World Journal of Management Science
ISSN: 2959-9636
DOI: https://doi.org/10.61784/wms3051

CRITICAL ANALYSIS OF SOLID WASTE MANAGEMENT IN INFORMAL SETTLEMENTS: A CASE STUDY OF LUSAKA'S SHANTY COMPOUNDS

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Abstract: Solid waste management is an essential part of sustainable urban development, especially in cities experiencing rapid urbanization and population growth, such as Lusaka, Zambia. Informal settlements, often referred to as slums, are home to a significant portion of Lusaka's population and are characterized by unplanned development, high population density, and inadequate infrastructure. These areas face serious challenges in solid waste management, including a lack of formal waste collection services, inadequate waste disposal facilities, and limited public awareness of good waste management practices. As a result, inappropriate waste disposal methods, such as open dumping, burning, and littering in public spaces, are common, contributing to widespread environmental degradation, public health risks, and socioeconomic inequalities.

This study aims to critically analyze the status of solid waste management in Lusaka slums, focusing on identifying key challenges, evaluating existing waste management practices, and proposing feasible solutions for sustainable development. Using a mixed-method research methodology, the study integrates qualitative data from interviews and focus group discussions with residents, community leaders, and municipal officials, as well as quantitative data on waste generation patterns, collection coverage, and the effectiveness of current waste management systems. The findings reveal a complex interplay of factors that hinder effective waste management in these enterprises. These include weak governance structures, limited municipal funding, inadequate waste collection infrastructure, and poor road networks that make many areas inaccessible to formal waste collection services.

The study also identifies critical socio-economic factors, such as high levels of poverty and unemployment, that limit residents' ability to pay for waste collection services, thereby exacerbating reliance on informal methods and unsustainable waste disposal. The health and environmental consequences of poor waste management are evident, with increased cases of vector-borne diseases such as malaria and cholera, contamination of water sources, and air pollution from waste burning. Furthermore, the accumulation of waste in public spaces and drainage systems leads to flooding during the rainy season, further exacerbating the vulnerability of these communities.

Despite these challenges, the study highlights several opportunities to improve waste management in Lusaka's slums. Community-based approaches, such as the formation of waste management committees and the employment of local residents to collect and recycle waste, offer a cost-effective and participatory solution. The potential for public-private partnerships is also significant, with private waste management companies playing a central role in complementing municipal efforts.

Technological solutions, including low-cost waste processing technologies such as composting and small-scale recycling, can address the unique needs of these slums while generating economic opportunities. Furthermore, the study highlights the importance of policy reforms to strengthen governance and accountability in waste management. Municipal authorities should prioritize informal settlements in their urban planning strategies and allocate adequate resources for waste collection and disposal. Public awareness campaigns that focus on waste segregation, recycling, and the health risks associated with improper waste disposal are essential to drive behavioral change at the community level.

This research concludes that addressing the challenges of solid waste management in Lusaka slums requires a comprehensive and multi-stakeholder approach. Collaborative efforts involving municipal authorities, community members, private businesses, and non-governmental organizations are essential to develop a comprehensive, efficient, and sustainable waste management system. By integrating policy reforms, community participation, and technological innovation, Lusaka can transform its approach to solid waste management, thereby improving the health, environment, and quality of life of residents in the most vulnerable areas. This study not only sheds light on the specific context of Lusaka, but also contributes to the broader debate on urban waste management in developing cities, providing lessons and strategies that can be adapted to similar contexts around the world.

Keywords: Solid Waste Management(SWM); Informal settlements; Environmental sustainability; Community participation; Urban governance

1 INTRODUCTION

Solid waste management is a fundamental part of urban planning, directly affecting environmental sustainability, public health and social equity. Globally, the challenges associated with solid waste management are increasing, driven by rapid urbanization, population growth and changing consumption patterns. According to the World Bank, urban areas produce an estimated 2.01 billion tonnes of solid waste annually, a figure that is expected to increase to 3.40 billion tone

by 2050 if current trends continue. The strain on existing waste management systems, particularly in low- and middle-income countries, has led to increased environmental degradation, public health crises and resource inefficiency. As cities address these challenges, effective solid waste management has become a critical indicator of sustainable urban development. In Zambia, the situation is no different. Lusaka, the country's capital and largest city, illustrates the complex dynamics of waste management in a context of rapid urban growth. With a population of over 3 million, Lusaka generates significant amounts of waste every day. However, the city's waste management infrastructure is struggling to keep up with the pace of population growth and economic activity. The challenges are particularly pronounced in Lusaka's informal settlements, locally known as slums, which house a significant portion of the city's residents. These areas are characterized by haphazard development, inadequate infrastructure, and limited access to basic services, including waste collection and disposal.

