World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

Check for updates

Fight against insalubrity linked to solid waste generated at the central market of the city of Kisangani, in the Democratic Republic of Congo from 15 /11 to 15 /12 2023

Indani Remo Jean-Chretien [1] and Akondji Bainakofota Dieudonné [2,*]

[1] *Department of Epidemiology, Higher Institute of Medical techniques of Kisangani, RD Congo.*
[2] *Department of Private and Judicial Law, University of Kisangani, Faculty of Law, RD Congo.*

World Journal of Advanced Research and Reviews, 2025, 26(02), 2733-2742

Publication history: Received on 30 March 2025; revised on 16 May 2025; accepted on 18 May 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.26.2.1383

Abstract

Introduction: Waste management is at the heart of development issues. It has a direct impact on the good governance of urban centers, just as it challenges everyone's relationship with the environment and public space. Poor waste management contributes to climate change and air pollution, directly affecting many ecosystems and species.
The study has the following objectives: Identify the problems that prevent the sanitation and management of waste generated at the central market in the city of Kisangani.

Methodology: This is a descriptive, cross-sectional and quantitative study on the issue of waste management at Kisangani's central market from 15 /11 to 15 /12 2023.

The population of this study is composed of all waste sanitation workers of the central market of the city of Kisangani.

Data were collected using an interview technique based on a pre-established questionnaire.

Results: After analysis, we arrived at the following results: 1. The sanitation and waste management service of the central market of the city of Kisangani exists, operating with an insufficient number of staff; 2. remuneration is regular but modest, not allowing them to make ends meet for the month and to meet the costs of medical care.

Keywords: Insalubrity; Management; Waste; Generated; Central Market

1. Introduction

The sanitation sector in the city of Kisangani is characterized by the inadequacy of existing sanitation services, coupled with population growth, leading to environmental degradation and a real threat to public health.

With 15 m3 of waste produced daily by Kisangani's central market, the market's users are now faced with veritable mountains of filth! [1].

The Kisangani central market is home to a number of garbage pits. As a result of this cohabitation, the market's merchants are no longer ashamed to sell food products alongside garbage of all kinds, almost forming reliefs. A visit to the site is enough to realize the risk of disease caused by this filth.

* Corresponding author: Akondji Bainakofota Dieudonné

Spending some time in Kisangani's central market is no longer a good time. Most of the buyers in this trading area are forced to pinch their noses to protect themselves from the bad smells that pollute the environment. Worse still, after settling on the garbage, flies end up on the fish, meat, vegetables and other foodstuffs on sale.

The insalubrious nature of Kisangani's central market is a major factor in the development of dirty-hand diseases, in particular typhoid fever, which is now endemic in several districts of this municipality.

Waste management, however, is at the very heart of development issues. It has a direct impact on the good governance of urban centers, just as it challenges everyone's relationship with things and public space.

Sorting is a necessary action, reducing the quantity of waste by reducing the volume of waste, which in turn reduces collection and treatment costs. Waste produced at markets is a reservoir of micro-organisms that can infect vendors, buyers and composting workers.

An Anses study of 28 waste management sectors revealed that exposure to waste is one of the health risk factors for workers in this sector (waste collection, recovery and disposal). Around 85% of the waste produced at markets is infectious. In some cases, this waste is incinerated in the open air, and its combustion can lead to the emission of dioxins, furans, particles and dessert gases [2].

In the field of waste management, improvements are based on the following elements: Setting up a comprehensive waste disposal system; raising awareness of waste-related risks and practices to ensure the safety of workers and others [3].

People in charge of market waste disposal experience more respiratory, intestinal and skin disorders. Other more severe manifestations, such as asthma and cases of pulmonary aspergillosis, can also be observed.

Poor waste management contributes to climate change and air pollution, directly affecting many ecosystems and species. Landfills, considered the last option in the waste hierarchy, also release methane, a potent greenhouse gas associated with climate change. Methane is produced by micro-organisms that thrive on the biodegradable waste such as food, paper or green waste present in these landfills. Depending on their design, landfills can also contaminate soil and water [4].

