INDERSCIENCE PUBLISHERS
Linking academia, business and industry through research

International Journal of Global Environmental Issues

ISSN online: 1741-5136 - ISSN print: 1466-6650
https://www.inderscience.com/ijgenvi

The impact of fostering public participation in improving waste quality in a comprehensive solid waste management system

Edmore Shamu, Thabang Maphanga, Boredi S. Chidi, Patience Mbola, Babalwa Gqomfa, Xolisiwe Sinalo Grangxabe, Karabo Concelia Malakane, Benett Siyabonga Madonsela, Terry Takalani Phungela

DOI: 10.1504/IJGENVI.2025.10071535

Article History:

Received:	02 May 2024
Last revised:	16 May 2024
Accepted:	22 September 2024
Published online:	04 June 2025

The impact of fostering public participation in improving waste quality in a comprehensive solid waste management system

Edmore Shamu and Thabang Maphanga*

Ecological Biotechnology Research Group,
Department of Environmental and Occupational Studies,
Faculty of Applied Sciences,
Cape Peninsula University of Technology,
Corner of Hanover and Tennant Street,
Zonnebloem, Cape Town, South Africa
Email: edmoreshamu@gmail.com
Email: Maphangat@cput.ac.za
*Corresponding author

Boredi S. Chidi

Ecological Biotechnology Research Group,
Department of Biotechnology and Consumer Science,
Faculty of Applied Science,
Cape Peninsula University of Technology,
Corner of Hanover and Tennant Street,
Zonnebloem, Cape Town, South Africa
Email: Chidib@cput.ac.za

Patience Mbola, Babalwa Gqomfa and Xolisiwe Sinalo Grangxabe

Ecological Biotechnology Research Group,
Department of Environmental and Occupational Studies,
Faculty of Applied Sciences,
Cape Peninsula University of Technology,
Corner of Hanover and Tennant Street,
Zonnebloem, Cape Town, South Africa
Email: Mbolap@cput.ac.za
Email: Gqomfab@cput.ac.za
Email: Grangxabex@cput.ac.za

Karabo Concelia Malakane

Department of Biodiversity,
School of Molecular and Life Sciences,
University of Limpopo,
Private Bag X1106, Sovenga, 0727, South Africa
Email: Karabo.malakane@ul.ac.za

Benett Siyabonga Madonsela

Ecological Biotechnology Research Group,
Department of Environmental and Occupational Studies,
Faculty of Applied Sciences,
Cape Peninsula University of Technology,
Corner of Hanover and Tennant Street,
Zonnebloem, Cape Town, South Africa
Email: Madonselab@cput.ac.za

Terry Takalani Phungela

Ecological Biotechnology Research Group,
Department of Environmental and Occupational Studies,
Faculty of Applied Sciences,
Cape Peninsula University of Technology,
Corner of Hanover and Tennant Street,
Zonnebloem, Cape Town, South Africa
and
Department of Water and Sanitation,
35 Brown Street, Mbombela, RSA, South Africa
Email: Phungelat@dws.gov.za

Abstract: A variety of factors, such as efficient waste management techniques, community awareness and attitudes, laws that promote community involvement, and the active involvement of important stakeholders such as local governments and formal and informal partners, all contribute to the facilitation of community engagement in solid waste management. The benefits and active involvement of communities such as Atlantis in South Africa in decisions regarding solid-waste management were explored from this perspective. It has been found that community involvement can occur at different stages and levels of intensity throughout the project lifecycle, with the aim of strengthening community members' ability to sustain project services once the facilitating organisation concludes its operations. Profitable community initiatives include residential waste segregation prior to municipal waste collection, recyclable marketing, and community decomposition programs. However, community participation can be crucial for addressing the complexities of sustainable solid waste management and the unique characteristics of indigenous low-income suburbs, such as Atlantis in South Africa.

Keywords: community participation; illegal dumping; economy; South Africa; environmental management.

Reference to this paper should be made as follows: Shamu, E., Maphanga, T., Chidi, B.S., Mbola, P., Gqomfa, B., Grangxabe, X.S., Malakane, K.C., Madonsela, B.S. and Phungela, T.T. (2025) 'The impact of fostering public participation in improving waste quality in a comprehensive solid waste management system', *Int. J. Global Environmental Issues*, Vol. 24, No. 5, pp.1–16.

Biographical notes: Edmore Shamu is a Master's candidate a highly knowledgeable and skilled Learning and Development Specialist with excellent interpersonal skills and strong abilities in designing, conducting and implementing training and educational programs. Effective management professionals emphasise innovation and creativity in solving complex problems. He has energetic and result-focused with success in developing and leading diverse teams to achieve outstanding results. He is a training professional with extensive leadership experience in staff development, process and productivity improvements, performance management and curriculum design. He has superior technical writing skills and thorough knowledge of adult learning theory and best training program practices.

Thabang Maphanga is an experienced academic with more than ten years of experience in higher education. He demonstrated skill in creating connections and fostering confidence with students from diverse backgrounds, particularly first-generation university students. He is also a Co-PIf an institutional research group; Ecological Biotechnology Research Group (EcoBio) in the Applied Sciences faculty. Throughout his tenure as a researcher, he has authored an over 40 internationally peer reviewed publications in reputable journals, one book chapter.

Boredi S. Chidi is a Senior Lecturer at Cape Peninsula University of Technology and has more than ten years industry and research experience to date. He is a PI of an institutional research group; Ecological Biotechnology Research Group (EcoBio) in the Applied Sciences faculty. His current research interests are on bioprocess development, bioprocess engineering, fermentation technology, winemaking, enzymology, microbiology, biotechnology, biochemistry, environmental science, and others. Throughout his tenure as a researcher, he has authored a total of 57 scholarly publications in reputable journals, one book chapter, and has contributed to the proceedings of 12 conferences.

