centre. Located in north-western Guinea, approximately three and a half hours' drive north of the capital Conakry, it is bounded to the north by the estuary of the Rio Nunez and the sub-prefecture of Kanfanrandey, to the south by the sub-prefecture of Bintimodia, to the west by the Atlantic Ocean, and to the east by the sub-prefecture of Kolaboui. Covering an area of approximately 472 km^2, its population experienced rapid growth: from 730 inhabitants in 1968 (GEE/IPC, 1969), to around 8,000 in February 1983, and 134,000 in 1996 (RGPH 1996), corresponding to a density of about 287 inhabitants per km^2.

Having become a major industrial hub thanks to the Compagnie des Bauxites de Guinée (CBG), which exploits one of the world's largest bauxite reserves on the Sangarédi plateau, the city exhibits a pronounced urban dichotomy. The "cité" neighbourhood, largely dominated by CBG, features broad, illuminated avenues and individual houses for expatriate and national managers, whereas more modest housing is allocated to enterprise workers (Wikipedia, accessed 9 Nov 2024); a few kilometres away, "Kamsar-village" consists of informal housing lining the main road to Boké, about 50 km distant.

Kamsar is considered one of the better organised medium-sized towns in the country, benefiting from continuous water and electricity supply in the "city" quarter. It is connected to other towns and prefectures via paved roads, a 135 km railway line linking the Kamsar plant to the Sangarédi mine, and has health infrastructure including ANAIM hospital and several health centres such as Kassapo.

The relief is gentle, consisting mainly of plateau, low alluvial and marshy plains favourable for rice cultivation. The climate is shaped by maritime winds, with a rainy season from May to October and a dry season from November to April. The town is crossed by numerous navigable waterways and is surrounded by mangroves, mangrove trees, palm trees and coconut trees.

According to the National Institute of Statistics of Guinea (2016), Kamsar counted over 360,000 inhabitants, drawn from diverse ethnic groups such as the Bagas, Nalous, Landouma, Soussous, Kpelles, Malinke's, Tomas, Peul's, and many foreigners. Economic activities are primarily based on extractive industry, trade — notably at the Sahara market — and fishing, which generates income for fishermen and many women who smoke and market the products. The city features two ports: Port Fory (former) and Port Nene (new). However, most boats are unmotorised and port infrastructure is outdated, limiting incomes and rendering the population vulnerable to environmental changes. In addition, agriculture, crafts and livestock raising are also practised.