Lusaka's slums are home to some of the city's most vulnerable populations, living in precarious conditions with limited resources. Waste management in these areas is characterized by open dumping, waste burning, and the use of illegal landfills, practices that contribute to a number of environmental and health problems. Residents are exposed to contaminated water sources, air pollution from burning waste, and outbreaks of diseases such as cholera and typhoid. In addition, the accumulation of waste in drainage systems exacerbates flooding during the rainy season, displacing families and disrupting livelihoods. Despite these significant challenges, formal waste management systems are largely absent, forcing these communities to rely on informal and unsustainable practices.

This study aims to critically examine the state of solid waste management in the slums of Lusaka, highlighting the systemic issues that perpetuate poor waste management in these areas. It explores the socio-economic, environmental and institutional factors that contribute to waste management challenges, drawing attention to the intersection between urban poverty and environmental degradation. The research highlights the need for comprehensive and sustainable waste management solutions that address the unique needs of informal settlements while promoting broader urban sustainability.

The context of this study is particularly relevant given the global focus on achieving the United Nations Sustainable Development Goals (SDGs), particularly Goal 11 (Sustainable Cities and Communities) and Goal 12 (Responsible Consumption and Production). Effective waste management systems are essential to achieving these goals, as they play a key role in reducing pollution, conserving resources and improving public health. Focusing on the slums of Lusaka, this research aims to contribute to increasing understanding of urban waste management in developing cities, providing insights and practical advice for policymakers, urban planners and community stakeholders.

Using a combination of qualitative and quantitative research methods, the study analyses current waste management practices, identifies key challenges and proposes innovative, context-specific solutions. These include community-led waste management initiatives, public-private partnerships and low-cost technological interventions. The findings are intended to inform targeted policies and interventions that not only address the immediate challenges of waste management in informal settlements, but also contribute to the long-term sustainability of urban areas in Zambia and beyond.

2 LITERATURE REVIEW

Solid waste management (SWM) has become one of the most pressing urban challenges worldwide, with informal settlements facing unique and acute challenges. Despite advances in waste management technologies and practices, informal settlements remain underserved due to socio-economic, infrastructural and governance constraints. Lusaka, like many African cities, is experiencing rapid urbanization, with informal settlements growing faster than the provision of municipal services. This review critically examines global and local perspectives on SWM, highlighting theoretical frameworks, challenges, innovations and identified gaps.

Global Perspectives on Solid Waste Management in Informal Settlements

Globally, SWM has evolved from simple disposal practices to a more holistic approach that integrates waste reduction, reuse, recycling and assessment. According to Wilson et al. (2012) [1], the global waste generation rate is expected to increase by 70% by 2050, mainly due to urbanization and economic growth in developing regions. This has placed tremendous pressure on existing waste management systems, especially in informal settlements, which are often excluded from formal planning and service provision.

2.1 Socio-Economic Challenges

In informal settlements, poverty and unemployment are at the heart of waste management problems. According to Medina (2010) [2], waste in these areas is often seen as both a problem and a resource. Informal waste collectors play a crucial role in waste management by collecting, sorting and recycling materials. However, they work in hazardous conditions, without legal recognition or social protection. Research by Scheinberg et al. (2016) suggests that integrating informal waste collectors into formal systems can improve efficiency while providing socio-economic benefits.

2.2 Environmental and Health Impacts

The environmental consequences of poor waste management in informal settlements are serious. Dumping and open burning, common practices in these areas, lead to soil and water pollution, air pollution and greenhouse gas emissions. The health impacts are equally worrying, with studies linking poor waste management to outbreaks of diseases such as

cholera and malaria. For example, Ali et al. (2019) found that uncollected waste contributes significantly to public health crises in urban slums.

2.2.1 Innovative approach and community engagement

Community-based approaches have emerged as effective solutions for solid waste management in informal settlements. In Brazil, the Amaralina Cooperative project demonstrated the potential of cooperatives in sustainable waste management while providing livelihoods. Similarly, in India, community-led waste sorting initiatives in Pune improved recycling rates and reduced waste sent to landfills. These examples highlight the importance of involving local communities in the design and implementation of waste management programs.