Patience Mbola is a qualified Environmental Health Practitioner and currently serves as an Academic Lecturer in the Department of Occupational and Environmental Studies at the Cape Peninsula University of Technology. She holds a Master's in Environmental Health from Nelson Mandela University and is presently pursuing a PhD at Tshwane University of Technology. Her research interests focus on strengthening Environmental Health practice, with a particular emphasis on disaster hazard management.

Babalwa Gqomfa is a Lecturer in 'Environmental' Resources at the Cape Peninsula University of Technology (CPUT). Her main research interests are water quality, pollution, waste management, sustainable development, water law, and environmental impact assessment. She is pursuing her PhD, focusing on micro- and nanoplastics in aquatic environments. She has co-authored several papers including: The impact of informal settlement on water quality of Diep River in Dunoon, El Niño southern oscillation (ENSO) implication towards crocodile river water quality in South Africa, and The state of public participation in the EIA process and its role in South Africa: a case of Xolobeni.

Xolisiwe Sinalo Grangxabe is a PhD candidate in Environmental Management with over four years of experience. She specialises in community engagement, academia and environmental conservation. She has contributed to various research publications, addressing waste management and air quality issues. Her expertise also includes actively participating in community outreach, such as beach clean-ups, demonstrating her commitment to enhancing environmental awareness and building strong stakeholder relationships.

Karabo Concelia Malakane is experienced academic and researcher with over eight years of expertise in biodiversity, ecology, environmental management, and environmental law. She excels in creating connections within interdisciplinary environments and fostering collaboration. Her strong research and verbal communication skills are essential for effective teamwork. She holds a Master's in Zoology and Bachelor's in Law (LLB). Additionally, she has published over 15 internationally peer-reviewed articles, and one book chapter focused on aquatic ecology, environmental health, waste management, environmental management, and biodiversity.

Benett Siyabonga Madonsela is a Lecturer and Research Fellow in the Department of Environmental and Occupational Studies at the Cape Peninsula University of Technology, South Africa. He is a Co-PI of an institutional research group; Ecological Biotechnology Research Group (EcoBio) in the applied sciences faculty areas of research interest include the advancement of indigenous solid waste management knowledge systems and air quality.

Terry Takalani Phungela is a PhD candidate and water resources scientist with a focus on biological wastewater treatment, according to his LinkedIn profile. He is also a published scholar and was featured in the 2023 News 24 100 Young South Africans. He works on ResearchGate and Google Scholar.

1 Introduction

Historically, the perception of waste as a waste less and valueless substance has existed. Improper solid waste (SW) management has contributed to the environmental degradation of the community and even caused health problems (Mohammed and Elias, 2017). African countries are faced with a huge amount of SW, which has a direct effect on human health, safety and the environment however it is one of the issues facing the world globally (Bello et al., 2016; Mihai and Taherzadeh, 2017). As per Miller's (2002) definition, SW refers to any non-liquid or non-gaseous material that is considered worthless, undesirable, or wasted and this includes domestic waste. SW is characterised by a diverse combination of components, such as rubble, metal, glass, paper, cardboard, textiles, putrescible materials, vegetable products, and plastic. Environmental elements include biophysical, socioeconomic, political, scientific-technological, contextual, and personal factors. The interaction of these components can either enhance or degrade the environment. Waste is easily recognisable than defined. Some consideration is taking some materials as waste when they are no longer useful to the owner or it is used and fails to fulfil its purpose (Bulle, 1999).

There has been a significant global focus on waste management issues, specifically regarding their environmental impacts. A series of conferences, encompassing local, regional, and international scopes, has been convened with the objective of mitigating the environmental consequences of development. The significance of waste management in achieving sustainable environmental control has led to a proliferation of studies aimed at understanding the associated challenges. Agenda 21, which emerged from the United Nations Conference on Environment and Development (UNCED) in 1992, highlights the adverse consequences, both immediate and prolonged, of inadequately regulated waste management on both the natural environment and human well-being. Despite the increasing recognition of the potential environmental hazards associated with inadequate

management of SW, the responses observed in developing nations have been contradictory. Many African nations are grappling with the problem of inadequate rubbish collection services, which significantly impacts the waste management system in informal settlements (Grangxabe et al., 2023a, 2023b). This trend is observable in townships and rural regions, where the practice of incinerating junk is prevalent as a means to diminish waste generation. The repercussions arise due to the absence of waste disposal services. The practices result in the emission of greenhouse gases, which contribute to the deterioration of air quality (Khumalo, 2016; Cogut, 2016; Wang et al., 2018). In informal settlements, solid garbage is frequently left uncollected, resulting in accumulation along roadsides and open spaces (Mihai and Grozavu, 2019). The unregulated disposal of waste results in its dispersion throughout various locations, including water bodies and grazing lands, among others.

Sauro (2006) conducted a study on residential SW management in India and identified certain deficiencies in the existing practices. These deficiencies strongly suggest that public participation may be the most viable solution. The study conducted by Joardar (2000) revealed a deficiency in the implementation of a systematic waste sorting process at various stages, starting from the point of waste generation to its final disposal sites. Additionally, a significant discovery was made indicating that incineration has not demonstrated effectiveness in managing waste due to the heterogeneous nature of the waste stream, which is not subjected to sorting processes (Madonsela et al., 2024). The responsibility for basic sorting of waste should ideally be assumed by the public at the point of waste generation. The practice of waste sorting is essential for achieving sustainable management of SW.