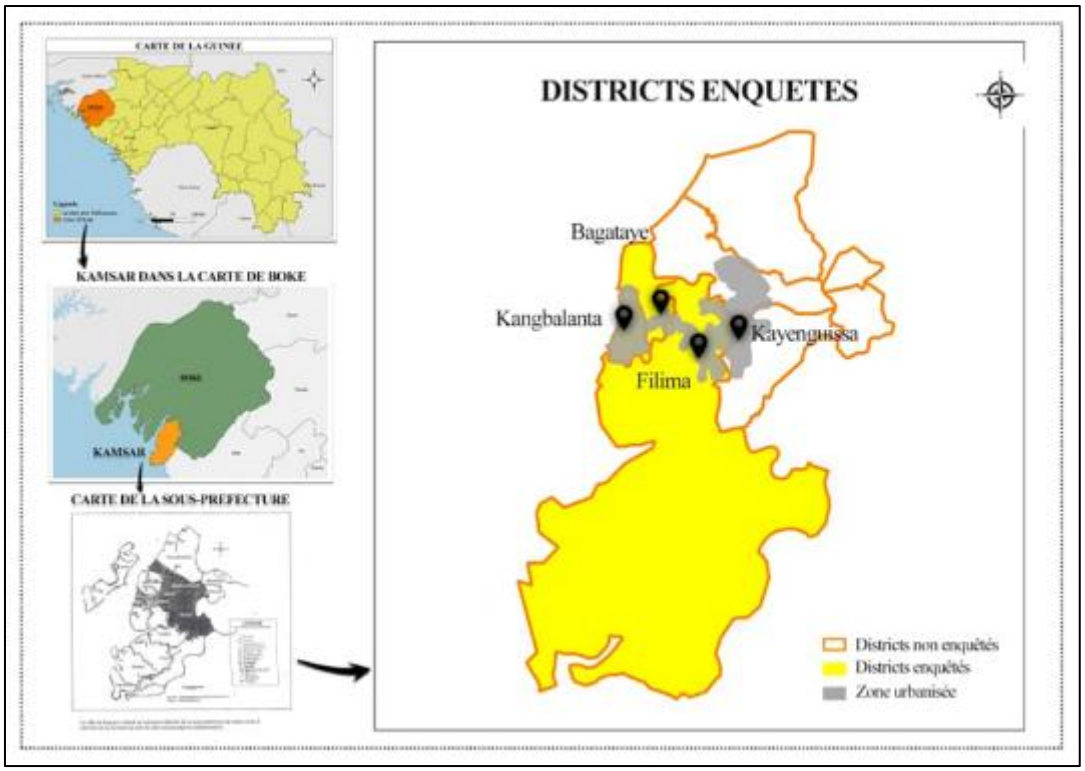

Figure 1 Map of Kamdar City

2.2. Study framework and materials used

Following field-data collection campaigns in Kamsar, the research was conducted within the frameworks of the Laboratory Dynamic Rurales of the Université Jean Jaurès de Toulouse and the Laboratory for Urban Studies and Research (LERU) of Higher Institute of Architecture and Urban Planning (ISAU). iPhones were used to geolocate sites, survey illegal dumping grounds and take photographs. The Kobo Collect app and the software packages Excel, Microsoft Word and QGIS were employed for data collection, processing and map creation.

2.3. Collection techniques and sampling

With regard to data-collection techniques, we relied on documentary research to review previous studies on household waste management in Africa and in Guinea. We also employed semi-structured interviews, direct observation and questionnaire surveys to complement the literature-derived data. The surveys were conducted from 30 August to 11 September 2024 and from 7 to 22 January 2025. In total, 96 households were interviewed, including 4 former managers of SMEs engaged in waste collection, 2 officials of the rural commune, and 8 members of waste-management and cleaning companies (1 at SOREGEN, 1 at SOANE and 6 at SONARC).

During these periods, we collected socio-economic data from households, identified and geolocated the various illegal dump sites in the town, as well as the geographic coordinates of the surveyed households. Our questions were addressed

to the commune and SME officials, the SONARC, SOANE and SOREGEN companies, and to households in the districts served by SONARC. For sampling, we applied the method of Bouchard, cited by Nkunzwenabake (2010), which states that "when the population studied is less than or equal to 1 000 000 individuals, one may select a sample of 96 individuals with a margin of error of 10%". The formula used is.

$$N_c = \frac{n}{1 + \frac{n}{N}}$$

were

- NC= corrected sample size
- n= total universal sample (in this case, 96)
- N= population size (in this case, 360 000).

Thus, given that Kamar's population is 360 000 inhabitants, we determined that the total number of households to survey in the town should be 96.

The questionnaire survey enabled us to gather information on the socio-economic profile, characteristics and practices of households in relation to municipal solid-waste management. This survey was complemented by interviews with commune and SME officials, as well as observations of the living environment, with photographs used to illustrate our analyses.

