International Conference on Social Science and Humanity
Homepage : https://proceeding.antispublisher.or.id/index.php/icossh
Email : admin@antispublisher.com

e-ISSN : 3063-9611
ICOSSH, Vol. 3, No. 1, 2026
Page 1-10

Can Colour-Coded Waste Bins Help Improve Waste Management in Lokoja, Kogi State, Nigeria?

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DOI : https://doi.org/10.61796/icossh.v3i1.571

Sections Info

Article history:
Submitted: December 10, 2025
Final Revised: December 25, 2025
Accepted: January 16, 2026
Published: January 31, 2026

Keywords:
Aste management and recycling
Colour-coded bins
Community perceptions
Urban sustainability
Lokoja
Kogi state nigeria

ABSTRACT

Objective: *This study attempts to narrow the gap in the implementation of how people perceive, accept, and interpret challenges of color-coded waste bin systems in Nigerian cities, particularly in Lokoja, Kogi State, as a response to the challenges of municipal solid waste management.* ***Method:*** *This study employed a qualitative research design to investigate in-depth viewpoints, experiences, and recommendations regarding current waste management procedures and solutions. A total of twenty purposefully chosen participants were involved: ten residents (R1–R10), five local government representatives (LG1–LG5), three waste collectors (WC1–WC3), and two community leaders (CL1–CL2). Phenomenology was used to understand how different stakeholders perceive and experience issues related to waste segregation, focusing on the possibility of color-coded bins. Data were collected using semi-structured interviews and focus groups, then transcribed verbatim and analyzed thematically using NVivo 12.* ***Results:*** *The results indicated that the adoption of color-coded bins based on traffic signal colors that are already culturally familiar was viewed favorably, despite potential obstacles such as cost, low education levels, and enforcement challenges. Participants also highlighted the financial and environmental benefits, including increased recycling rates, reduced landfill reliance, and income streams. Overall, there was moderate awareness of waste management challenges, and the color-coded bins were seen as a culturally relevant and pragmatic solution to waste disposal issues in Lokoja.* ***Novelty:*** *This study presents a novel approach to addressing municipal waste management issues in Nigerian cities by introducing a color-coded bin system that is culturally familiar and practically applicable, aiming to improve waste segregation. The study also emphasizes the need for collaboration among government agencies, community stakeholders, academic institutions, and international partners to ensure the successful implementation of such interventions.*

INTRODUCTION

Waste management represents a significant challenge for urban centres throughout Nigeria, including Lokoja, the capital of Kogi State. This rapid upward trend in solid waste generation is attributable to urbanisation and growth of commercial activities which is intimately associated with the rapid population growth being experienced in Lokoja as a result of its status as the capital of Kogi state. In its most recent report, which was obtained by the News Agency of Nigeria in Lokoja, the Kogi State capital, the city generates around 250 tons of waste on a daily basis, out of which only 60% is regularly collected, implying that there is still a considerable waste management deficit in the city. Waste management practices via traditional methods are out of reach and are leading to indiscriminately dumping, fills up dump sites and unhealthy surrounding for living that is harming the public health and environment [1].

The issues experienced across the city of Lokoja are representative of a widespread crisis affecting cities across Nigeria, including poor waste segregation, inadequate

collection and disposal infrastructure, limited public education on the topic of waste disposal, and a total lack of environmental service funding [2]. As such, with nearly all waste being collected and being transported before they are separated, recycling is impossible and land fill sites are heavily burdened. This inefficiency causes environmental pollution, such as clogged drainage systems, contaminated soil and water, and an increase in disease-carrying insects such as rodents and mosquitoes.

Colour-coded waste bins are widely recognised as an effective strategy for improving waste management outcomes. Assigning specific colours to different waste categories is intended to facilitate straightforward, comprehensible, and efficient waste segregation [3]. Green bins are most commonly associated with organic or biodegradable waste, like food scraps and garden waste, while red bins are recyclables, such as plastics, metals and paper.

However, colour–coded waste bins take time in Lokoja due to the following: Many residents are faced with changing decades of disposal behaviour, and general knowledge about the importance of waste segregation methods is also lacking. Also, equipping every household and public area with bins can prove to be an expensive and time-consuming task for local authorities, given the tight budgets they operate under. Enforcement of segregation rules also requires political will and institutional capacity that may currently be lacking.

Purpose of the Study

This study explores the question: Can colour-coded waste bins help improve waste management in Lokoja? It focuses on understanding the perceptions of residents, waste collectors, and local government officials about the introduction of a colour-coded bin system. Specifically, the study aims to:

a. Assess community awareness and understanding of waste segregation and colour-coded bins.
b. Explore the community perceptions of using colour-coded waste bins for waste segregation in Lokoja
c. Identify anticipated challenges to implementation from various stakeholders' perspectives.
d. Examine expectations regarding the roles of the state government and international organisations in facilitating adoption.