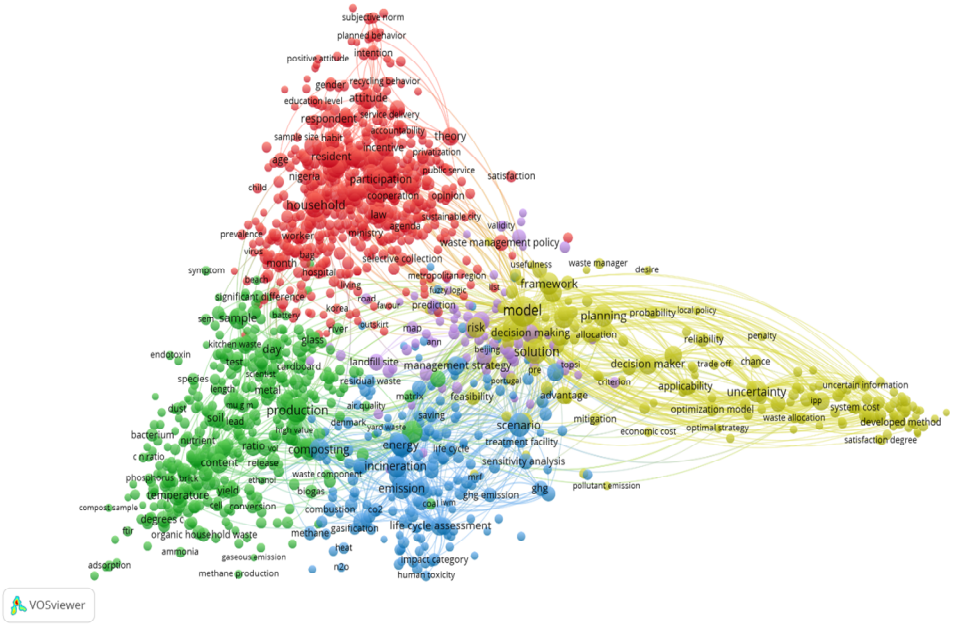
South Africa encounters numerous challenges in the waste management sector, particularly at the municipal level, where individuals responsible for overseeing the process lack adequate training in SW management (Marshall and Farahbakhsh, 2013). Insufficient understanding of waste management within communities exacerbates the preexisting issue. The improper disposal of waste has significant implications for waste management and the environment, encompassing health hazards, aesthetic degradation, and the generation of unpleasant odours, among other factors. Hence, the involvement of local communities in the management of SW is deficient in developing nations. SW is a significant factor in the multitude of challenges that contribute to the degradation of the environment. In order to mitigate the adverse effects of inadequate SW management at the local level, it is imperative for communities and municipalities to engage in collaborative efforts. The global economies have experienced a significant growth rate, and South Africa has also been a participant in this trend. The exponential expansion has resulted in a corresponding escalation in the production of waste. As the economy experiences growth, there is a corresponding increase in consumption, leading to a subsequent rise in the quantity of SW produced.

The issue under investigation arises from the escalating prevalence of environmental pollution in urban regions of South Africa, attributable to inadequate practices in the management of SW. Inadequate management of SW collection and disposal poses a significant risk to public health and the overall well-being of urban inhabitants. The phenomenon of rapid urbanisation in South Africa has resulted in the emergence of informal settlements across various urban areas. These informal settlements are characterised by a lack of essential services, particularly around SW management. The absence of a consistent waste management system has led to the indiscriminate disposal of SW in various locations such as vacant lots, public areas, rivers, and the practice of

incineration within residential premises. The accumulation of uncollected SW on drains and its subsequent infiltration into sewage systems can result in the occurrence of sewage spills and flooding. Sewage spills are frequently observed in Witsand, a low-income suburb of Atlantis in South Africa (DEDAT, 2016).

SW dumps create an environment conducive to the proliferation of rodents and insects. Rodent and insect infestation is prevalent in informal settlements and many low-income residential areas within South Africa. These vectors, which transmit diseases, present a significant risk to the overall well-being of the general population. Diseases such as yellow fever, malaria, diarrhoea, and dysentery are prevalent in regions characterised by inadequate SW management practices. The waste management systems in impoverished communities continue to decline, despite the government's responsibility for maintaining environmental cleanliness. The inquiry pertains to the perspective and involvement of the community within the existing waste management system in impoverished communities of South Africa.

Figure 1 Structure of research in Web of Science using specialised VOSviewer tool software2 (see online version for colours)



The involvement of the community is crucial for the efficient handling of SW, especially in nations like South Africa where waste management challenges are prevalent. Involving communities in decision-making and waste management activities has the potential to enhance environmental sustainability, public health, and overall well-being (Grangxabe et al., 2023a). This paper offers a compelling perspective on the efficacy of community involvement in the management of SW, with a specific focus on South Africa. The study analyses the importance of community engagement, assesses current initiatives, identifies challenges and obstacles, explores successful examples, and provides suggestions for enhancing community involvement. Gaining insight into the function of communities in waste management enables policymakers, practitioners, and stakeholders to formulate

policies that promote sustainable waste management practices in South Africa and other locations (Grangxabe et al., 2023b) The escalating volume of SW generated in several places of the developing globe is a cause for concern due to its impact on the environment and public health (Kubanza, 2021). Utilising community participation as an intervention might prove to be a helpful recourse for individuals and communities in addressing this problem (Edward and Ofili, 2023). The current traditional paradigm of waste management, wherein waste management organisations and local governments provide structures and processes for SW management, is ineffective and unsustainable owing to inadequate coverage and failure to enforce existing regulations. Figure 1 generally indicates the veracity of community involvement in the domain of SW management across the globe. In the context of community participation VoS-viewer indicate a close relationship between household, respondent, attitude, waste incentive and residents amongst others.