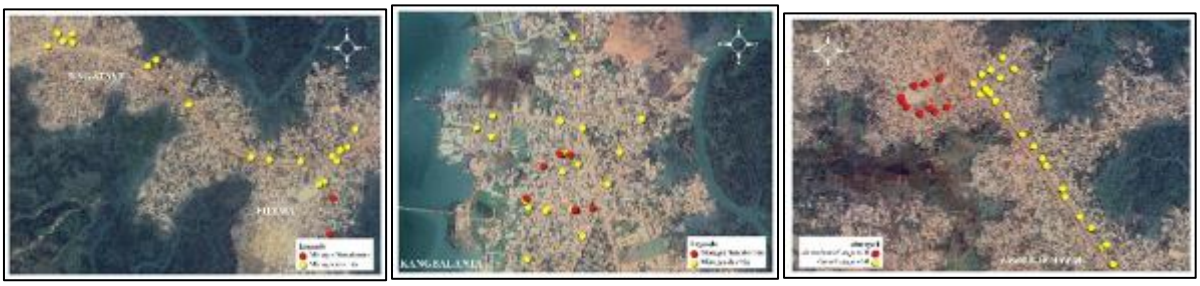

Figure 2 Location of the survey areas in Baga Taye and Filima (2a), Camp Balanta (2b), and Kaegis (2c)

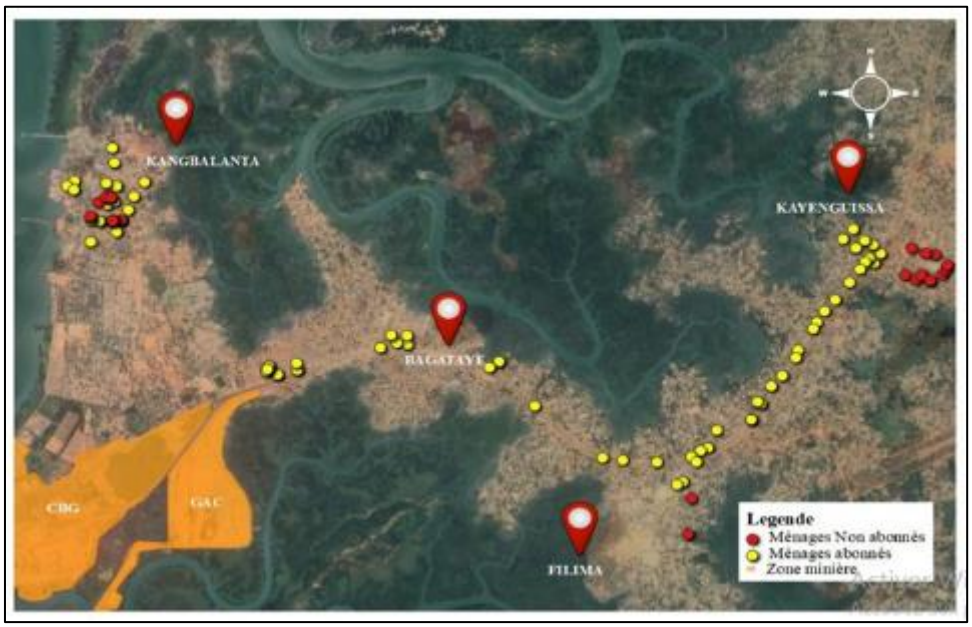

Figure 3 Overview of the survey zones

3. Results and discussions

This section presents the results of our research displayed in tables and graphs

3.1. Sociodemographic Profile

The sociodemographic profile of the households surveyed in Kamsar was structured around several key dimensions — notably gender, age, educational attainment and socio-professional status. These variables can significantly influence the social and economic dynamics that shape residents' everyday lives and their capacity to manage the specific challenges they face.

3.1.1. Distribution of Households by Gender

The gender-based distribution enables us to identify who shoulders responsibility for waste-related tasks within the household, and how that affects practices such as sorting and recycling.

The survey data reveal that women constitute a majority (64 %) compared to men (36 %). This can be explained by the fact that women often play a central role in the management of household tasks, including waste management. Moreover, they tend to be more available to participate in surveys and discussions on this subject, due to their engagement in domestic and community activities. Furthermore, cultural and social factors influence this distribution, notably gender norms that assign to women the responsibility for household cleanliness and maintenance.