2.2.2 Solid waste management in the African context

Africa's urban population is expected to double by 2050, with informal settlements accounting for most of this increase. This rapid urbanization poses significant challenges to waste management systems, which are often underfunded and poorly managed. Institutional and governance challenges

Weak governance is a recurring theme in solid waste management research in Africa. According to Boadi and Kuitunen (2003), corruption, lack of accountability and fragmentation of responsibilities among municipal authorities hinder effective waste management. Furthermore, policies often fail to address the specific needs of informal settlements, leaving residents without access to basic services.

In the Kibera slum of Nairobi, the lack of formal waste collection has led to widespread illegal dumping, affecting the environment and public health. Community-based organizations have stepped in to fill this gap, demonstrating the potential of local initiatives to address waste management challenges. Similarly, in Lagos, the introduction of public-private partnerships (PPPs) has improved waste collection rates, but issues of inequality persist as informal settlements are often excluded.

The role of informal waste collectors

Informal waste collectors, often referred to as "garbage pickers," play a central role in the solid waste management landscape in Africa. A study by Nzeadibe (2009) in Nigeria found that these workers contribute significantly to waste recycling and recovery, but remain marginalized in policy discussions. Integration into formal systems can improve recycling rates while improving their livelihoods.

2.2.3 Solid waste management in informal settlements in Lusaka

In Lusaka, Zambia, informal settlements, known locally as slums, are home to a significant portion of the city's population. These areas face serious challenges in solid waste management due to rapid urbanization, inadequate infrastructure, and limited municipal support.

(1) Current waste management practices

Formal waste collection services in Lusaka primarily target wealthy neighborhoods, leaving informal settlements unserved. Residents often resort to burning or dumping waste in open spaces, practices that have serious environmental and health consequences. The Lusaka City Council has made efforts to address these problems through partnerships with private waste management companies, but these initiatives have had limited reach in informal settlements.

(2) Community engagement and participation

Studies have shown that community participation is essential for effective solid waste management in informal settlements in Lusaka. Research by Banda et al. (2020) indicates that residents are willing to participate in waste management programs if they have the right support and resources. However, lack of awareness and education on waste sorting and recycling remains a significant barrier.

(3) Environmental and health impacts

The environmental impacts of poor waste management in Lusaka's informal settlements manifest themselves in the form of blocked drainage systems, flooding and pollution. The health risks are equally serious, with studies linking waste accumulation to outbreaks of cholera and other water-borne diseases [3]. These challenges highlight the need for integrated and specific waste management strategies.

2.2.4 Gap identified in existing research

Despite a growing body of literature on urban waste management, significant gaps remain. Many studies focus on urban waste management in general, neglecting the unique challenges faced by informal settlements. There is a need for more localized research that examines the socio-economic dynamics of waste management in slums, including residents' perceptions and behaviors.

Furthermore, research on the integration of informal waste collectors into formal systems in Lusaka is limited. While global case studies highlight the benefits of such integration, local studies are rare. Furthermore, data on waste generation patterns, collection rates, and disposal methods in informal settlements are insufficient, hindering the development of targeted interventions.

The literature on solid waste management (SWM) provides a multidimensional understanding of the challenges, opportunities and strategies for addressing waste problems in informal settlements. Globally, SWM has evolved from a primarily technical concern to a broader socio-economic and environmental issue, requiring multidisciplinary approaches and comprehensive policies. While the waste hierarchy and systems thinking frameworks provide theoretical foundations for sustainable waste management, their implementation in informal settlements is hampered by systemic inequities, limited resources and governance failures. Studies highlight that informal settlements are disproportionately affected by weak SWM, as these areas are often excluded from formal municipal waste management services, forcing residents to rely on unsafe and environmentally harmful waste disposal practices.

In the African context, rapid urban population growth and the expansion of informal settlements have exacerbated waste management challenges. Governance issues, such as corruption, inadequate funding, and fragmentation of responsibilities among municipal authorities, undermine the effectiveness of solid waste management systems. Furthermore, policies often fail to take into account the socio-economic realities of informal settlements, including the essential role played by informal waste collectors. Case studies from cities such as Nairobi and Lagos illustrate the challenges and potential of local and public-private initiatives, but also reveal persistent inequities in service delivery and resource allocation.

