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Evaluation of Waste Management in Large Cities of Côte d'Ivoire: Case of the City of Bouaké

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Abstract

The article assesses household and similar waste management in Bouaké, Côte d'Ivoire. It examines the governance framework, infrastructure, collection methods, funding, and stakeholders involved in the waste management system. The study uses a mixed-methods approach involving stakeholder meetings, documentary collection, field visits, and SWOT analysis. Findings reveal centralized governance dominated by MINHAS and ANAGED, insufficient infrastructure and equipment despite accessibility, a capped budget hindering achievement of WHO collection rate targets, and an informal pre-collection system financed by households.

Keywords

Bouaké, Waste, Stakeholder, Collection, Landfill

1. Introduction

Cities in the Global South, much like those in the North, are increasingly concentrating on various human activities that generate large quantities of waste. Over the past two decades, the issue of household and similar waste in the Global South has become more complex due to rapid urban growth [1].

In Côte d'Ivoire, the urbanization rate increased from 32% in 1975 to 52.5% in 2021 [2]. Concurrently, the management of household and similar waste faces significant challenges in the implementation of solutions. According to [3] and [4], these difficulties are mainly financial, technical, structural, and institutional [5]. Note that the problems are further complicated by the exponential increase in

waste due to rapid population growth and the emergence of informal settlements. [4] observe that the amount of waste produced is increasing faster than the amount collected, leading to the resurgence of illegal dumpsites and contributing to unsanitary conditions in these cities. Managing these challenges has become one of the difficult environmental problems today, and there is also an insufficiency of specific legal frameworks applicable to the entire waste management system alongside a multitude of stakeholders.

Bouaké, the city of focus in this study, is the capital of the central region and the second largest city in terms of area and population, with 832,371 inhabitants [2]. What is the state of solid waste and similar waste management there? According to [6] "Despite these investments and the authorities' efforts to organize the waste sector, several areas of the city of Bouaké remain unsanitary." Many areas of the city are not covered by waste collection services [7].

Thus, the study "**Evaluation of Waste Management in Large Cities of Côte d'Ivoire: Case of Bouaké**" aims to assess waste management in its entirety in Bouaké. It specifically seeks to evaluate governance frameworks through stakeholder mapping, analyze the infrastructure, management methods, collection equipment, funding sources, and identify the strengths and weaknesses of the waste management sector through a SWOT analysis.

2. Methodology

2.1. Presentation of the Study Area

Located in the North-Central part of Côte d'Ivoire, the commune of Bouaké is located approximately 350 km from Abidjan (the economic capital) and 107 km from Yamoussoukro (the political capital) of Côte d'Ivoire. Administratively part of the Bandama Valley District and the capital of the Gbêkê Region, the commune of Bouaké has an area of 71.79 km^2 and extends:

- from North to South between 7˚30 and 8˚ degrees North latitude;
- from West to East between 5˚ and 5˚30 degrees West longitude.

Bouaké is influenced by a humid tropical climate. There are four distinct seasons, each clearly differentiated by their rainfall patterns: a long, hot, dry, and non-rainy season (November to February); a long, hot, humid, and rainy season (March to June); a short dry season (July to August); and a short rainy season (September to October). In Bouaké, the average temperature ranges from 28˚C (February, March, and April) to 24˚C in August. The average annual temperature hovers around 26˚C and varies little throughout the year.

The urban landscape of Bouaké is dominated by three main housing types: residential housing, low-cost/evolving housing, and spontaneous housing.

The original inhabitants of Bouaké are the Baoulés, an ethnic group that belongs to the larger Akan group. However, due to its geographical position as a migratory crossroads, Bouaké hosts a diverse mosaic of ethnicities from other regions of the country as well as from West Africa.

Demographic evolution (the number of informal settlements, etc.): According

to the General Population and Housing Census (RGPH) conducted in 2021, the population of the commune of Bouaké is 785,133 inhabitants. The distribution of this population by gender is 408,939 men and 376,194 women.

The city of Bouaké has basic socio-economic infrastructure, including transportation infrastructures such as an airport and a railway with a train station. Across the entire city, 135 km of roads are unpaved but in good condition, 410 km are unpaved and in poor condition, and 325 km consist of unstructured roads. The city also has educational infrastructures, including a public university, private universities, large schools, secondary schools, technical and vocational training centers, and a social training center. Additionally, it has health care facilities, including a University Hospital Center, a Regional Hospital Center, urban and rural health centers, private clinics, and analysis laboratories. Figure 1 shows the geographical location of the city of Bouaké.