3.1.2. Distribution of Households by Age Group

This variable enables an exploration of how different age cohorts perceive waste-management issues, and helps identify initiatives that might foster active participation by all age groups in sustainability efforts.

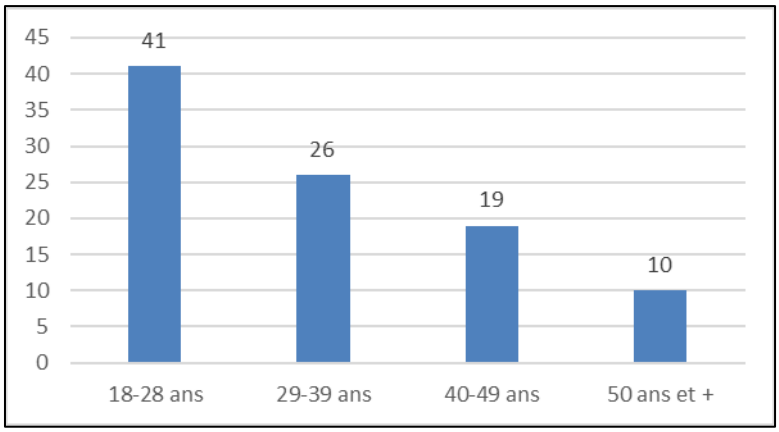

Figure 4 Distribution of households by age group

The analysis of Figure 4 shows that the largest proportion of respondents (43 %) belongs to the 18–28 years age group, followed by 27 % of households aged 29–39 years. This predominance of younger age groups may indicate a population more receptive to improved waste-management practices such as recycling, sorting and waste reduction. The subsequent age cohort (40–49 years) accounted for 20 % of the sample, while those aged 50 years and over made up 10 %. This age distribution may be crucial for understanding behaviors and attitudes toward waste management.

Regarding educational attainment, it emerges as a key factor in waste management since higher education levels are often associated with heightened awareness of environmental issues and waste-management practices. Our survey results show that 38 % of households had attained secondary education. This figure reflects the industrial nature of Kamsar, which attracts many young people who, after obtaining the baccalaureate, did not pursue tertiary studies but instead enrolled in technical or vocational programmes aimed at rapid employment by CBG. 21 % of respondents had studied Arabic (classified as "other"), followed by those with a university degree (19 %), no formal education (13 %) and primary education (10 %). Respondents with university, secondary or Arabic education may play a pivotal role in raising awareness among others by sharing their knowledge about waste-management issues. Indeed, they show greater understanding of the harmful impacts of waste on their living environment and health.

3.2. Distribution of Households by Waste Disposal Method

The survey data indicate that a substantial majority (67 %) of the households interviewed are subscribed to the SONARC service, which collects their domestic waste and transports it to the town's only disposal site — a low-lying area whose ownership is disputed between the company and a private individual. The collection frequency by SONARC varies significantly. Among the non-subscribed households (33 %), many dispose of their waste in inappropriate locations: 3 % throw rubbish onto railway tracks, 12 % in vacant spaces or illegal dumps, 7 % incinerate their waste, and 11 % dump in mangrove zones.

Despite the constraints and operational difficulties faced by SONARC, a high proportion of subscribing households (92 %) express satisfaction with the service. Conversely, dissatisfaction among the non-subscribers stems primarily from high service costs and the absence of collection bins. This satisfaction rate is markedly higher than rates found previously in the Kaloum district of Conakry in 2007, where only 36 % of households reported being satisfied and 64 % dissatisfied, due to irregular service, remote collection points and lack of SME-based services. It is also higher than the findings of Bangoura M.R. (2017) for the communes of Conakry, which reported 89 % of households as dissatisfied, just 8 % satisfied, and 3 % with no opinion.