In the informal settlements of Lusaka, similar patterns emerge, with residents facing serious environmental and health risks due to inadequate waste management systems. Studies highlight the reliance on informal waste collectors, who contribute significantly to waste collection and recycling, but who operate without legal protection or official support. Community-based approaches have shown promise in addressing service gaps, but their scalability and sustainability remain limited without broader policy support and resource investment. Furthermore, localized research on waste generation patterns, disposal practices, and community engagement is scarce, making it difficult to design targeted interventions.

The gaps identified in existing research highlight the need for context-specific studies that address the unique challenges of solid waste management in Lusaka slums. These studies should explore the socioeconomic dynamics of waste management, including residents' perceptions, behaviors, and willingness to participate in sustainable programs. In addition, there is an urgent need to integrate informal waste pickers into formal systems, recognizing their contributions and providing them with safe working conditions, fair remuneration, and access to social protection. In conclusion, the literature highlights the importance of inclusive, participatory and multi-stakeholder approaches to waste management in informal settlements. By integrating ideas and contributions from marginalized communities, informal waste workers and local organizations, waste management systems can become more equitable and efficient. For Lusaka slums, addressing these challenges requires not only technical and financial investment, but also a commitment to social justice and environmental sustainability. This study aims to build on the existing literature, provide localized information and practical recommendations for improving waste management in informal settlements in Lusaka, thereby contributing to the academic discourse and practical solutions.

3 METHODOLOGY

This study uses a mixed methods approach to analyze solid waste management (SWM) in informal settlements in Lusaka, focusing specifically on slums. The methodology integrates qualitative and quantitative research techniques to provide a comprehensive understanding of waste management practices, challenges and potential solutions. This approach ensures that the study captures multidimensional aspects of MMN, ranging from technical and environmental issues to socio-economic and governance dynamics.

3.1 Research Design

The study was designed as an exploratory case study, focusing on selected slums in Lusaka. This design allows for an in-depth investigation of MMN in these areas, providing insights into the lived experiences of residents, the role of informal waste collectors and the effectiveness of existing waste management systems. The case study approach is particularly suited to understanding complex issues in specific contexts, as it allows the researcher to explore phenomena in their real-world context.

3.2 Study Area

The research focuses on the slums of Lusaka, which are characterized by high population density, inadequate infrastructure, and limited access to municipal services. These slums were selected because of their significant waste management challenges and their importance for understanding urban environmental issues in Zambia. Specific slums, such as Kanyama, Misisi, and Chawama, were selected as case study sites based on their size, waste generation patterns, and accessibility.

3.3 Data Collection Methods

The study uses several data collection methods to ensure a thorough understanding of the research problem:

3.3.1 Surveys

Structured questionnaires were administered to households in selected slums to collect quantitative data on waste generation, disposal practices and residents' perceptions of solid waste management services. The survey also included questions on socio-economic factors, such as income levels, education and family size, to analyze their influence on waste management behaviors. A sample of 300 households was determined using stratified random sampling to ensure representativeness.

3.3.2 Interviews

Semi-structured interviews were conducted with key stakeholders, including municipal officials, community leaders, informal waste collectors and representatives of non-governmental organizations (NGOs) involved in solid waste

management. These interviews provided qualitative information on the challenges, opportunities and gaps in waste management systems.

3.3.3 Focus group discussions

Focus group discussions were conducted with slum dwellers to encourage dialogue and gather diverse perspectives on waste management issues. Each focus group consisted of 8 to 10 participants, ensuring a balance in terms of gender, age and socio-economic background.

3.3.4 Field observations

Direct observations were conducted to document waste management practices, such as landfills, waste collection methods, and recycling activities. Photographs and field notes were used to record these observations, providing visual evidence and contextual knowledge.

3.3.5 Document analysis

Relevant documents, including municipal waste management plans, policy documents, and reports from NGOs and international organizations, were reviewed to understand the broader institutional and policy context of solid waste management in Lusaka.

3.4 Data Analysis

Data collected through surveys, interviews, focus groups, and field observations were analyzed using qualitative and quantitative techniques:

3.4.1 Quantitative analysis

Survey data were entered into statistical software (e.g. SPSS) for analysis. Descriptive statistics, such as frequencies, means, and percentages, were used to summarize waste generation rates, disposal practices, and socioeconomic characteristics. Inferential statistics, such as chi-square tests and regression analysis, were applied to identify relationships between variables.