2 Conceptual framework

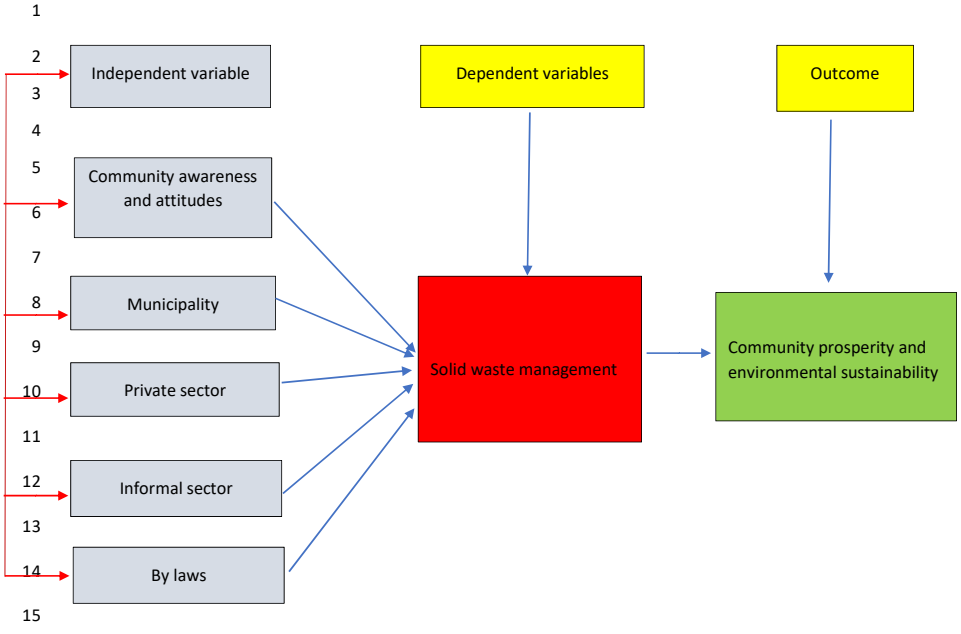
The conceptual framework presents a collection of fundamental concepts and principles for structuring and directing the discussion or analysis that follows (Kombo and Tromp, 2006). Conceptual frameworks serve as explanatory tools, presenting the fundamental concepts or variables and their hypothesised interrelationships either through graphical representations or narrative descriptions (Kombo and Tromp, 2006). The successful engagement of the community in SW management relies on various factors, including the implementation of effective waste management practices, the level of awareness and attitudes among community members, the existence of legislation supporting community participation, and the active involvement of key stakeholders such as local authorities and formal and informal partners. According to the existing body of literature, the conceptual framework has identified various concerns pertaining to community involvement in SW management, particularly in relation to the overall well-being of society. This study examines the impact of community involvement in SW management on community welfare, focusing on indicators such as the creation of employment opportunities, the rise in health risks, and environmental pollution. The intervening variables encompass slum expansion, economic ramifications, and political polarisation. The diagram presented in Figure 2 illustrates the correlation between dependent and independent variables and the anticipated results.

3 Community participation in SW management

Anschutz (1966) defines a community as a group of people living in a certain geographical area, who have access to the use of the same services or resources. In this study, community participation will focus on the active processes in which the community influences decisions on or takes part in SW management in Atlantis. Community participation refers to the involvement of community members at various stages and levels of intensity throughout the project cycle. The aim is to enhance the community's ability to sustain the services established during the project even after the facilitating organisation has departed (Waste, 2002). Communities may be involved in waste separation at a household level before municipal refuse collection, collecting

recyclables and selling them and even setting up community composting programmes as an income generation venture. Briefly, community participation in SW management can benefit local authorities, as it will greatly save them in terms of collection and disposal costs (Hope, 1998; Grangxabe et al., 2024).

Figure 2 Conceptual framework for community participation in SW management (see online version for colours)



The concept of community participation emerged as a response to the growing advocacy for the elimination of top-down development strategies, in favour of a more inclusive approach that involves stakeholders in development programs (Cohen et al., 2000; Grangrabe et al., 2023a). There exists a disparity in the extent of public participation between developing and developed nations (Oberlin, 2011; Grangrabe et al., 2023a). In developing nations, community engagement primarily encompasses the practice of waste segregation, wherein individuals sort their waste, and private enterprises assume responsibility for its collection and remuneration for the segregated materials. The fees are remitted to finance the comprehensive waste sorting process implemented by the community. Private waste collectors are entrusted with the responsibility of managing waste, albeit for a fee (Oberlin, 2011; Maphanga and Madonsela, 2023).

In 2008, Practical Action Nepal implemented a waste collection service at the household level, supported by funding from the European Union. This initiative led to the generation of employment opportunities within the community. Several individuals from the community were employed as street sweepers, while strategically positioned dumpsters were provided to facilitate the convenient disposal of segregated waste. The implementation of this initiative has led to a significant decrease in the indiscriminate disposal of waste in open areas and along the riverbanks in Biratnagar. The Greater Chennai Corporation (2016) has actively engaged individuals, communities, and non-governmental organisations in collaborative efforts aimed at promoting sustainable

waste management practices and transforming waste into valuable resources. This has facilitated the corporation in managing the increasing quantity of waste produced because of rapid urbanisation. The active participation of stakeholders who are directly impacted by SW management is crucial for achieving sustainability in this domain.

4 Implementation of community participation in developing countries' SW management

In the developing world, communities continue to be considered as passive recipients of government services and are often not consulted in local decision-making processes (Tadesse, 2006). Community participation could therefore provide a key link to sustainable SW management. It is essential to involve the immediate stakeholders because they will be the first ones to bear the brunt of inappropriate SW management practices. Communities are part of the waste generators; hence authorities need to work with them in ameliorating the impacts on health and the environment. Waste volumes have continued to mount in urban areas as a result of a rapid increase in population, increased consumption patterns, industrial expansion and inadequate finance and facilities to manage waste collection and disposal (National Environmental Management Act – NEMA). This has created a situation where a SW generation has outstripped the ability of the available facilities and systems to handle the menace.