Appropriate management of organic market waste, such as inedible or unused food, can reduce dependence on chemical fertilizers, help restore soil fertility and improve water retention and nutrient supply to plants. More broadly, by reducing food waste, waste management also helps reduce greenhouse gas emissions that contribute to climate change. It is estimated that food loss and waste generate 8-10% of global greenhouse gas emissions [5].

Desire, buy, consume, throw away and repeat: this is a simple cycle of waste production without realizing it. Today, billions of tonnes of waste are produced worldwide in a single year. While the vast majority of developed countries have made waste treatment an environmental priority, other, much more vulnerable nations are unable to keep pace and are crumbling under mountains of waste [6].

In Europe, around 10% of total waste production consists of “municipal waste”, in other words, waste generated mainly by households and, to a lesser extent, by small businesses and public institutions such as markets, schools and hospitals [7].

Kinshasa's central market produces over 60 cubic meters of rubbish a day. Every evening, several teams are mobilized to clean the various pavements and avenues surrounding this trading center. But only two trucks belonging to the Régie d'assainissement et des travaux publics de Kinshasa (RATPK) are available to clean up the garbage. These vehicles often break down, forcing the cleaners to make several rotations a day, according to RATPK officials. As a result, the rubbish that has not been removed continues to lie next to the stalls. What's more, the agents in charge of waste collection are no longer regular, as their salaries have been lowered and their numbers reduced; the places built in the nine communes for waste collection have been abandoned, removed or destroyed.

As a result, government spokesman Dominique Weloli justified the city's sanitation difficulties by pointing to the non-retrocession of 40% of national revenue fees to the provinces.

The Marché Central de Shabunda in Maniema province has not been spared. It suffers from the same situation of general insalubrity caused by the dysfunction of the State services responsible for cleaning up the environment of the Market

and its surroundings; the ecological ignorance of vendors about the damaging effects of insalubrity on human health; and the non-application of polluter-pays measures [8].

Kisangani is always dirty. Whatever the Kisangani ville-propre operation, nothing has changed. The central market is flooded with filth. The wide variety of waste produced at the central market, and the difficulties involved in collecting and disposing of it, expose vendors, buyers and workers to a wide range of dangers: toxic chemical and electronic substances, mould, bacteria, high temperatures, the presence of sharp objects, etc. [9].

Waste that is not properly collected ends up in the environment, causing visual and olfactory pollution. When it decomposes, its components are released and pollute the environment. These components persist for varying lengths of time in nature (Mashi Bagalwa, Karume K, 2018) [9].

Indeed, in most cities in underdeveloped countries, poor waste management is plausible.

This state of affairs prompts us to pose the following single research question:

- What are the problems related to the management of waste produced at the central market in the city of Kisangani?

1.1. Research objective

- Identify the problems that prevent waste generated at the central market in the city of Kisangani from being properly disposed of.

1.2. Research goal

- The ultimate aim of this research is to raise the awareness of users of Kisangani's central market, and the political and administrative authorities who manage it, of the need for each of them to take part in keeping the place clean. The aim is to ensure the health of the whole community, a source of development.

1.3. Aim of the study

We conducted this study with a view to protecting our environment from unhealthy conditions. In this way, science can only evolve when several researchers are concerned with finding a solution to a problem facing society. Interest is the very driving force behind action. There is no action without interest.

So, as far as this study is concerned, it has two interests:

On a scientific level: it enriches documentation in the context of waste composting work for anyone (researcher, partner, etc.) who wants to intervene or invest in this sector.

On a practical level: this research is intended as a frame of reference, to raise awareness among the population, particularly workers involved in waste management, to avoid health risks and the transmission of diseases due to poor waste management, as well as the use of protective equipment.

Consequently, the city authorities will be informed and sensitized on the subject with the aim of cleaning up the market by recycling the waste produced there for agricultural use by fertilizing the soil.