Research Questions

To accomplish the objective of the study, it is important to address the following research questions:

1. How much awareness does the community have on waste segregation and the colour-coded bins in Lokoja?
2. How do the community perceive the usage of colour-coded waste bins for waste segregation in Lokoja?
3. What residents, waste collectors and government officials expect to be the challenges when implementing a colour-coded waste management.

4. To what extent do stakeholders expect the state government and international organisations to empower the adoption of colour coded waste bins in Lokoja?

The results of this study will be relevant to policy makers, environmental managers and development partners as they seek to inform actions to improve waste management in Lokoja. Such local framing and prioritisation of issues lays the ground for community-relevant communication strategies, resource allocation and space for programmers to design efforts towards the introduction and sustained uptake of colour-coded waste bins. In addition, now it can justify the investment and attract the global development agencies as partners by documenting the expected costs and benefits. Though simple in essence, a little tweak in the waste segregation process through colour coded bins which are easier for people to understand is a step forward in the protection of the environment, public health and sustainable economic savings for the state.

Waste Management

Waste management encompasses the collection, transportation, treatment, and disposal of waste, along with monitoring and regulation of the waste management process. Effective waste management is a critical component of sustainable urban development and environmental protection [4], [5]. In many developing countries, including Nigeria, poor waste management techniques are a major cause of urban flooding, public health problems, and environmental degradation [6].

Globally, waste production is still increasing due to changes in consumption patterns, urbanisation, and population growth. According to World Bank estimates, if immediate action is not taken, the amount of waste produced worldwide will increase from 2.01 billion tonnes in 2016 to 3.40 billion tonnes by 2050 [4]. Low levels of public awareness, inadequate institutional capacity, and inadequate infrastructure all contribute to the issue in Sub-Saharan Africa [7]. Moreover, Nigerian municipal solid waste management is virtually ineffective due to non-collection, poor disposal methods, and lack of source segregation [8].

There is growing evidence of the need for more participatory and community-oriented approaches to waste management. Some of them are bringing in unofficial waste pickers, engaging the community and then bring in innovations such as colour-coded bins to simplify recycling or waste sorting [9]. Policy initiatives to address waste governance in Nigeria have come short and the country still struggles with this challenge. For urban centers like Lokoja, challenges include under-funding, limited access to sorting facilities, and weak enforcement of environmental laws [10]. Such issues highlight why we need waste management solutions that are innovative, bottom-up, and community specific.

Best practices in other countries in terms of Colour Department Systems for Waste Bins

While recycling was another reason source segregation is necessary to effective waste management, composting would not be viable without source segregation. At the household level, measures inducing behavioural change have been reported to promote waste separation [11]. Visual aids, like colour-coded bins, are also helpful in

normalizing and simplifying this process of segregating waste. Previous evidence from Nigeria and Africa suggested that such interventions/directions strongly enhance waste segregation and recycling [12].

Various countries have devised colour-coded waste bin schemes, generally green for organic waste, yellow for recyclable waste and red for hazardous waste, to encourage source segregation and proper disposal of waste [13]. If implemented right, these systems have been proven to increase recycling and decrease landfill pressure [14]. Nonetheless, stakeholder involvement has been regarded as a key prerequisite for success [15].

One approach to tackle this, recognised internationally, is the standardisation of bin colours. The Global Waste Management Outlook suggests blue for recyclables, green for organic waste, and red for hazardous waste in order to minimize user confusion and promote global consistency [16]. Lagos, Nigeria and urban China literature indicates residents will respond to this visual cue system with increased waste sorting compliance [17], [18]. Cultural acceptance and familiarity remain key determinants of success. In Nigerian urban contexts, colours aligned with intuitive symbols such as traffic lights have been shown to enhance adoption and reduce cognitive burden [19], [20].

Present Approaches and Shortcomings in Lokoja's Waste Management

Local government reports highlight persistent issues such as indiscriminate dumping, irregular waste collection, and the absence of waste segregation systems in Lokoja [21]. With little money and low involvement of the community, there are not enough bins, and enforcement as we know is close to non-existent.

This has a number of possible advantages arising from the introduction of colour coded bins that will litter Kogi state capital Lokoja. Closer alignment of the waste management process to residents' current disposal habits through improved sorting methods has the potential to minimize the negative externalities associated with urban waste management, such as soil and water body contamination and dependence on landfills, which can in turn improve urban environmental quality [22], [20]. There may also be economic advantages associated with decreasing landfill expenses and building companies based around recycling [23]. The visibility of colour-coded bins can also foster increased public awareness and civic responsibility.