In a study conducted by Tevera (1988), an examination was undertaken to investigate the extent of involvement in community-based SW management within the Nkulumane Suburb located in Bulawayo, Zimbabwe. The data in this study was gathered through a combination of door-to-door surveys and interviewer-administered questionnaires, which were used to collect information from households that were randomly selected. Data was also collected from officials responsible for SW management through the use of semi-structured interviews. The study's results indicate that the integration of community participation in SW management has not effectively mitigated the prevalence of improper waste disposal practices within local communities. There was a lack of significant initiative in implementing alternative waste management practices such as waste recycling and composting. The exacerbation of this issue was attributed to the municipality's insufficient SW infrastructure, specifically the absence of adequate waste containers, which hindered the community's ability to separate waste at its origin. The research findings of Liyala (2011) and Araen et al. (2015) align with the research conducted by Tevera (1988), indicating a dearth of community involvement in African developing nations. Liyala (2011) conducted a study on the issue of SW financing in Kisumu, Kenya. The research revealed that the inability of impoverished communities to afford waste collection services had significant consequences for the management of SW. This concept led to the adoption of various practices by community members, such as incinerating waste, burying it within their own premises, or disposing of it in unregulated areas. In Jalingo City, Nigeria, a study was conducted by Araen et al. (2015) to examine the effects of public participation on SW management. The study findings revealed that a significant proportion of individuals refrained from engaging in SW management due to the absence of collaborative frameworks facilitating greater cooperation between the general public and waste management authorities.

Despite the positive factors that could promote effective community participation in SW management, other issues have the potential to limit that. Anschutz (1966) identified

that a felt need is a precondition for the successful realisation of community participation in SW management. The low prioritisation of SW management can be one of the biggest obstacles to community participation. Communities may also have a lack of willingness to keeping public places clean, waste separation, collection, composting or recycling.

5 Impacts of community participation in SW management

The limited availability of financial, technical, and human resources poses significant challenges for the majority of local authorities in developing countries when it comes to sustaining essential services such as SW management. Community participation plays a crucial role in providing a valuable human resource at a reduced cost, thereby alleviating the burden placed on limited financial resources. According to Cotton et al. (1998), the engagement of community members in local initiatives fosters a sense of accountability and fosters a greater sense of ownership in the upkeep of services offered by local governing bodies. The engagement of community members fosters a discourse surrounding the importance of comprehending and reaching consensus on the allocation of costs related to both physical and financial contributions. Community participation plays a pivotal role in mitigating conflicts and fostering cooperation and understanding among diverse stakeholders. According to Colon and Fawcett (2006), active involvement of the community can lead to a decrease in project execution delays and conflicts, resulting in a reduction in overall costs. Active participation contributes to the development of effective negotiating abilities and fosters collaborative relationships between governing bodies and various stakeholders, thereby facilitating the pursuit of shared goals and enhancing the capacity to address community issues promptly and effectively. The implementation of this approach provides communities with the ability to proactively develop and implement strategies aimed at enhancing their surrounding environment.

The involvement of the community in sustainable SW management fosters a sense of collective responsibility in coordinating endeavours such as clean-up initiatives, meetings, and campaigns aimed at raising awareness (Colon and Fawcett, 2006). Participation may also encompass the mobilisation of financial and material resources in order to enhance waste collection. The implementation of waste-sorting initiatives leads to a substantial increase in the availability of recyclable materials, consequently giving rise to the establishment of manufacturing facilities that will effectively utilise these materials. This development in turn generates employment opportunities. According to the Asian Development Bank (ADB, 2002), there will be emerging opportunities for the establishment of micro-enterprises involved in the recycling of paper, tetra pack cartons, and pet bottles.

The process of waste collection, sorting, and processing requires a significant amount of labour. In certain nations, communities have taken additional measures to engage labourers in the aforementioned role, thereby generating employment opportunities. According to the Environmental Protection Agency (EPA, 2002), the employment opportunities resulting from recycling 10,000 tons of waste material are estimated to be 36 individuals, whereas landfilling the equivalent workload would only employ six individuals. According to Gupta (2001), the waste sector in India employs a workforce exceeding one million individuals. According to Bournay (2006), the implementation of sustainable SW management practices not only facilitates financial gains for those

involved but also provides developing countries with the opportunity to export waste metals and plastics, thereby generating valuable foreign currency. According to Achankeng (2003), a portion of the waste that has been sorted and segregated is purchased by artisans and women's groups. These individuals then transform the waste into various products, including hats, bags, necklaces, baskets, door rugs, and seedling cups. These crafted items are subsequently sold within the local community. Recycling is a crucial and economically viable approach to waste management. Compared to the methods of landfilling and incineration, recycling necessitates fewer government subsidies, thereby mitigating environmental impacts. Recycling has been advocated for various reasons, including the potential for lower taxes, energy conservation, and the promotion of a cleaner environment (Achankeng, 2003).

6 Challenges of community participation in sustainable SW management

Community participation in sustainable SW management processes is challenged by several factors depending on the method chosen for that purpose, as well as the characteristics of the households in a particular area. Attitudes towards recycling are influenced by appropriate opportunities, facilities, and convenience (Achankeng, 2003). The diversity of people with regards to their knowledgebase and feelings plays a critical role in their level of involvement and ultimately affects their attitudes. Cooperation from municipal authorities and the community is essential as the authorities have the responsibility of collecting and disposing of the left-over waste. It is the municipality's responsibility to allocate composting space to the community. A below-par performance from municipal authorities will create challenges for community interventions (Ramkumar, 1996). Some community members assume that participation is an extra voluntary task to which they may not fully commit themselves. The prevailing of such attitudes results in the collapse of systems with no one running and monitoring on a full-time basis (Crown, 2012).