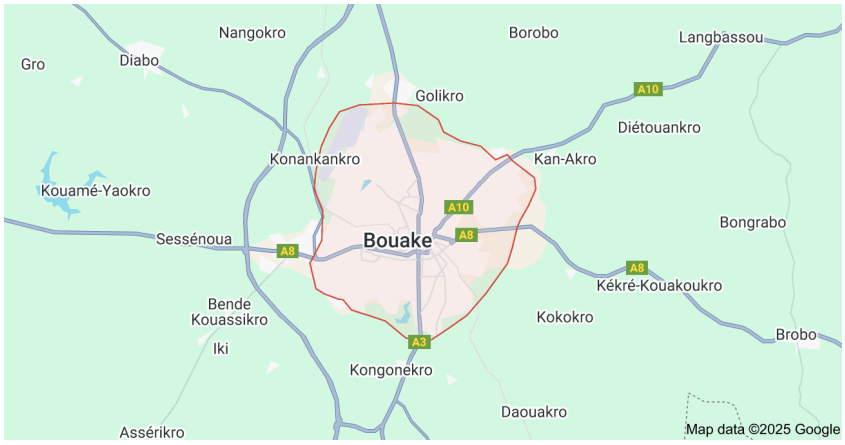

Figure 1. Geographic location of the city of Bouaké (source: Map data 2025 Google).

2.2. Data collection

As part of this study, two methodological approaches were developed for data collection. The first approach consisted of quantitative data collection using probabilistic sampling methods. Probabilistic sampling methods are characterized by the equal probability of selecting individuals from the population, thus making it possible to give the collected data an extrapolable character to the entire population. The second approach, which is rather qualitative, made it possible to complement the quantitative method with an interview guide for key stakeholders in the waste sector as a tool. Qualitative analysis allows for a better understanding of the results from the quantitative analysis.

The data collection tools were:

- Questionnaire for collecting data from households;
- Interview guide for interviews with institutional stakeholders;
- Routing truck sheet for pre-collectors, local businesses, stakeholders at high-waste production sites, and private solid waste management companies.

The household questionnaire describes aspects concerning the socio-economic

profile of households, their knowledge, attitudes and practices in waste management, their difficulties, their perceptions and their willingness to change their behavior for better solid waste management in the municipality of Bouaké. As for the interview guides intended for stakeholders in the waste sector in the city of Bouaké, they focus on various concerns about the social organization of communities, their relationship with the structures in charge of waste management, their level of contribution to waste management, the available infrastructure, the sources of information for the populations and communication channels.

2.2.1. Sampling

- Determining the size of households to sample

The calculated target population for the survey is 118,579 households. For this household survey, the Slovin formula was used to determine the number of households to survey. This is suitable for sampling a large population with unknown behavior (a behavioral study). The Slovin formula allows the population to be sampled with the desired degree of accuracy and provides the sample size (n) using the known population size (N) and the acceptable error value (e).

The confidence interval we chose is 95% for a margin of error of 5%, or e = 0.05. The formula for determining the sample is therefore:

$$n = \frac{N}{1 + N(e)^2}$$

n = 399

With N (household size in 2024) = 118,579

And e (the margin of error) = 0.05

Applying this formula results in a minimum household sample size of 399. This sample is distributed proportionally to the household size per neighborhood. The formula for determining the sample (ni) to be surveyed per neighborhood is:

$$ni = n(pi/N)$$

Where

n = total sample

Pi = number of households in the neighborhood

N = total number of households

To better understand the reality of waste management in each neighborhood of Bouaké, at least five households were selected from each neighborhood. Thus, the reconsidered sample is 423 households.

- Determining the sample of public and other stakeholders

An exhaustive list of state and other stakeholders involved in the waste sector was established: at the state level, these are the Regional Directorate of Sanitation, ANAGED, and the Bouaké civil society platform (represented by unions, NGOs, traders, and community leaders). Other stakeholders include the Federation of Waste Pre-Collectors of the Municipality of Bouaké (17 in number); the Association of Women Food Traders of the Bouaké Main Market (the butcher's shop); the municipal unions and intercity station managers; the president of the Dar-es-

Salaam Small Market; and the president of the small market in the industrial zone.

- Data collection was conducted electronically using the KoBoCollect application, using structured questionnaires with mixed (open-ended and closed-ended) questions developed and installed on smartphones.

2.2.2. Meeting of Stakeholders and Documentary Collection

Regarding data collection from other key stakeholders, semi-structured interviews were conducted using interview guides that helped frame the meetings. In total, three (3) focus groups and six (6) individual interviews were conducted as part of this survey. In order to facilitate the survey, it began after the information meeting attended by administrative and customary authorities and community leaders. Questions focused on the choice of management method, the content of private service providers' specifications, collection equipment, the layout of grouping stations, and the difficulties encountered by users during pre-collection.