Challenges to Adoption and the Need for Government and International Support

Rapid urban growth continues to strain municipal solid waste management systems in developing countries. Nigerian cities, including Lokoja, face persistent challenges related to inadequate collection infrastructure, low public awareness, and insufficient funding [24]. Such challenges, in fact, are not unique to Morocco, as population growth surpasses waste management service expansion across regions in Sub-Saharan Africa [25].

These issues further complicate implementation through high initial investment costs, relatively limited institutional capacity, and lackluster public buy-in [26]. Experience from cities in Nigeria show that success requires sustained public education, good enforcement and infrastructure investment [24]. The World Bank, UNEP and others

continue to boost their financial and technical support for strengthening waste management systems [25], [23].

Qualitative Findings from Previous Research

Qualitative studies reveal that public trust in local government institutions strongly influences community acceptance of new waste management systems, including colour-coded bins [27]. Transparency in waste management operations and public expenditure significantly enhances community support. Behavioural changes, such as waste sorting and the use of designated bins, are more readily adopted when residents observe tangible improvements in environmental cleanliness and public health [20].

The involvement of community leaders and culturally sensitive communication strategies has also been identified as a key success factor. Local leaders serve as trusted intermediaries, reinforcing government initiatives and promoting sustained community engagement. These findings emphasise the importance of collaborative governance, inclusive planning, and continuous feedback mechanisms in urban waste management initiatives.

RESEARCH METHOD

General The study made use of a qualitative research design to investigate the opinions of respondents regarding the use of colour-coded trash cans in Lokoja, Kogi State, this study. In order to obtain insightful, comprehensive information about participants' opinions, experiences, and recommendations regarding waste management issues and solutions in the neighbourhood, a qualitative approach was selected. A total of 20 individuals participated in the study, including 10 residents (R1–R10), 5 local government officials (LG1–LG5), 3 waste collectors (WC1–WC3), and 2 community leaders (CL1–CL2). Methodology This study was framed by the phenomenological research paradigm as it aims to document and better understand the experiences and perspectives of WSWM stakeholders on waste segregation. This tradition frames the inquiry appropriately, as its interpretivist and descriptive nature best matches the exploratory purpose of the research by aligning with participants' perspectives of the phenomena of interest. The interviews were based on an interview guide and lasted between thirty and sixty minutes. Current waste disposal practices, acceptance of colour-coded bins, perceived benefits and drawbacks, financial implications, and recommendations for government or international agency involvement were just a few of the topics covered in the study. Eight residents participated in each FGD, which promoted candid conversation to support and enhance the results of individual interviews. With the participants' informed consent, all interviews and focus group discussions were audio recorded and verbatim transcribed. The NVivo 12 programme was used to organise and analyse the transcripts thematically. Multiple readings of the transcripts, coding data segments based on emerging themes, and classifying codes into more general categories were all part of the analysis. Responses were connected to stakeholder groups using the participant codes in order to spot trends and differences in

viewpoints. Participants were guaranteed confidentiality, anonymity, and their right to withdraw at any time without penalty.

RESULTS AND DISCUSSION

The study highlighted four key themes related to waste management and the adoption of colour-coded bins in Lokoja.

Table 1. Summary of Themes, Participant Codes, and Quotes.

Awareness of Waste Challenges	Irregular waste collection and poor sorting contribute to pollution	"Waste is everywhere because collection is not regular." (R3)	8 Residents, 2 Government Officials, 2 Waste Collectors
Perceptions of Colour-Coded Bins	Positive perception of using traffic light colours for bin identification	"Green means go, red means stop; these colours will help people remember." (CL1)	7 Residents, 2 Community Leaders, 1 Government Official
Implementation Challenges	Barriers include a lack of funding, inadequate public education, and weak monitoring	"It will be hard if the government doesn't provide bins and educate people." (WC1)	5 Residents, 3 Government Officials, 3 Waste Collectors
Financial Benefits	Anticipated savings in cleanup costs and employment opportunities	"Sorting waste can create jobs and reduce cleanup costs." (R5)	6 Residents, 1 Community Leader, 2 Government Officials

Question One: What is the level of community awareness and understanding of waste segregation and the use of colour-coded bins in Lokoja?