Information, knowledge, and awareness gaps amongst community members makes participation a challenging process. Read et al. (1998) discovered that there was low awareness about the best practices in waste minimisation across the different administrative areas in the UK. Community participation can be effective by narrowing the knowledge and awareness gaps. Community involvement with the presence of knowledge gaps can create challenges in the participatory approach. Insufficient awareness and appreciation of sound sustainable environmental management practices is a major constraint and requires a major paradigm shift within the community and society at large (USEPA, 1998). Essential policies must be devised by authorities because they give direction and impetus to the sustainable SW management system. The absence of clearer public policies has rendered such activities impossible in most parts of the developing world (Joader and Sauro, 2006). The participation of effective participation of communities in sustainable waste management becomes difficult in a structure that is devoid of clear public policies.

The participation of the private sector in SW management concentrates on municipalities contracting out secondary waste collectors by transferring the waste to dumpsites (Joader and Sauro, 2006). The participation of communities is still non-existent but provides the potential for promoting sustainable SW management. Strategies must be devised to enlist communities to embrace participation in SW

management. Kaseva and Mbulingwe (2005) also noted that negative attitude and culture impacted on public participation. They also noted that low levels of living, low literacy levels and poor economic performance were influencing factors on the low levels of willingness to participate in community SW management factors. Public policies must be devised to encourage public participation. Waste management issues in African counties remain low compared to other national development needs. Well-trained personnel and updated equipment should be made available to enhance sustainable waste management practices. This has been affected by the high cost of borrowing to purchase waste equipment. In most African countries, the population is generally poor and are reluctant to pay for waste collection fees (Borongan and Okumura, 2010). Most local institutions also lack the infrastructure and resources to enforce laws, regulations and policies under their jurisdiction (Rotich et al., 2006). In most municipalities in the developing world, sustainable SW management is constrained by many hurdles. These hurdles include poor funding, poor administration, lack of transport, equipment, and inadequate remuneration for qualified staff. There is also an absence of adequate human and financial capital for local authorities to manage waste properly.

In African nations, waste separation at the source is limited, national policies aimed at waste reduction are lacking, and the practice of mixing various waste streams, including hazardous waste with domestic waste, is prevalent. The utilisation of recyclable materials is generally limited, and there is inefficiency in the recycling process, particularly for organic waste. Additionally, there is a lack of technical support to upgrade waste recycling facilities, insufficient markets for certain recycled products, and a scarcity of institutions dedicated to the recovery and recycling of hazardous wastes and empty containers (Ellen MacArthur Foundation, 2015).

7 Plausible community participation initiatives in SW management

An instance of effective community engagement in SW management involves the implementation of recycling programmes. By encouraging residents to separate recyclables from regular garbage, these programmes help to reduce the amount of waste sent to landfills (Kadyamadare and Samson, 2024). An additional effective endeavour entails the installation of composting systems, which enable inhabitants to effectively eliminate organic waste, including yard trimmings and food leftovers (Ayilara et al., 2020). These initiatives not only facilitate waste reduction but also advocate for an environmentally conscious and sustainable approach to waste management. As an illustration, within a municipality grappling with substantial SW accumulation, a viable community engagement endeavour might encompass the proliferation of recycling facilities across diverse residential areas (Viljoen et al., 2021). Indeed, by employing locals who have received training in waste segregation and recycling methods, these centres would be operated, empowering the community to assume responsibility for waste management and generating employment opportunities. Furthermore, the recycling centres may serve as a means to facilitate the collection and subsequent composting of yard waste, including leaves and grass clippings. By diverting organic waste from landfills, this approach would generate compost that is abundant in nutrients and suitable for gardening and agriculture purposes by local inhabitants (Hargreaves et al., 2008). Moreover, it would support the circular economy and diminish reliance on chemical fertilisers. For instance, a recycling centre could be established in a small town to educate

the public on proper waste segregation and recycling techniques. The centre can subsequently be managed by these community members who have received training in segregating and processing recyclable materials, thereby generating employment opportunities. Additionally, the facility may solicit garden trimmings from local inhabitants and convert them into nutrient-dense compost for agricultural and horticultural uses; this would promote sustainable practices and decrease reliance on chemical fertilisers.

8 Conclusions and recommendations for future action

Research carried out in some developing countries shows that most city dwellers staying in slums face mega problems with regards to SW management. Very little SW is collected leaving tonnes of garbage scattered everywhere. The shortage of essential services remains a serious challenge affecting social and environmental urban development. Despite the successful implementation of community participation in SW management in some African countries, South Africa still lags behind in that respect. Very little of such studies have been conducted in Western Cape Province and Cape Town in particular. This study therefore unravels the extent to which communities are engaged in SW management. Consequently, this study illustrates the degree to which communities participate in the administration of SW. We put forth the subsequent suggestions and prospective measures to enhance community engagement in the administration of SW in Cape Town and Western Cape Province. Prior to anything else, greater education and awareness campaigns are required to emphasise the significance of appropriate waste disposal and the community's capacity to manage its own waste. By means of disseminating informative materials and organising workshops and seminars, this can be accomplished. Furthermore, it is imperative that the local government institute unambiguous protocols and standards pertaining to waste management, thereby guaranteeing that communities are supplied with the essential infrastructure and resources. Lastly, fostering partnerships between local governments, community organisations, and non-governmental organisations can facilitate the development of inclusive and sustainable waste management initiatives that empower communities and promote environmental responsibility.

Consent for publication

All participants gave their consent for their data to be published in the journal article.