The information search also provided an opportunity to consult documents (reports, dissertations, books, articles, etc.) that addressed solid waste issues, both locally and nationally. It was also an opportunity to collect relevant data (demographics, organization, existing infrastructure, ongoing projects, etc.).

2.2.3. Visits and Field Observation

The field visits and observations were carried out using observation sheets and photographs. Their aim was to better appreciate the reality of solid waste management in the city of Bouaké (visit to the Bouaké landfill, the grouping station(s), the collection circuit, illegal dumping stations, large waste production sites such as markets and stations) and particularly in all the neighborhoods as well as in the landfill. Figure 2 below illustrates images of site visits and waste collection equipment.

Figure 2. Image de visite de site de déchets et d'équipements de collecte.

2.2.4. Analysis of the Actors' Performance Using the Mactor Method

This method was developed by Michel Godet in 1990 as a step in strategic analysis using scenarios and foresight methods. It allows for the preparation of the most appropriate scenarios based on a thorough understanding of the objectives of the various stakeholders and the resources that can be mobilized to achieve the strategic objective.

This matrix is used to develop the influence/dependence plan, from which four types of stakeholders are identified. In our work, it served as a methodical guide for analyzing the influence and strengths exerted by key stakeholders on each other and on waste management in Bouaké. Figure 3 shows the Mactor matrix.

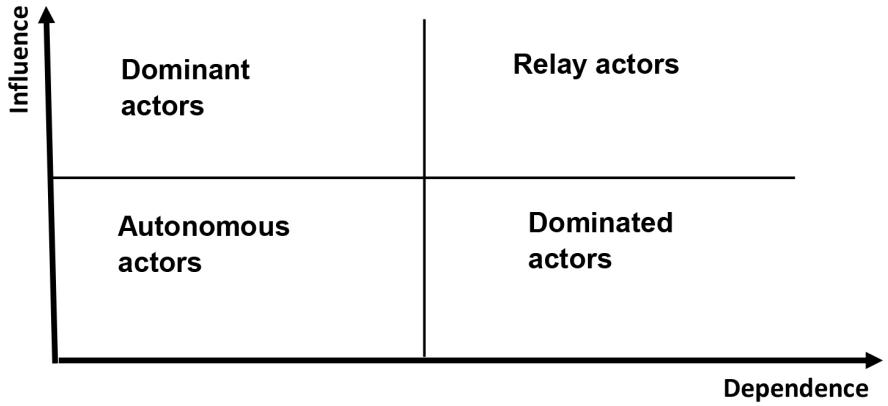

Figure 3. Mactor Matrix (source: Mactor Result).

- **Dominant actors:** Actors who have a strong influence on others without being strongly influenced themselves.
- **Relay actors:** Actors with strong influence and they are also highly dependent.
- **Autonomous actors:** Actors with little influence and little dependence.
- **Dominated actors:** Actors who have low influence and are highly influenced.

2.3. Evaluation of Collection Equipment

We used the tool developed by UNEP in 2009. This method uses assessment sheets. Collection and landfilling were assessed using this tool. This method allows us to assess the type of material, quantities, and availability rate. The sheets were adapted for our work.

2.4. SWOT Analysis

SWOT analysis allows us to identify strengths, weaknesses, opportunities, and threats. For our work, this analysis was conducted using a matrix based on the following parameters:

Strengths: The strengths and achievements of the waste sector.

Weaknesses: The shortcomings and deficiencies.

Opportunities: Research, studies, and strategic documents.

Threats: The hazards that could affect part or all of the sector.

3. Results

3.1. Stakeholder Mapping

3.1.1. Identification and Roles of Stakeholders

Several actors with different roles have been identified as part of our work. These include institutional actors, local communities, NGOs and civil society organizations, private companies and enterprises, and informal organizations. Their identities and roles are detailed in Table 1 below.

Table 1. Identification and role of stakeholders (source, field surveys, 2023).