Nevertheless, certain households in Kamsar continue to engage in waste-disposal practices detrimental to the living environment and human health, as photographic evidence shows. The agents of SONARC can collect waste from only a limited number of households in the town. Public spaces (streets, railway edges), undeveloped plots, and incineration remain the disposal modes used by non-subscribing households. Earlier studies in popular neighborhoods of Bonon (Côte d'Ivoire) have documented similar disposal patterns (Gohourou and Yao-Kouassi, 2022). Such illegal dumps unfortunately become genuine sources of nuisance: children often play in them unaware of the surrounding hazards, and stray dogs feed from them. This situation creates a worrisome link between waste accumulation and human health. Indeed, the proximity of these unhygienic zones fosters the spread of diseases, putting not only the children at risk but the entire community.

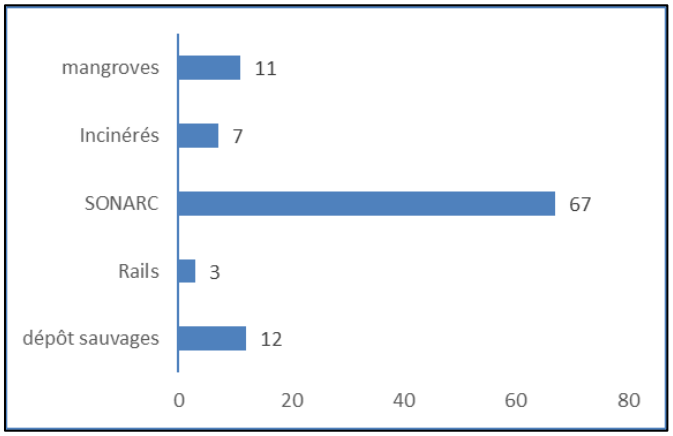

Figure 5 Distribution of Households by Waste Disposal Method

Figure 6a and 6b an agricultural area converted into a landfill by SONARC, August 2024

Figure 7a and 7b Illegal dumps in Kamdar-Centre and Camp Balanta, August 2024

The photographic evidence depicts the condition of the dumping grounds, showing the presence of animals and residential dwellings nearby, as well as dust and mud. This highlights the urgent need to establish a landfill or a sanitary waste-disposal site designed to meet international standards.

Our survey indicates that, beyond the absence of adequate disposal sites, the resources allocated to SONARC are insufficient. As a result, the company is unable to implement an effective system to combat unsanitary conditions in Kamdar. The difficulties it faces include

- A shortage of bins, containers, subsidies and official deposit zones;
- Insufficient material and equipment for its workers;
- The refusal or reluctance of some households to subscribe to the service and to pay the monthly fee;
- Conflicts between households and pre-collectors;
- The proliferation of illegal dumpsites and the fact that some subscribers must travel 3 to 5 km per day to reach collection points;
- A lack of training, of incentive premiums and inadequate technical and financial support from the state;
- Low wages and delayed payment of monthly salaries.

4. Discussions

The present study sheds light on the multifaceted challenges and emerging opportunities associated with household solid-waste management in the city of Kamsar. The findings highlight an interplay of demographic, infrastructural, institutional and behavioural factors that both inhibit and enable improved service delivery. Viewed against the backdrop of global research on household waste management in developing-country contexts, several key themes emerge.

4.1. Demographic Dynamics and service uptake

Our data show that 67 % of households are subscribed to the local service provider (SONARC), while 33 % remain unserved and rely on inappropriate disposal routes (rail tracks, vacant spaces, mangroves, open burning). This gap in coverage is consistent with patterns observed in other urban centers in sub-Saharan Africa where rapid urbanisation outpaces waste-service expansion. The predominance of younger households (43 % aged 18–28) and a notable share in the 29–39 band suggests a population cohort that may be more receptive to modern waste-management practices. Research indicates that younger, better-educated households tend to adopt waste-segregation and recycling behaviours more readily. However, our data show a paradox: although many households subscribed to the service, the frequency and consistency of collection vary, and non-subscribers resort to illegal dumping or burning. This indicates that demographic receptivity alone does not guarantee proper management in the absence of reliable infrastructure and institutional support.