Declarations

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work in this article.

Data availability statement

The authors confirm that the data supporting the findings of this study are available within the article.

References

Achankeng, E. (2003) 'Globalisation, urbanisation and municipal solid waste in Africa. African studies of Australia and the Pacific, Adelaide', *Conference-Proceedings, African on a Global Stage*.

Anschutz, J. (1996) *Community Based Solid Waste Management and Water Supply Projects: Problems and Solutions Compared. Urban Waste Expertise Program (UWEP)*, Community Participation in Waste Management, UWEP Working Document 2, Waste, Gouda.

Araen, A.S., Nabengu, A.B., Shenpam, G.D., Ali, A.B. and Giwa, C.Y. (2015) 'An analysis of public participation in solid waste management in Jalingo City, Taraba State, Nigeria', *Journal of Multidisciplinary Scientific Research*, Vol. 3, No. 1, pp.1–26.

Asian Development Bank (ADB) (2002) *Solid Waste Management for Africa*, African Development Bank, Abidjan.

Ayilara, M.S., Olanrewaju, O.S., Babalola, O.O. and Odeyemi, O. (2020) 'Waste management through composting: challenges and potentials', *Sustainability*, Vol. 12, No. 11, p.4456, https://doi.org/10.3390/su12114456.

Bello, I.A., Ismail, M.N.B. and Kabbashi, N.A. (2016) 'Solid waste management in Africa: a review', *International Journal of Waste Resources*, Vol. 6, No. 2, pp.1–4.

Borongan, G. and Okumura, S. (2010) *Municipal Waste Management Report: Status-Quo and Issues in South East and East Asian Countries*, Copyright VAIT/UNEP Regional Resource Center for Asia and the Pacific, United Nations Environment Programme, Thailand, pp.1–43.

Bournay, E. (2006) *Vital Waste Graphics 2*, Vol. 2, UNEP/Earthprint, Arendal.

Bulle, S. (1999) *Issues and Results of Community Participation in Urban Environment*, Urban Waste Expertise Program, Patan City, Nepal.

Cogut, A. (2016) 'Open burning of waste: a global health disaster', *R20 Regions of Climate Action*, pp.1–63.

Cohen, L., Manion, L. and Morrison, K. (2000) *Research Methods in Education*, 5th ed., Routledge/Falmer, London.

Colon, M. and Fawcett, B. (2006) 'Community based waste management: lessons learnt from Exnora's zero waste management scheme in two south Indian cities', *Habitat International*, Vol. 30, No. 4, pp.910–941.

Cotton, A.R., Sohail, M. and Taylor, W.K. (1998) *Community Initiatives in Urban Infrastructure*, Loughborough University, London.

Crown, G. (2012) *Guidance on Legal Definition of Waste and its Application Food and Rural Affairs*, London [online] http://www.defra.gov.uk/environment/waste/legislation/eu-framework-directive/.

Department of Economic Development and Tourism (DEDAT) (2016) *Western Cape Integrated Waste Management Plan* [online] https://www.westerncape.gov.za/eadp/sites/eadp.westerncape.gov.za/files/atoms/files/Western%20Cape%20Integrated%20Waste%20Management%20Plan%202017-2022.pdf (accessed 10 April 2024).

Department of Environmental Affairs and Tourism (2012) *National Waste Management Strategy*, Pretoria [online] https://www.gov.za/sites/default/files/gcis_document/201409/env20122017combined.pdf.

Edward, E. and Ofili, A.N. (2023) 'Effect of community participation on knowledge, attitude and practice of domestic solid waste management in Uyo, Nigeria', *Ibom Medical Journal*, Vol. 16, No. 3, pp.237–245.

Ellen MacArthur Foundation (2015) *Towards a Circular Economy*, Ellen MacArthur Foundation, Brussels.

Environmental Protection Agency (EPA) (2002) *Campaigning Against Waste*, Washington DC [online] https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/epa-2002-guidelines-ensuring-and-maximizing-quality (accessed January 2024).

Grangxabe, X.S., Madonsela, B.S., Maphanga, T., Gqomfa, B., Phungela, T.T. and Malakane, K.C. (2024) 'An overview of waste management practices of street vendors in Sub-Saharan Africa: a meta-analysis', *Journal of Environmental Management*, Vol. 364, p.121464, https://doi.org/10.1016/j.jenvman.2024.121464.

Grangxabe, X.S., Maphanga, T. and Madonsela, B.S. (2023a) 'Public participation on waste management between nature reserves and surrounding informal settlement: a review', *Journal of the Air & Waste Management Association*, Vol. 73, No. 8, pp.589–599.

Grangxabe, X.S., Maphanga, T., Madonsela, B.S., Gqomfa, B., Phungela, T.T., Malakane, K.C., Thamaga, K.H. and Angwenyi, D. (2023b) 'The escalation of informal settlement and the high levels of illegal dumping post-apartheid: systematic review', *Challenges*, Vol. 14, No. 3, p.38.

Greater Chennai Corporation (2016) *Solid Waste Management*, Chennai [online] http://www.chennaicorporation.gov.in/departments/solid-waste-management/index.htm (accessed January 2024).

Gupta, S.K. (2001) *Rethinking Waste Management in India*, United Nations, Humanscape, New Delhi.

Hargreaves, J., Adl, M. and Warman, P., (2008) 'A review of the use of composted municipal solid waste in agriculture', *Agriculture, Ecosystems & Environment*, https://doi.org/10.1016/j.agee.2007.07.004.

Hope, E. (1998) *Solid Waste Management*, Canoe Press, University of West Indies (Ed.), West Indies.

Joader, D. and Sauro, D. (2006) 'Urban residential solid waste management in India', *Public Works Management and Policy*, Vol. 4, No. 4, pp.319–330.