Actors	Roles
Ministry of Sanitation (MINHAS)/National Waste Management Agency (ANAGED)	● Authority responsible for solid waste management competence ● Contracts with private operators ● Ensures the planning, coordination, monitoring and evaluation of services ● Ensures fiduciary management ● Participate in raising awareness among the population
Control office	● Control and monitoring of the activities of the collection and management companies of the Bouaké landfill in accordance with the specifications
Bouaké City Hall	● Ensures awareness and social mobilization; ● Provides spaces to be developed for grouping stations
Private providers	● Operators benefiting from a public cleaning service delegation contract for Zones 1 and 2 of Bouaké and the landfill. ● Provides the collection and transport of household waste and its disposal in landfills,
Pre-collectors	● Ensures pre-collection ● Actively participates in raising awareness among the population ● Act within the framework of an umbrella association
Pre-collectors	● They are responsible for collecting household waste to the grouping stations, and they mainly work in areas that are inaccessible to collection vehicles.
Households	● Ensure the packaging of solid waste in containers, ● Remove household waste ● Contribute financially to pre-collection.
Civil Society Organizations - NGOs	● Mobilize resources from development partners ● Provide information and raise awareness ● Support environmental education in schools ● Build the capacity of community stakeholders ● Participate in waste management operations by cleaning gutters and streets
Ivorian Electricity Company (CIE)	● Collection of Household Waste Removal Tax (TEOM)

3.1.2. Acting

The Figure 4 below highlights four groups of stakeholders involved in waste management in Bouaké, which are:

- **Dominant actors:** the matrix identifies three dominant actors, primarily institutional ones: the **MINHAS**, ANAGED, and the control office represented by Bureau Veritas. They are highly influential in decision-making and have a low level of dependency on their actions. This is due to their provision of financial resources and their role in defining the waste management method.
- **Intermediary actors:** There are two intermediary actors, namely the NGOs and **civil** society, as well as private service providers (Tielou Service and Moya).

These actors are influential because the waste collection rate depends on their effectiveness in the field. However, they are highly dependent on the programs and standards set by the dominant actors.

- **Autonomous actors:** These include the City Hall, households, and the Ivorian Electricity **Company** (CIE). These actors have little influence and are not very independent, as they do not participate in decision-making but can contribute to finding solutions for effective management.

Subordinate actors: The primary subordinate actors are the pre-collectors. They are not officially recognized by the institutional actors because they do not have legal contracts. Due to their high dependency, they are subjected to the terms set by private service providers and face the threat of their activities disappearing. The graph above illustrates the influence of the different actors among themselves.

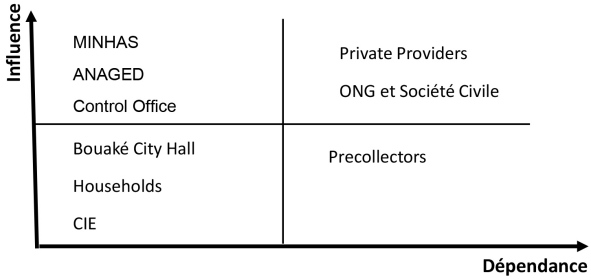

Figure 4. Stakeholder Dynamics (source: Mactor Result).

3.2. Household Overview of Waste Management

3.2.1. Pre-collection of Waste Systems

As shown in **Figure 5**, 59.78% of respondents stated that their neighborhoods did not have waste collection systems, compared to 40.22% who stated the opposite. For the latter, pre-collection systems consisted of a designated area (52%) or garbage bins or containers (48%). The neighborhoods with the most waste collection systems were 133 dwellings, Hôpital, and Kamounoukro. According to the respondents in these neighborhoods, even when pre-collection devices exist, they are located less than 50 meters from homes (33%), otherwise it is generally more than 50 meters (61%) from their homes and sometimes up to more than 100 meters (34%) as in the neighborhoods of Adjéyahokro, Belle ville 2. The distance of the devices from homes could explain the lack of interest of households in going there for better waste packaging.

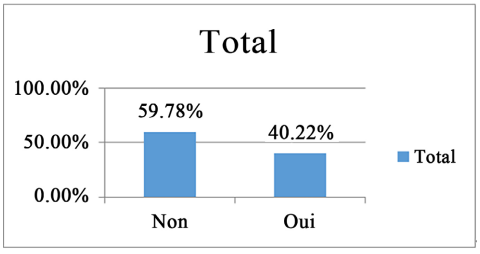

Figure 5. Distribution of respondents according to knowledge of the presence of a device.

Concerning households that claim to be unaware of the presence of waste collection facilities, they dispose of their waste either in the pre-collection vehicles of the operators MOYA and TIELOU (10%), or through the neighborhood's pre-collection waste services (26%), but especially in nature (37%). As we can see, a significant portion of the population contributes to the proliferation of waste in the city of Bouaké through its practices.

3.2.2. Frequency of Pre-Collection Vehicles

When asked how often the pre-collection vehicles of official operators arrive, the majority of households using this service (30%) responded that it was once a week, compared to 28% that it was twice a week, and 23% that it was three times a week. Another 15% did not know or could not remember how often they arrived. The time of arrival varied from 10 a.m. to 5 p.m., but according to 70% of them, the vehicles arrived at 10 a.m. and within 50 meters of their homes (64%).