Awareness of Waste Management Challenges

Five participants believed poorly arranged waste management, infrequent waste collection and improper waste separation as problematic in Lokoja. The adverse consequences of irregular waste disposal were further emphasised by eight residents (R1, R3, R5, R7, R8, R9, R10), two local government officials (LG2, LG4), and two waste collectors (WC1, WC3). R3 writes that: "Trash piles up everywhere, because collection is not regular. These results are consistent with previous researches that show persistent problems linked to insufficient waste infrastructure and low public engagement in the cities of Nigeria [24], [25].

Question Two: What are the community perceptions about the use of colour-coded waste bins for waste segregation in Lokoja?

Perceptions of Colour-Coded Waste Bins

The introduction of colour-coded waste bins elicited largely positive responses. Seven residents (R2, R4, R6, R8, R9, R10, R1), two community leaders (CL1, CL2), and one government official (LG3) expressed support for the use of familiar colours aligned with traffic signals to enhance recognition and compliance. According to CL1, "Green means go, red means stop; these colours will help people remember." This perception aligns with existing research demonstrating that culturally familiar colour schemes can significantly improve community engagement and compliance with waste segregation practices [19].

Question Three: What challenges do residents, waste collectors, and government officials anticipate in implementing a colour-coded waste management system?

Implementation Challenges

Despite general enthusiasm, participants identified several anticipated challenges. Three waste collectors (WC1, WC2, WC3), three government officials (LG1, LG4, LG5), and five residents (R1, R3, R5, R7, R10) highlighted concerns related to the cost of procuring bins, the need for sustained public education, and the enforcement of compliance. One waste collector (WC1) stated, "It will be hard if the government doesn't provide bins and educate people." These concerns mirror documented barriers associated with limited funding, behavioural change, and institutional capacity in similar urban contexts [26], [24].

Question Four: What are the perceived environmental and financial benefits of adopting a colour-coded waste bin system in Lokoja?

Financial Benefits of Adoption

Participants identified several financial benefits associated with the adoption of colour-coded waste bins, including cost savings and employment opportunities. One community leader (CL2), two government officials (LG2, LG5), and six residents (R2, R4, R6, R8, R9, R10) noted that effective waste sorting could reduce landfill-related expenditures and generate income through recycling activities. As expressed by R5, "Sorting waste can reduce cleanup costs and create jobs." These views are consistent with World Bank findings that improved waste management systems can create economic incentives while reducing municipal expenditure [23].

The results showed a positive attitude toward the adoption of colour-coded bins and a clear understanding of Lokoja's waste management issues. Because it draws on prior knowledge and may promote greater compliance, the use of well-known traffic light colours is especially preferred. But issues like the high implementation costs, the requirement for continuous public education, and the enforcement of appropriate waste segregation still exist. These challenges underscore the vital role that international and governmental support plays in financing, educating, and maintaining such programmes.

Strong adoption motivators were found to be financial incentives, such as the possibility of creating jobs and lower waste management expenses. This suggests that

highlighting the financial advantages of appropriate waste sorting can encourage community support, which is consistent with evidence from around the world. Although colour-coded bins are a widely recognised best practice for enhancing waste management, their effectiveness in Lokoja largely depends on tailoring tactics to local circumstances and guaranteeing cooperation between the government, communities, and development partners.

CONCLUSION

Fundamental Finding : The study explored stakeholders' perceptions of colour-coded trash cans in Lokoja, Kogi State, for improving waste management. The findings revealed that stakeholders were aware of waste disposal issues and showed positive attitudes towards colour-coded bins, especially when associated with the traffic light system (red, yellow, green). This association would help residents easily remember which waste should be sorted into which bin. However, participants also highlighted major barriers to successful implementation, including financial constraints, low public education, and insufficient enforcement of waste segregation rules. **Implication :** The positive reception of colour-coded bins suggests that they could be an effective solution for waste management in Lokoja if the challenges identified in the study are addressed. For the system to be successful, it will require international collaboration, strong government commitment, and local support. Economic benefits from reduced waste disposal costs and job creation in recycling programs could further encourage community participation and support from local and government stakeholders. **Limitation :** The study was limited by challenges such as the lack of financial resources, low public education, and weak enforcement mechanisms that could hinder the successful implementation of the waste sorting system. These factors may limit the scale and sustainability of the project, highlighting the importance of overcoming these barriers for the program's long-term success. **Future Research :** Future research could focus on examining how other regions have successfully implemented similar colour-coded waste management systems, especially in areas with similar socio-economic and environmental challenges. Additionally, studies could explore the effectiveness of international collaboration in waste management initiatives and the role of public-private partnerships in supporting the sustainability of recycling programs. Further research may also investigate the long-term impact of waste segregation on environmental sanitation, health risks, and economic benefits in local communities.

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