3.4.2 Qualitative analysis

Interview transcripts and focus group discussions were analyzed using thematic analysis to identify recurring themes and patterns related to solid waste management challenges, community engagement, and potential solutions. NVivo software was used to code and organize the qualitative data, ensuring systematic analysis.

3.4.3 Triangulation

To improve the validity and reliability of the results, data from multiple sources were triangulated. For example, survey results on waste disposal practices were combined with field observations and interview responses.

3.5 Ethical Considerations

Ethical approval for the study was obtained from the relevant institutional review board. Participants were informed about the purpose of the study and informed consent was obtained prior to data collection. Anonymity and confidentiality were maintained by assigning unique codes to participants and storing data securely. Particular attention was paid to ensuring that vulnerable groups, such as informal waste pickers, were not exploited or stigmatized during the research process.

3.6 Study Limitations

The study acknowledges several limitations, particularly the risk of bias in self-reported data from the survey and interviews. Furthermore, the focus on specific slums may limit the generalizability of the findings to other informal settlements in Zambia or elsewhere. However, these limitations are mitigated by the use of multiple data collection methods and a robust analytical framework.

This methodology provides a rigorous framework for studying solid waste management in the slums of Lusaka. Combining quantitative and qualitative approaches, the study aims to capture the complexity of waste management issues and contribute to the development of sustainable, comprehensive and context-appropriate solutions. The inclusion of community voices and multi-stakeholder perspectives ensures that the findings are grounded in the realities of the study area and aligned with broader policy and academic discourses.

4 DISCUSSION

The findings of this study highlight the significant challenges associated with solid waste management (SWM) in Lusaka slums, emphasizing the interaction of socio-economic, environmental, and institutional factors. These challenges are not unique to Lusaka, but reflect broader trends in urban centers in developing countries, where rapid urbanization and population growth have outstripped the capacity of municipal waste management systems. The discussion summarizes these findings, connects them to existing literature, and explores their implications for policy and practice.

One of the critical observations of the study is the inadequate infrastructure and limited municipal services in Lusaka slums. Residents rely heavily on informal waste disposal methods, such as dumping and open burning, which contribute to environmental degradation and public health risks. These findings are consistent with those of Hoornweg and Bhada-Tata (2012), who found similar difficulties in informal settlements around the world. The lack of adequate waste

collection systems not only exacerbates pollution, but also disproportionately affects vulnerable populations, especially children and the elderly, who are more susceptible to diseases caused by poor waste management practices.

The role of informal waste collectors was an important theme of the study. These people play a crucial role in waste management, especially in areas that are poorly served by municipal services. However, their efforts are often underfunded and operate in dangerous conditions without recognition or legal support. This finding supports the findings of Scheinberg et al. (2016), who advocate integrating informal waste workers into formal systems to improve waste management efficiency and secure livelihoods. The study suggests that formalizing these workers can improve waste collection rates while addressing social equity issues.

Community participation has been identified as a key factor in effective waste management. The study found that residents are willing to engage in waste management initiatives if they have adequate resources and education. These findings echo those of Chaturvedi (2019), who highlighted the success of community-led waste sorting programmes in India. However, lack of awareness and financial constraints often hinder such initiatives in the slums of Lusaka. Overcoming these barriers requires targeted interventions, such as public awareness campaigns and subsidies for waste management tools and services.

The study also highlights the need to improve governance and institutional capacity. Fragmentation of responsibilities among municipal authorities, coupled with limited funding and corruption, has led to inefficiency in solid waste management. These findings are consistent with those of Boadi and Kuitunen (2003), who identified governance issues as a major obstacle to effective waste management in African cities.

Strengthening institutional frameworks and ensuring accountability are essential steps to address these challenges. Public-private partnerships, such as those seen in Lagos and Nairobi, offer a promising model for improving service delivery in informal settlements. Finally, the study highlights the environmental and health impacts of poor waste management. Uncollected waste contributes to flooding, land and water pollution, and greenhouse gas emissions. These results are consistent with those of UNEP (2018), which documented the global environmental consequences of inadequate waste management. In Lusaka, health risks associated with poor waste management, including cholera outbreaks and respiratory diseases, highlight the urgency of addressing this issue.