4.2. Institutional and infrastructure constraints

The findings underscore that the service provider SONARC operates under major constraints — insufficient bins and containers, inadequate labor and equipment, lack of formal deposit sites and weak institutional support. These bottlenecks echo wider findings in low-income urban contexts where insufficient budgets, weak governance and infrastructure deficits hamper collection and safe disposal. The contested ownership of the only disposal site in Kamsar, coupled with the proliferation of illegal dumpsites that encroach public spaces, highlights the risk of unmanaged waste flows affecting public health and the environment. The presence of waste dumps near residential quarters, rail lines and

mangroves underlines the environmental justice dimension of this issue—residents of less-served areas bear the brunt of exposure and nuisance.

4.3. Behavioral and socio-economic factors

The high satisfaction rate among service-subscribed households (92 %) is encouraging, yet must be interpreted cautiously. Satisfaction may reflect relative improvement rather than optimal service. The non-subscribed segment underscores key behavioural and economic deterrents: cost of service, lack of containers, absence of formal subscription mechanisms and long travel distances (3–5 km) to drop-off points. These barriers mirror global findings relating service cost, accessibility and convenience to household participation. Furthermore, our results suggest that higher educational attainment supports engagement in awareness and peer-sensitization activities. Households with secondary, university or Arabic education levels may act as vectors of change in their communities. Nonetheless, education alone is insufficient without enabling infrastructure and supportive policy frameworks.

4.4. Spatial and equity dimensions

A striking finding in Kamsar is the dualistic structure of waste-service provision: the “cite” (ex-company-worker housing) receives partial collection, while peripheral and downtown areas – inhabited largely by non-company workers – are underserved. This spatial inequity reflects historically rooted patterns of infrastructural investment and echoes colonial legacies, as described in our earlier section. Such geographical disparities exacerbate vulnerability: underserved zones face higher exposure to uncollected waste, informal dumping and associated health risks. Research from other African settings confirms that spatial clustering of poor service corresponds with lower income, informal settlements and greater environmental hazard.

4.5. Heath, environment and sustainability implications

The proliferation of informal dumpsites and open burning in Kamsar presents acute risks to human health and ecosystem integrity. Empirical work elsewhere in sub-Saharan Africa has documented links between unmanaged household waste and vector-borne diseases, respiratory illnesses and degraded living environments. In Kamsar’s context the issue is aggravated by rapid population growth, industrial activity (via CBG) and weak formal infrastructure. The absence of a sanitary landfill or controlled disposal facility further heightens the urgency. From a sustainability vantage, the current system fails to align with circular-economy and integrated waste-management paradigms, which call for source separation, recycling and safe final disposal.

4.6. Towards a sustainable model for Kamdar

- Given these findings, the next step is to propose a tailored, sustainable waste-management model for Kamsar. Key components should include
- Expansion of service coverage through formalization of subscription mechanisms, differential pricing schemes for poorer households and incentives for participation.
- Investment in infrastructure, including procurement of bins, vehicles, workforce training, and development of a sanitary landfill or engineered deposit site in collaboration with municipal authorities and CBG.
- Behavioral change strategies leveraging educated households as peer-ambassadors, awareness campaigns in neighborhoods, and integration of youth and women in collection schemes.
- Spatial equity planning, ensuring that peripheral zones and informal settlements are included in route planning, abandoning the legacy dual-system and promoting universal service coverage.
- Institutional strengthening and governance reform, to clarify responsibility among stakeholders, resolve site-ownership disputes, ensure timely payment of workers, and provide government subsidies or grants to cover up-front costs.
- Implementing such a model aligns with evidence from similar studies identifying education, income, legal enforcement and infrastructure as key determinants of proper household-waste management.