It should also be noted that these surveys revealed that the majority of households were unaware of the official operators MOYA and TIELOU and continued to rely on the City Hall for the city's pre-collection waste service. Furthermore, only 3.44% of respondents have closed, leak-proof trash cans. Used containers, plastic wrap, or empty rice bags are used instead of conventional trash cans. The same observation is made even in Kennedy and Air France 3, which are considered high-end neighborhoods. Under these conditions, storing waste for more than two days would expose it to health risks.

3.2.3. Waste Management Difficulties

Indeed, households report encountering various types of difficulties, but the most significant, in descending order, are the inadequacy and remoteness of garbage bins or containers (64%), irregular collection services (14%), impassable neighborhood access roads (11%), and a lack of organization for waste management at the local level (7%). This situation could partly explain the growing unsanitary conditions in the city of Bouaké. Indeed, only 14% of households report being aware of the presence of these structures throughout the city of Bouaké. Moreover, these are, for the most part, neighborhood associations whose activities are occasional and generally limited to neighborhood cleanup and awareness-raising activities with the support of NGOs.

3.3. State of Infrastructure and Management Equipment

3.3.1. Management Mode

The private service providers have a cleanliness contract with the State, represented by ANAGED. As such, they are responsible for street cleaning, gutter clearing, maintenance of green spaces, pre-collection, collection, and transport of waste, their disposal in landfills, and landfill operation. The two companies (MOYA and TIELOU SERVICE) have been awarded the contract. It should be noted that TIELOU Service also has the contract for landfill operation. Two collection schemes are observed on the ground: the first uses transfer points following pre-

collection, and the second involves collecting and transporting waste directly to the landfill without using grouping stations. Figure 6 below illustrates the technical stages of management.

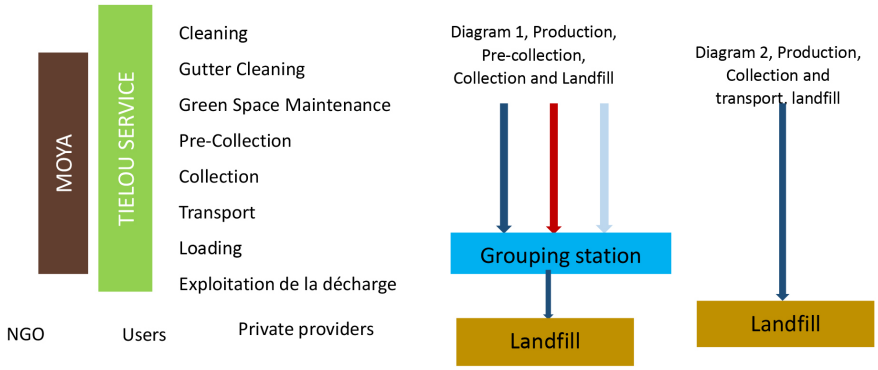

Figure 6. Overview of the technical stages of waste management in the city of Bouaké. (Source: 2023 field surveys)

3.3.2. Infrastructures

The bulk of waste management infrastructure consists of consolidation stations, which are developed spaces equipped with 36 garbage bins, and an uncontrolled landfill site for burying waste. In addition, there are a large number of undeveloped informal storage spaces, approximately 178 of which are scattered throughout the city, serving as makeshift consolidation stations for the population. Although informal, the waste stored in these spaces is mostly removed daily by service providers.