In conclusion, the discussion reveals that solid waste management in informal settlements in Lusaka is a complex problem that requires multi-stakeholder collaboration, community engagement and innovative solutions. Although the challenges are significant, the study identifies opportunities for improvement through the integration of informal waste collectors, increased community participation and strengthened governance. These findings contribute to the wider discourse on solid waste management in developing countries and provide actionable insight for policy makers and practitioners seeking to address the challenges of waste management in settlements informal urban.

5 THEORETICAL FLAMEWORK

The theoretical framework of this study is based on systems thinking and the waste management hierarchy, which together provide a comprehensive perspective for analyzing solid waste management (SWM) in informal settlements. These frameworks allow for the examination of SWM as an interconnected system influenced by social, economic, environmental and governance factors. This approach is particularly relevant in the context of Lusaka slums, where waste management issues are deeply rooted in broader urbanization and socio-economic challenges.

The waste management hierarchy, widely accepted as a fundamental model of SWM, emphasizes the priority of waste reduction, reuse and recycling over disposal. This hierarchy supports several global strategies aimed at achieving sustainable waste management. However, its practical implementation in informal settlements is often limited due to insufficient infrastructure, lack of public awareness and resource constraints. In these contexts, the model serves more as an aspirational framework, guiding the identification of gaps and opportunities for improvement, rather than prescribing specific interventions.

Complementing the hierarchy, systems thinking provides a holistic approach to understanding the complexity of waste management in informal settlements. Systems thinking recognizes that waste management is not an isolated problem, but is part of a broader urban ecosystem that includes social behaviors, economic activities, governance structures and environmental impacts [3]. For example, inadequate waste collection services in slums are linked to governance inefficiencies, which in turn affect residents' waste disposal practices and exacerbate environmental degradation. This interdependence highlights the importance of integrated, multi-stakeholder solutions that address root causes rather than symptoms.

The study is also informed by social capital theory, which emphasizes the role of community networks and collective action in addressing common challenges. In the context of solid waste management, social capital is evident in informal networks of waste collectors, community-led clean-up initiatives, and the willingness of residents to participate in waste management programs. The use of these networks can improve the effectiveness of solid waste management interventions by fostering trust, cooperation, and shared responsibilities among stakeholders [4].

In addition, the study considers environmental justice theory, which emphasizes the equitable distribution of environmental benefits and burdens. Informal settlements such as those in Lusaka are often marginalized in terms of access to municipal services, including waste management, leading to disproportionate exposure to environmental hazards. This theoretical perspective emphasizes the need for comprehensive policies that address the systemic inequalities faced by slum dwellers [5].

By integrating these theoretical perspectives, the study provides a solid framework for analyzing the multidimensional challenges of waste management in informal settlements in Lusaka. This approach not only deepens our understanding of the dynamics of waste management, but also informs the development of targeted, sustainable, and equitable solutions [6].

6 RESEARCH GAP

Despite the growing recognition of the importance of solid waste management (SWM), significant gaps remain in understanding and addressing the unique challenges faced by informal settlements, particularly in sub-Saharan Africa. Most existing research focuses on urban waste management at the municipal or national level, often generalizing challenges without delving into the specific and localized problems of informal settlements. These areas, characterized by high population density, inadequate infrastructure and poverty, face unique waste management challenges that require tailored solutions.

However, there is a lack of detailed studies that explore the socio-economic, environmental and cultural factors that influence waste management behaviors and practices in such contexts.

This gap limits the development of interventions that correspond to the lived realities of informal settlement residents. Insufficient attention is paid to the informal waste sector. Informal waste collectors and recyclers play an important role in waste management in slums, often compensating for the inadequacy of formal municipal services [7]. However, their contribution remains undervalued and research on how their work can be formalized and integrated into structured solid waste management systems is limited. Studies rarely examine how their inclusion can improve the overall efficiency of waste management and bring social and economic benefits, such as job creation and improved livelihoods.

This lack of attention to the informal sector leaves an important part of the solid waste management process unexamined and unsupported. Community participation in solid waste management is another underexplored area. While many studies emphasize the importance of local community participation in waste management processes, little research has been conducted on the specific barriers to participation in informal settlements. Factors such as lack of awareness, financial constraints, and lack of trust in municipal authorities often hinder community engagement. Research rarely examines strategies to mobilize and sustain resident participation, particularly in contexts where resource constraints and competing priorities significantly impact their willingness and ability to engage in solid waste management initiatives. Furthermore, the intersection between governance and solid waste management in informal settlements has not been sufficiently addressed in the literature. Governance issues such as fragmentation of responsibilities, insufficient funding and lack of policy implementation compound the challenges of waste management [8]. However, little research has been conducted on how these systemic issues interact with the socio-economic dynamics of informal settlements to perpetuate inefficient waste management practices. Furthermore, innovative governance models, such as public-private partnerships and decentralized waste management systems, remain unexplored in the context of low-resource settings.