2. Methodology

2.1. Type of study

This is a descriptive, cross-sectional and quantitative study on the fight against insalubrity linked to solid waste generated in the central market of the city of Kisangani, in the Democratic Republic of Congo from 15 /11 to 15 /12 2023.

2.2. Study population

The population of this study is composed of all waste sanitation workers in the central market of the city of Kisangani. As they rotate, it was difficult to bring them together, so we drew a representative sample to facilitate the study.

Given the importance of this study, our sample comprised 52 agents who had shown good faith in responding to our questionnaire.

2.3. Data collection methods and techniques

In view of all these considerations, and taking into account the nature and purpose of our study, as well as the different levels of education of our study population, we opted for the interrogatory method, whose interview technique enabled us to collect the data. We used a questionnaire that we designed and administered to the respondents, in the form of a structured interview.

Once we had finished with the market administration, we were accompanied by an agent from the administration to collect the data. In view of the time available, data collection took place every Tuesday, Thursday and Friday from 10 a.m. to 2 p.m..

We therefore randomly administered data to 52 agents, making up the size of our study population.

2.4. Data processing

The data collected were processed and encoded using Microsoft Office Excel 2013 and SPSS 20.1. Results were presented in tabular form. Data analysis was made possible by calculating frequencies and percentages.

3. Results

3.1. Age group and gender of respondents

Table 1 Age and gender distribution of respondents

Age group (in years)	**Gender**				**Total**	
	Female		*Male*		*f*	*%*
	f	*%*	*f*	*%*		
24-30	2	3.8	10	19.2	12	23
31-37	4	7.7	12	23.1	16	30.8
38-44	4	7.7	12	23.1	16	30.8
45-51	0	0	8	15.4	8	15.4
Total	10	19.2	42	80.3	52	100

The team of waste composting workers at Kisangani's central market was found to be made up of 80.3% males aged between 31 and 44, i.e. 61.6%.

3.2. Study subjects' level of education

Table 2 Distribution of respondents by level of education

Level of education	**f**	**%**
Secondary	8	15.4
Primary	28	53.8
Illiterate	16	30.8
Total	52	100

This study showed that the majority of composting workers in Kisangani's central market were primary school graduates (53.8%), followed by illiterates (30.8%).

3.3. Marital status

Table 3 Distribution of study subjects by marital status

Marital status	**f**	**%**
Married	34	65.4
Single	18	34.6
Total	52	100

After analyzing the data from this study, we found that 65.4% of the subjects were married, compared with 34.6% who were single.

3.4. Variables under study

3.4.1. Source of waste generated at the market

Table 4 Distribution of study subjects by waste source N=52

Source of waste	***f***	***%***
transport Vehicles	9	17.3
Stores and boutiques	13	25
Restaurants	29	55.8
Vendors	52	100

The main sources of waste production would be salespeople and restaurants, according to 100% and 55.8% of the respective subjects.

3.4.2. Reasons for the presence of rubbish hills around the market

Table 5 Distribution of study subjects according to reasons for presence of rubbish hills around the market N=52

Reasons for presence of rubbish hills	***f***	***%***
Insufficient number of workers	*28*	*53.8*
Lack of working materials	*33*	*63.5*
De-motivation of sanitation workers	*47*	*90.4*

According to 90.3%, 63.5% and 53.8% of respondents respectively, the main reasons for the presence of rubbish hills around the market are the lack of motivation among sanitation workers, the lack of working materials and the insufficient number of workers in the sanitation sector.

3.4.3. Composition of waste from Kisangani's central market

Table 6 Distribution of study subjects by waste composition N=52

Waste composition	***f***	***%***
Cloth shreds, bags	6	11.5
Unsold and decomposed food	10	19.2
Animal waste and blood, bones	20	38.5
Green leaves, vegetables, packaging, paper, bags, plastic bottles	38	73.1
All market residues	48	92.3

Waste is made up of everything left over from the market (92.3%); green leaves, vegetables, packaging, paper, bags, plastic bottles according to 73.1%; rot, bones and animal blood according to 38.5% of those surveyed.