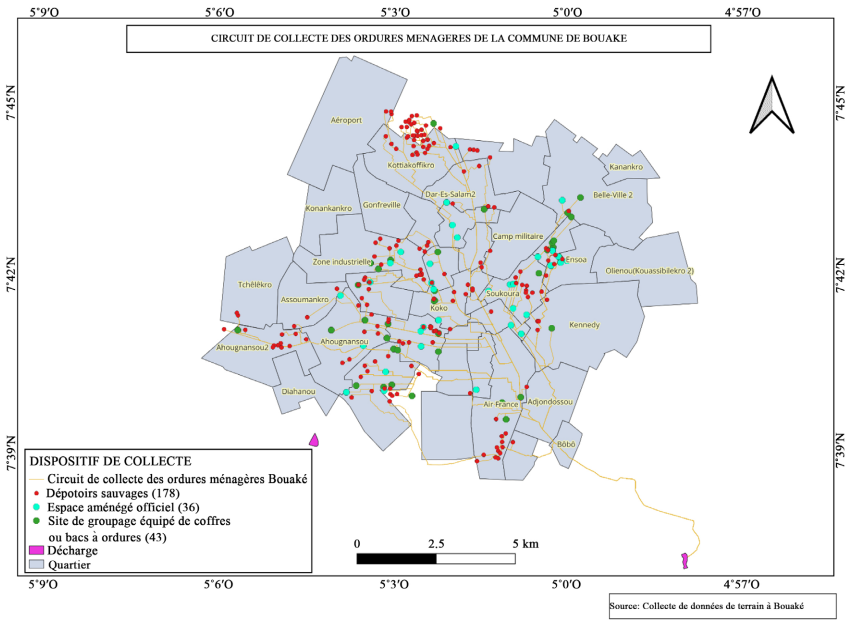

Figure 7. Distribution of grouping stations updated in 2023 (Source: 2023 field surveys).

The current Bouaké landfill is located 17 km southeast of the city of Bouaké, approximately 3 km from the villages of N'dakro and Sounbonou. The identified

site has been operating since 2018 as the authorized and uncontrolled landfill for the city of Bouaké. The official infrastructure is well maintained but insufficient in number and does not meet recommended standards. Figure 7 shows respectively the layout of the formal and informal grouping stations and the location of the landfill in the city of Bouaké.

3.3.3. Collection Materials

The collection equipment consists of tricycles and various types of trucks, tractors, and containers. In most cases, the quantity and quality of the equipment do not reflect the specifications required by private service providers. Only half of the equipment is available. The quantities and availability of the equipment are shown in Table 2 below.

Table 2. Characteristics of landfill collection equipment (Source: 2023 field surveys, private service provider specifications).

N°	Type and characteristics of the material	Minimum number required per zone according to the specifications	Material availability rate	Material availability rate
			ZONE 1 MOYA	ZONE 2 TIELOU
	Materials for daily waste collection			
1	Improved tricycles with tipping (3 m^3)	14	75%	75%
2	Multi-dump truck or hook lifts	4	50%	50%
3	Compactor Bins	2	100%	100%
4	Grab buckets	2	0%	0%
5	14 m^3 or 20m^3 chests	30	83%	66%
6	Tractors attached to a trailer	4	50%	25%
7	Vans	7	14%	0%
8	Dump trucks (KB)	03	66%	66%
	Collection materials for special operations			
8	Dump trucks	3	0%	100%
9	Loaders	1	100%	100%

3.3.4. Material for Landfill

The equipment required for landfilling consists of bulldozers, excavators, loaders, compactors, graders and different types of trucks. The number of each equipment and their availability are mentioned in Table 3 below.

Table 3. Characteristics of the equipment for landfill (Source: 2023 field surveys, private service provider specifications).

N°	Type and characteristics of the material	Minimum number required according to the specifications	Material availability rate
	Material for landfill		
1	Bulldozers	01	100%
2	Excavators	01	0%
3	Loaders	02	50%
4	Compactors	01	100%
5	Graders	01	100%
6	Dump trucks	01	50%
7	Tarpaulin vans	01	0%
8	Tank trucks	01	0%

3.4. Source of Funding for Waste Management

According to our research and investigations, it appears that since October 25, 2017, with the advent of ANAGED, the State of Côte d'Ivoire has been aiming to centralize the management of all types of waste and reorganize the public service delegation. Born from the merger between ANASUR and FFPSU, ANAGED has administrative authority from the Ministry of Hydraulics, Sanitation, and Sanitation (MINASS) and financial oversight from the Ministries responsible for the Budget and the State Portfolio.

Until 2017, the waste management financing model had shown its limitations. Indeed, funding sources have evolved over time in line with changes in management methods. However, the two main categories that emerge in the resources are:Ressources interne: elles sont principalement constituées des éléments suivants:

- Property tax share: 25% of the property tax, which increased to 50% in 2022;
- Specific urban sanitation tax, consisting of the following elements: a) road, hygiene, and sanitation tax: 2% of the rental value for owners exempt from property tax; b) special tax on certain plastic products: 50 CFA francs/kg of plastic bags or films produced or imported; c) remunerative tax for household waste collection: 2.5 CFA francs/kWh of low-voltage electricity consumed;
- State grants and subsidies;
- Internal resources were estimated at around 50 billion CFA francs in 2022:
  - Loan contracted by the State;
  - External financial support: donors, decentralized cooperation;
  - One-off funding from the World Bank since 2009 through the Emergency Urban Infrastructure Project (PUIUR).