Finally, while the environmental and health impacts of poor waste management are widely recognized, the long-term implications for informal settlements have not been studied in depth. Most studies highlight immediate risks, such as pollution and disease outbreaks, but few examine how prolonged exposure to inadequate waste management practices affects the well-being of these communities over time. Furthermore, there is a lack of research on how emerging approaches, such as circular economy principles and climate-resilient waste management strategies, can be adapted to the specific needs and constraints of informal settlements.

These gaps highlight the need for comprehensive and localized research that bridges the gap between academic discourse and ground realities. By filling these gaps, future studies can contribute to the development of comprehensive, sustainable, and context-specific solutions for solid waste management in informal settlements, thereby improving environmental outcomes and the quality of life of marginalized urban populations.

7 CONCLUSION

Solid waste management (SWM) in informal settlements, particularly in rapidly urbanizing areas such as the slums of Lusaka, represents a fundamental challenge that requires multidimensional and localized solutions. These areas are disproportionately affected by inadequate waste management systems, leading to severe environmental degradation, public health risks and socio-economic inequality. This study has highlighted the complexity of SWM in such contexts, where the interplay of poverty, limited infrastructure, weak governance and cultural practices create unique barriers to effective waste management. Addressing these issues requires a comprehensive approach that prioritizes the needs and capacities of marginalized communities.

7.1 One of the Main Conclusions of This Study is the Important but Undervalued Role of the Informal Waste Sector

Informal waste collectors and recyclers play a vital role in the solid waste management process, often filling the gap left by inadequate municipal services. Their efforts contribute to waste collection and recycling, thereby reducing the overall burden on the environment. However, the lack of formal recognition and integration of these actors into official waste management systems limits their impact and sustainability. Formalizing their role through supportive policies,

training and access to resources can not only improve their efficiency, but also create economic opportunities and improve their livelihoods.

7.2 Community Participation has Emerged as Another Crucial Factor in Improving Solid Waste Management in Informal Settlements

The study highlighted that active participation of residents in waste management initiatives leads to better waste sorting, collection and disposal practices. However, barriers such as low levels of awareness, financial constraints and distrust of local authorities prevent sustainable participation. Overcoming these barriers requires targeted interventions, including community education programmes, awareness campaigns and the provision of affordable waste management solutions. Empowering communities to take ownership of solid waste management can foster collective responsibility and ensure the long-term success of interventions.

7.3 Governance and Institutional Capacity also Play a Central Role in Addressing the Challenges of Solid Waste Management in Informal Settlements

The study found that fragmentation of responsibilities across government agencies, insufficient funding and weak policy implementation exacerbate waste management problems. Strengthening governance structures and fostering cooperation among different stakeholders are essential to overcome these challenges. Innovative governance models, such as public-private partnerships and decentralized waste management systems, offer promising avenues for improving efficiency and accountability. These models can also facilitate resource mobilization and ensure that waste management efforts are tailored to the specific needs of informal settlements.

7.4 The Environmental and Health Consequences of Inadequate Waste Management in Informal Settlements Cannot be Overstated

Poor waste management contributes to pollution, the spread of disease and increased vulnerability to environmental hazards, disproportionately affecting already marginalized populations. Long-term strategies that integrate environmental sustainability and public health considerations are essential. Adopting circular economy principles, which focus on reducing waste and maximizing resource use, can provide sustainable solutions while mitigating environmental impacts.

7.5 This Study Highlights the Urgent Need for Comprehensive and Context-Specific Approaches to Waste Management in Informal Settlements

Effective solutions must integrate informal waste management actors, promote community participation, strengthen governance and adopt innovative and sustainable practices. Bridging the gap between research and practice, this study provides valuable insights into the broader debate on sustainable urban development and waste management. Policymakers, practitioners and stakeholders should prioritize inclusive and participatory strategies to transform solid waste management systems, ensuring environmental sustainability and improving the quality of life of the most vulnerable urban populations. Through collective efforts and targeted actions, it is possible to create resilient waste management systems that address the unique challenges of informal settlements.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

FUNDING

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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