3.4.4. Existence of a sanitation service and central market waste management

Data analysis showed that the sanitation and waste management department at Kisangani's central market is understaffed, according to all respondents (100% of cases). The service is financed by revenues generated by market stall taxes.

3.4.5. Worker protection

Table 7 Distribution of study subjects according to protection against biological agents

Protection	***f***	***%***
No protection	16	30.8
Yes	36	69.2
Total	52	100

The study showed that 36 subjects, or 69.2%, said they were protected against biological agents, compared with 30.8% who said they were not.

3.4.6. Protective equipment

Table 8 Distribution of study subjects according to protective equipment against biological agents N=36

Equipment de protection	***f***	***%***
Vest	12	33.3
Muffler	15	41.7
Gloves	21	58.3
Boots	36	100

Protective equipment would be boots (100%), gloves (58.3%) and mufflers (41.7%) in all cases.

3.4.7. Remuneration

All the subjects in the study, i.e. 100% of cases, stated that their remuneration was regular but modest, making it impossible for them to make ends meet and pay for medical care.

3.4.8. High-risk work

The results of this study indicated that all the subjects in the study, i.e. 100% of cases, recognized that cleaning up market waste constitutes a very high health risk job to which the public is exposed.

3.4.9. Risks faced by sanitation workers at the central market

Table 9 Distribution of study subjects according to risks incurred by sanitation workers at the N=52

Risk incurred	***f***	***%***
Intoxication	19	36.5
Mycoses	26	50
Infections	52	100
Wounds	52	100

The main risks incurred by sanitation workers in the central market would be infections and Wounds (100% data exquo), mycoses at 50% and intoxication at 23.1% of the respective cases.

3.4.10. Proposal to improve working conditions

Table 10 Distribution of study subjects according to proposals for improving working conditions N=52

Proposal to improve working conditions	f	%
Purchase of vehicles (skips, etc.) for rapid and safe evacuation	10	19.2
Equip workers with modern protective equipment	27	51.9
Provide health care for workers who are seriously exposed to health risks	39	75
Pay workers a decent wage	52	100

Giving workers a decent wage, providing health care for workers who are seriously exposed to health risks, and equipping workers with modern protective equipment were the proposals made to improve working conditions according to 100%, 75% and 51.9% of the respective subjects.

4. Discussion and comments

4.1. Age group and gender

The team of waste composting workers at Kisangani's central market was found to be made up of 80.3% males aged between 31 and 44, or 61.6%.

As this is a difficult and unhealthy job, we believe that women are not interested in this type of work.

4.2. Study subjects' educational level

In this study, we found that the majority of composting workers in Kisangani's central market were primary school graduates (53.8%), followed by illiterates (30.8%).

This situation can be explained by the fact that it is education that shapes and prepares good citizens. However, an intellectual would not have access to such a job. As they have no other activities, it is only people with a low level of education who can easily access this kind of job.

4.3. Marital status

After analyzing the data from this study, we found that 65.4% of the subjects were married, compared with 34.6% who were single.

We believe that married people work hard to provide for their families.

4.4. Variables under study

4.4.1. Source of waste generated at the market

The main sources of waste generation would be the vendors and restaurants, according to 100% and 55.8% of the respective subjects.

Desiring, buying, consuming, throwing away by market users constitutes a simple cycle of waste production without their realizing it (Fodha, H. and J.K. Symens, 2007) [6].

Kinshasa's central market produces more than 60 cubic meters of rubbish per day, while in Kisangani, the market produces almost 15m3 of waste per day.

In our opinion, the market is a generator of waste, all the more so as it is a place par excellence where buyers and sellers meet and trade. Commercial activities do generate waste.

4.4.2. Reasons for the presence of garbage hills around the market

According to 90.3%, 63.5% and 53.8% of respondents respectively, the main reasons for the presence of hills of rubbish around the market are the lack of motivation among sanitation workers, the lack of working materials and the shortage of workers in the sanitation sector.

Kinshasa's central market produces over 60 cubic meters of rubbish a day, while Kisangani's market produces almost 15m3 of waste a day.