Joardar, S.D. (2000) 'Urban residential solid waste management in India: issues related to institutional arrangements', *Public Works Management & Policy*, Vol. 4, No. 4, pp.319–330.

Kadyamadare, G. and Samson, M. (2024) 'Thinking households – how resident conceptualisations of waste, reclaimers and separation at source shape recycling practices', *Urban Forum*, Vol. 35, pp.25–46, https://doi.org/10.1007/s12132-023-09497-9.

Kaseva, M.E. and Mbuligwe, S.E. (2005) 'Appraisal of solid waste collection following private sector involvement in Dar es Salaam City, Tanzania', *Habitat International*, Vol. 29, No. 2, pp.353–366.

Khumalo, S.A. (2016) *Environmental Impact of Household Solid Waste Disposal Practices on Plant Growth in Rural Areas of KwaZulu-Natal: A Case Study of UThukela District Municipality*, Doctoral dissertation.

Kombo, D.K. and Tromp, D.L.A. (2006) *Proposal and Thesis Writing: An Introduction*, Pauline's Publications Africa, Nairobi.

Kubanza, N.S. (2021) 'The role of community participation in solid waste management in Sub-Saharan Africa: a study of Orlando East, Johannesburg, South Africa', *South African Geographical Journal*, Vol. 103, No. 2, pp.223–236.

Liyala, C. (2011) *Modernising Solid Waste Management Municipal Level*, Institutional Arrangements in Urban Centres in East Africa, Wageningen Academic Producers. Wageningen.

Madonsela, B.S., Machete, M. and Shale, K. (2024) 'Indigenous knowledge systems of solid waste management in Bushbuckridge rural communities, South Africa', in *Waste*, August, Vol. 2, No. 3, pp.293–311, MDPI.

Maphanga, T. and Madonsela, B.S. (2023) 'Evaluating waste management practices of street vendors in the informal settlement of Cape Town: a case study of Khayelitsha', *Anthropogenic Pollution*, Vol. 7, No. 2, https://doi.org/10.57647/j.jap.2023.0702.18.

Marshall, R.E. and Farahbakhsh, K. (2013) 'Systems approaches to integrated solid waste management in developing countries', *Waste Management*, Vol. 33, No. 4, pp.988–1003.

Mihai, F.C. and Grozavu, A. (2019) 'Role of waste collection efficiency in providing a cleaner rural environment', *Sustainability*, Vol. 11, No. 23, p.6855.

Mihai, F.C. and Taherzadeh, M.J. (2017) 'Introductory chapter: rural waste management issues at global level', *Solid Waste Management in Rural Areas*, Chapter 1, pp.1–10, ISBN: 953513485X, 9789535134855.

Miller, G.T. (2002) *Living in the Environment: Principles Connections and Solutions*, Wadsworth Group Books, New York.

Mohammed, A. and Elias, E. (2017) 'Domestic solid waste management and its environmental impacts in Addis Ababa city', *Journal of Environment and Waste Management*, Vol. 4, No. 1, pp.194–203.

Oberlin, A.S. (2011) *The Role of Households in Solid Waste Management in East Africa*, Wageningen Academic Producers, Wageningen.

Practical Action Nepal (2008) *Best Practices in Waste Management in Nepalese Cities. Practical Action Nepal*, Kathmandu.

Ramkumar, T.K. (1996) *Exnora's Case Study on Community Initiative in Municipal Solid Waste Management*, UMP/SDC, Cairo.

Read, D., Adan, P.S. and Murphy, A. (1998) 'Waste minimisation as a local government issue: fact or fiction', *Sustainable Development*, Vol. 6, No. 2, pp.78–91.

Rotich, H.K., Yongsheng, Z. and Jun, D. (2006) 'Municipal solid waste management challenges', *Waste Management*, Vol. 26, No. 1, pp.92–100.

Sauro, U. (2006) 'Changes in the use of natural resources and human impact in the karst environments of the venetian Prealps', *Acta Carsologica*, Vol. 35, Nos. 2–3.

Tadesse, E. (2006) *The People Shall Govern: A Research on Public Participation in the Policy Process*, Centre for the Study of Violence and Reconstruction (CSRV) and Action for Conflict Transformation (Action), Johannesburg.

Tevera, D.S. (1988) *Urban Waste Management in Sub-Saharan Africa: An Introduction to Environmental, Financial and Economic Issues*, Unpublished Report, World Bank, Washington DC.

United Nations Convention on Environment and Development (UNCED) (1992) *Agenda 21*, Convention on the Combat of Desertification, Rio de Janeiro.

United States Environmental Protection Agency (USEPA) (1998) *Municipal Solid Waste Source Reduction: A Snapshot of State Initiatives in Washington DC*, Washington DC.

Viljoen, J.M.M., Schenck, C.J., Volschenk, L., Blaauw, P.F. and Grobler, L. (2021) 'Household waste management practices and challenges in a rural remote town in the Hantam Municipality in the Northern Cape, South Africa', *Sustainability*, Vol. 13, No. 11, p.5903, https://doi.org/10.3390/su13115903.

Wang, Y., Zhang, X., Liao, W., Wu, J., Yang, X., Shui, W., Deng, S., Zhang, Y., Lin, L., Xiao, Y. and Yu, X. (2018) 'Investigating impact of waste reuse on the sustainability of municipal solid waste (MSW) incineration industry using energy approach: a case study from Sichuan province, China', *Waste Management*, Vol. 77, pp.252–267, https://doi.org/10.1016/j.wasman.2018.04.003.

Waste (2002) *The Second Arab Fair and Forum for Recycling and Waste Management Technologies and Services*, WASTE 2002 Newsletter No. 2, MultiFairs, Cairo, Egypt, June.