In 2022, external resources were estimated at around 20 billion CFA francs. In total, around 70 billion CFA francs are devoted to the management of household and similar waste across the Ivorian territory. The authorities' efforts to mobilize financial resources to cover expenses related to waste management in Côte d'Ivoire are noted. Indeed, from a budget allocation of 43 billion CFA francs in 2019, it has increased to nearly 70 billion CFA francs in 2023, a jump of more than 162%. This is explained by the expansion of the share of land taxes, which increased from 25% in 2019 to 50% in 2022.

In Bouaké, waste management funding is subject to a contractual budget allocation provided for in the contract of each private service provider. The allocation comes from the central budget allocated to ANAGED. The city has a three-year budget (3 years) capped at 10,450 tonnes per month per zone, or 20,900 tonnes per month for the two zones of the city. The annual budget allocated for the collection, transport and landfill of household and similar waste in the municipality of Bouaké for the period 2020-2022 amounted to more than 6 billion FCFA, or an annual budget of approximately 2 billion. This represents 2.85% of the total cost of the national budget. This figure corresponds approxi-

mately to the proportion of the population of the commune of Bouaké in relation to the national population estimated at approximately 2.65% during the last RGPH of 2021. We deduct an annual cost of tonnes of waste per inhabitant which stands at 2500 CFA francs.

This budget does not take into account pre-collection, which remains informal and the responsibility of households who pay a monthly subscription for the removal of their waste.

Table 4 below provides details of the three-year budget (2020 to 2022) allocated to waste management in Bouaké.

Table 4. Cost of collection and landfill (source: field investigation 2023).

Designation	Q (tons)	PU (F CFA)	PT (F CFA)
Collection and transport of household and similar solid waste (Zone 1)	376 200	5 500	2 069 100 000
Collection and transport of household and similar solid waste (Zone 2)	376 200	5 500	2 069 100 000
Landfilling of household waste	7 52 400	2 500	1 881 000 000
TOTAL (Triennial)			**6 019 200 000**
TOTAL (Annual)			**2 006 400 000**

The city of Bouaké produces approximately 500 tons per day with a population of 785,133 inhabitants, or 0.65 kg/day. A collection rate of 70%, or 350 tons collected per day. With a collection budget of 1.3 billion, a ton of waste costs 6,500 CFA francs. Interviews with collection companies revealed that the average distance from the city to the landfill is around 17 km, or approximately 450 km traveled per day. The cost of collecting a ton of waste is around 10,500 CFA francs. The current budget represents 62% of the budget required for a 90% collection rate.

3.5. SWOT Analysis of Waste Management in Bouaké

The SWOT analysis of the waste sector shows that waste management in Bouaké has assets that constitute its strengths, notably the presence of two private service providers for collection and storage infrastructure. However, this management has many weaknesses stemming from centralized governance. Opportunities exist, but threats must also be taken into account. Table 5 below illustrates this.

Table 5. SWOT Analysis of Waste Management.

SWOT analysis of household and similar waste management	
STRENGTHS	**WEAKNESSES**
● The presence of actors at different levels of responsibility in the management of household and similar waste in Bouaké. ● The municipality has three private service providers (waste collection and landfill companies)	● Centralized management. ● Bouaké City Hall has little influence in local governance • Lack of equipped collection points

Continued

	• The existence of a large number of informal collection points. • The outdated and inadequate collection equipment (approximately 50% availability). • The landfill is uncontrolled, a source of nuisance and pollution. • Capped and insufficient budget. • Pre-collection is not funded and remains the responsibility of households.
• Accessible consolidation stations and a landfill. • A budget allocation for municipal waste management. • Contribution from civil society and businesses.	• Irregular removal of waste from informal collection points, which leads to odors, the development of harmful insects and other disease vectors.
OPPORTUNITIES	**THREATS**
• The possibility of financing recovery by economic operators and associations. • Funding of waste management master plan studies by donors.	• Institutional instability at the level of Central governance (change of ministry and management agency). • Political and social instability, which can lead to the alienation of donors.

4. Discussion

The results of this study show that institutional actors, particularly MINHAS and ANAGED, are highly influential in waste management in Bouaké; they largely dominate other actors. They concentrate all the power and exercise centralized governance over the entire waste sector. This fact is partly corroborated by [4] who mention centralized management in the context of a waste management evaluation study they carried out in Treichville. In addition to centralized management, these authors mention that decentralized management is provided by the town hall, which is responsible for sweeping and cleaning gutters. It should be noted, however, that since March 2020, town halls have been stripped of this prerogative during the call for tenders for waste management for the 2020-2022 financial year, where this prerogative was entrusted entirely to private service providers by ANAGED. Centralized management has advantages because policies and decisions are implemented directly by decentralized structures. The difficulty, however, is that the solutions are often unsuited to local realities. This management is well illustrated by [8] speaking of decentralization and participation in the management of the public sector in developing countries, indicated this: "we see too much centralization of power due to the domination of the Central State, which is omnipresent and reigns in 'commando' in developing countries through the centralization of planning, political decisions and the management of public affairs." Contrary to this assertion, centralized waste management is not widespread or even rare in the world where in most cases, waste management is decentralized, with 99.99% of the responsibility for waste management resting with the municipalities and the group of municipalities [9] and [10]. In the countries of the global south, waste management in most cities is handled by municipalities, which represent the public sector. Municipalities manage the entire waste sector in partnership with the private sector for waste collection and treatment. One ex-

ample is Greater Lomé in Togo [11] Bouaké is therefore an exception.