Every day, users of the central market carry out their activities and produce waste that should be evacuated by the titled service. Disposing of this waste is no easy task. In our opinion, the demotivation of workers in this sector is the reason for the hills of rubbish surrounding Kisangani's central market.

4.4.3. Composition of Kisangani central market waste

Waste is made up of everything left over from the market (92.3%); green leaves, vegetables, packaging, paper, bags, plastic bottles, according to 73.1%; rot, bones and animal blood, according to 38.5% of those surveyed.

The processing and disposal of market waste can indirectly entail health risks for workers, due to the release of pathogens and toxic pollutants into the environment. They include paper, packaging materials, unsold and damaged goods, organic and inorganic materials, which contain hazardous substances and chemicals that can adversely affect the health of those handling them.

4.4.4. Existence of a central market sanitation and waste management service

The data analysis showed that the central market sanitation and waste management service exists with an insufficient number of staff according to all the subjects studied, i.e. 100% of cases. The service is financed by revenues generated by market stall taxes.

Kisangani's central market is a revenue-generating administrative entity managed by the mayor's office. It has a specialized sanitation department which, in our opinion, is not well supervised.

4.4.5. Worker protection

The results of this study showed that 36 subjects, or 69.2%, had stated that they were protected against biological agents, compared with 30.8% who had not.

Regulations lay down a number of precautions to be taken to ensure proper waste management, protecting the environment and human health. Generally speaking, the term "waste management" encompasses all activities involved in the organization of waste management, from its production to its final treatment. It includes waste collection, transportation, treatment and disposal. Each of these activities is governed by rules set out in the French Environment Code, and each player is subject to a number of obligations [4].

We believe that risk prevention in the waste treatment sector should take place at several levels, from plant design to operation, from collective protection to individual protection of workers. In terms of personnel protection, it is the employer's responsibility to identify the hazards to which workers are exposed, to provide the required protective equipment (clothing, safety footwear, high-visibility vest, gloves, goggles, dust mask or gas mask) and to ensure special medical surveillance.

4.4.6. Protective equipment

Protective equipment would be booties (100%); gloves (58.3%) and nose cover (41.7%) in all cases.

Waste sanitation is a process that allows the degradation of organic matter in waste in condition. The treatment and elimination of this waste may result in the release of certain pollutants into the natural environment, with a consequent impact on human health. Employers must therefore provide workers with a certain amount of equipment to make their work easier and safer.

4.4.7. Earnings

All the subjects in the study, i.e. 100% of cases, stated that their remuneration was regular but modest, making it impossible for them to make ends meet and pay for medical care.

In Tshopo Province and the city of Kisangani, the sanitation sector in general, and solid waste management in particular, is neglected and poorly financed by both public authorities and development partners. Its financing is the responsibility of the mayor's office, which collects sanitation taxes from market vendors.

In our opinion, it's a lack of love for one's fellow man that pays sanitation workers a salary that doesn't allow them to take care of themselves.

4.4.8. High-risk work

The results of this study indicated that all subjects in the study, i.e. 100% of cases, recognized that market waste sanitation constitutes a job with a very high health risk to which the public is exposed.

In France, the waste collection, treatment and disposal sector is one of the occupational sectors reporting the most frequent and most serious occupational accidents.

Waste contains several pathogens such as Balantidium coli, Shigella flexneri, Ascaris lombricoides and Escherichia coli, which can be associated with diarrheal diseases commonly encountered in health center statistics [10].

The main problems concerning the disposal of waste produced at the market are the workers' lack of awareness of the health hazards and their failure to protect themselves [3].

4.4.9. Risk incurred by sanitation workers

The main risks faced by sanitation workers in the central market are infections and injuries (100% exquo), mycosis (50%) and poisoning (23.1%).

The World Health Organization defines environmental health as "the aspects of human health, including quality of life, determined by the physical, chemical, biological, social and psychosocial factors in our environment [4].