4.7. Limitations and research directions

While this study provides rich empirical insight into Kamsar’s waste-management dynamics, limitations must be acknowledged. The cross-sectional survey design restricts causal inference; self-reporting may introduce bias; and spatially, our sample covers only identified zones. Future research should incorporate longitudinal monitoring, geo-spatial data on waste-flow mapping and cost-benefit analysis of proposed infrastructure investments. Additionally, exploring industrial-household waste interactions (given CBG’s presence) would provide a more holistic view of the local waste system.

5. Conclusion

In summary, the waste-management situation in Kamsar is emblematic of the complex challenges that many medium-sized industrial towns in West Africa increasingly confront: rapid urban growth, demographic shifts, uneven service provision, institutional fragility and behavioural inertia. The convergence of these dynamics creates a "perfect storm" in which the demand for household-waste services rises faster than the capacity to supply them, leaving large segments of the urban population exposed to environmental, health and social risks. For example, studies report that in West Africa only about 40 % of solid waste is properly managed and less than 4 % is recycled.

However, Kamsar also offers reasons for cautious optimism. The relatively high subscription rate of 67 % of households to the local service provider (SONARC) and the presence of a young, relatively educated cohort of residents signal real potential for positive change. These human capital and social-uptake dimensions are critical: research shows that population segments with higher education and younger age profiles are more likely to adopt improved waste-management practices and to engage in sustainable behavior.

To capitalize on this potential, the path forward requires concerted investment across four mutually-reinforcing dimensions:

- **Infrastructure development:** Establishing a sanitary landfill or engineered disposal site, acquiring sufficient bins and collection vehicles, extending collection routes into underserved zones, and upgrading technical equipment. Without such capital investment, informal dumps, uncontrolled burning and illegal disposal will continue to dominate the landscape, with attendant greenhouse-gas emissions and health threats. Indeed, the waste sector in Africa accounts for around 8 % of total greenhouse-gas emissions and its disposal practices are often highly inefficient.
- **Behaviors changes and community engagement:** While willingness to subscribe is present, actual behavior—such as source-separation, timely payment, and avoiding dumping in prohibited zones—needs reinforcement through awareness-raising, peer-education (especially via educated young adults) and incentives. Behavioral inertia remains a key barrier even where services exist.
- **Equitable coverage:** The dualistic service provision in Kamsar—whereby the "cité" district receives partial collection and peripheral/downtown districts are largely neglected—must be addressed. Waste services must be universal and inclusive if environmental justice and effective outcomes are to be achieved. Unserved populations are at greater risk of exposure to open dumping, vector-borne diseases and degradation of local quality of life.
- **Institutional reform and governance:** Stronger institutional frameworks, clearer responsibilities, transparent financing, and timely payment of workers are all required. The ownership dispute over the current disposal site and the weak technical support to SONARC illustrate how governance deficits hamper progress. From a policy perspective, regional standards and international conventions (such as those under ECOWAS and the African Clean Cities Platform) exist but often fail to translate into effective local action.

In closing, the urgency of Kamsar's situation cannot be overstated. Without decisive action, the risks to human health—through exposure to uncollected waste, open burning and vector-breeding sites—will escalate. Environmental quality will deteriorate as illegal dumps fill public spaces, waterways and mangroves, and urban resilience will weaken in the face of climate-related stresses and population growth. Yet the foundation for change is in place: the engaged households, the young educated population segment, and the local industrial base (via CBG) that could partner in shared-responsibility models. If Kamsar harnesses these assets through coordinated investment, policy reform and inclusive service design, it has the potential to transition toward a more sustainable, equitable and resilient household-waste-management system—serving as a model for other West African towns facing similar trajectories.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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[17] You may consider referencing that version instead, with the full bibliographic details:

[18] Gbilimou, A., Bangoura, M. R., and Conte, F. (2024). Economic valorisation strategy of household solid waste in Conakry, Guinea, West Africa. International Journal of Applied Finance and Management Economics, [Volume], [Issue].

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