As for waste management infrastructure, there is an insufficiency or even a lack in the city of Bouaké due to land problems (not enough land reserves provided for this purpose) and the failure to plan the construction of new infrastructure over time. The grouping stations remain for the vast majority informal, 178 against 36 developed, or 20% of formal sites. This same observation was made by the TERRABO consulting engineer firm in 2014 in San Pedro through the waste characterization study commissioned by the ministry in charge of sanitation where only 06 formal sites existed against 36 informal sites, or approximately 19% of developed sites.

The city of Bouaké does not have a controlled landfill, which could lead to pollution of the soil, surrounding vegetation and the proliferation of harmful insects, resulting in health and environmental risks for the population [12] and [6].

The collection equipment (pre-collection, collection and transport) and landfill equipment are insufficient in number compared to the number provided for in the specifications, approximately 50% availability. This is due to non-compliance with the provisions provided for in the specifications by private service providers in terms of quantity and quality of the required equipment. These shortcomings are noted by [13] speaking of the difficulties of waste management in the commune of Cocody said this: The pre-collectors denounce the instability of the grouping centers, the inadequacy of the work equipment, the lack of support from the public authorities in the exercise of pre-collection in the commune of Cocody (Abidjan). This lack of equipment is recurrent in African cities. This is what [14] points out in the DRC and particularly in the city of Uvira where the lack of public trash cans is one of the determining causes of the problem of waste management in the city of Uvira accompanied by a host of consequences (insalubrity and diseases).

Added to these difficulties is the problem of obsolete equipment, which negatively impacts collection by reducing the collection rate, which is around 65%, against 90%, as recommended by the World Health Organization (WHO). As a result, more than 70% of the population of Bouaké say they are dissatisfied with the method of waste management, particularly the inadequacy of garbage bins and containers, and the irregularity of the passage of collection vehicles [6].

Despite the efforts made by the authorities in charge of waste in financing the waste sector, the thorny problem of waste management in Bouaké remains the financing of pre-collection, which, although a key point in improving the service, remains informal. Indeed, it is currently financed by households, most of whom demonstrate a willingness to pay. Nearly half of the households in Bouaké subscribe to a pre-collection service. This is confirmed by [11] who, according to him, the major constraint in waste management in Lomé (Togo) is financial because the foreseeable financial resources are not up to current needs.

This corresponds to the proportion of households willing to contribute in the commune of Medina in Dakar, which is 52.45% [15]. In addition, in Bouaké, re-

garding pre-collection, there is no official pricing adapted to the standard of living of different households depending on the neighborhood. The price is freely set by the pre-collectors, who turn to the most solvent households in wealthy neighborhoods, thus neglecting the poorest areas of the municipality [6].

The SWOT analysis shows that the household and similar waste management sector in Bouaké has many weaknesses, including restricted governance centralized in Abidjan, insufficient and outdated infrastructure and equipment with an insufficient budget to achieve the objectives of sustainable management. However, the municipality of Bouaké is one of the privileged cities that benefit from a daily garbage collection service. These weaknesses were noted by [4] in the Municipality of Treichville, including the population's willingness to pay pre-collection fees, irregular removals (more than 48 hours) and poor maintenance of grouping sites.

5. Conclusions

The study carried out a real "autopsy" of the waste management sector. The results study showed that household and similar waste management in the city of Bouaké faces organizational challenges, particularly at the governance level, which remains centralized. Infrastructure, collection, and landfill equipment are accessible but remain insufficient in number (50% availability). The city has a budget for waste management, approximately 2 billion CFA francs, but this is insufficient to achieve the WHO's recommended 90% collection rate.

Taking the above into account, the study contributed to the knowledge of the waste management sector in Bouaké. Authorities, decision-makers and non-governmental organizations can use the results of this study to significantly improve the entire waste sector. It also opens up, through the SWOT analysis, future studies, in particular, characterization studies for the determination of the typology and the potential for waste recovery and the implementation of a digital planning tool for sustainable management.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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