Around 85% of the waste produced at markets is infectious. In some cases, this waste is incinerated in the open air, and its combustion can lead to the emission of dioxins, furans, particulates and dessert gases. Composters also experience more respiratory, intestinal and skin disorders. More severe symptoms such as asthma and cases of pulmonary aspergillosis can also be observed [2].

The sanitation of waste exposes workers in this sector to certain health risks. Waste not only pollutes the environment, it is also a highly diverse source of disease. These include bacteria, viruses, parasites and fungi, which can cause malaria, food poisoning, typhoid fever, cholera, diarrhoea and more. Poor waste management is at the root of the public health problem, all the more so as it is the dominant factor in the creation of nests for the production of vectors that threaten health (mosquitoes, flies, cockroaches, mice, etc.).

4.4.10. Proposal to improve working conditions

According to 100%, 75% and 51.9% of respondents respectively, proposals to improve working conditions included paying workers a decent wage, providing health care for workers who are seriously exposed to health risks, and equipping workers with modern protective equipment.

In the field of household waste management, improvements are based on the following elements: Setting up a comprehensive waste disposal system; raising awareness of waste-related risks and practices to ensure the safety of workers and others [3].

Kisangani's central market produces a lot of rubbish every day. Every evening, several people are mobilized to clean up this trading area. However, there is only one vehicle belonging to the Mairie, which is made available to workers to remove all this waste. This vehicle often breaks down, forcing the workers to make several rotations a day by motorcycle tricycle. As a result, the rubbish that hasn't been removed continues to lie next to the stalls.

5. Conclusion

This study is descriptive in nature, with a cross-sectional focus on the "problem of managing the waste generated by Kisangani's central market, from 15 /11 to 15 /12 2022".

After data processing and analysis, the following main results were observed:

- According to 90.3%, 63.5% and 53.8% of respondents respectively, the main reasons for the presence of hills of rubbish around the market are the lack of motivation among sanitation workers, the lack of working materials and the shortage of workers in the sanitation sector;
- The risks incurred by sanitation workers at the central market were infections and injuries (100% exquo), mycosis (50%) and intoxication (23.1%).

Waste management at the central market in the city of Kisangani is not good, with an insufficient number of staff who are unable to do their job properly due to poor remuneration (demotivation), while these staff run a very high risk of illness.

Compliance with ethical standards

Disclosure of conflict of interest

No conflicts of interest have been noted.

Statement of informed consent

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

Authors' contributions

This work was carried out in collaboration among all authors read and approved the final manuscript.

References

[1] Kambuma. E. Waste from Kisangani's markets and roadways, a health risk, Memory, ISTM-Kisangani, 2017.

[2] Bayard, R. et R. Gourdon. Biological waste treatment, Engineering techniques, Environmental treaty, 2017. Available on: http://www.techniques-ingenieur.fr/base-documentaire/procedes-chimie-bio-agro-th2/traitement-biologique-des-déchets-j3966.

[3] Compaore, E. et Nanema LS. Composting and compost quality of municipal solid waste from the city of Bobo-Dioulasso, Burkinafaso. Tropicultura, 2010.

[4] World Health Organization (WHO). Insect and rodent control through environmental design, Geneva 2014.

[5] Fainet J-L. And Niang S. Recycling waste and effluents in urban agriculture. *In* : Smith, 2014.

[6] Fodha, H. and J.K. Symens J.K. Environmental problems in the Third World, United Nations Information Centre, Brussels, 2007.

[7] Ousseynon, E. New targets for waste management worldwide, CREA, AO, 2016.

[8] Kitoga Mwenyi J. Socio-sanitary impact of waste mismanagement in Shabunda central market and surrounding area, Memory, University for the Development of Congo (UDC), 2021.

[9] [9] Mashi Bagalwa, Karume K. Potential health risks of household waste in rural areas : case Irhambi Katana (South Kivu, Democratic Republic of Congo), 2018.

[10] [10] Messou E et col. Impact of sanitation and domestic hygiene on the incidence of ascariasis and hookworm disease in children aged 2 to 4 years in rural areas of Côte d'Ivoire. Bull Soc Path Exot, 2019.