

Integrated waste management as a catalyst for livelihood enhancement in Punjab, Pakistan



Memona Liaqat (Corresponding Author)	University of Agriculture, Faisalabad. Pakistan, memonarana323@gmail.com
Dr. Muhammad Idrees	Assistant Professor, University of Agriculture, Faisalabad. Pakistan, dr.midrees@uaf.edu.pk
Dr. Muhammad Atif	Assistant Professor, University of Agriculture, Faisalabad. Pakistan, aatiftabassam@uaf.edu.pk
Dr. Muhammad Iftikhar	Associate Professor, University of Agriculture, Faisalabad. Pakistan muhammad.iftikhar@uaf.edu.pk

Abstract: *Integrated Waste Management (IWM) plays a pivotal role in enhancing livelihoods in Punjab, Pakistan, by addressing both waste disposal issues and economic development opportunities. This study examines how IWM practices, such as community-based recycling programs, waste-to-energy projects, and the integration of informal waste pickers into formal systems, can create sustainable employment and improve living standards. Punjab, with its rapidly growing urban population, faces significant waste management challenges, which IWM strategies can help mitigate while fostering local economic growth. A system for collecting, recycling, reducing, and disposing of waste products generated by industrial, commercial, institutional, and residential land uses is described as Integrated Waste Management. Data was collected from the Scavengers and 180 scavengers was selected through snowball sampling technique. The collected data was processed through SPSS (Statistical Package for Social Sciences). Findings reveal that Integrated Waste Management (IWM) in Punjab, Pakistan, offers a comprehensive solution to both environmental and socio-economic challenges. Through the implementation of community-based recycling programs, the formalization of informal waste sectors, and the promotion of waste-to-energy initiatives, IWM has the potential to significantly enhance livelihoods in the region. Overall, IWM serves as a crucial tool in addressing waste-related issues in Punjab, while simultaneously contributing to the creation of green jobs, poverty alleviation, and sustainable development in the province. To fully harness these benefits, continued investment in IWM infrastructure, community engagement, and policy support is essential. It is suggested that it is crucial to promote public-private partnerships (PPPs) that focus on the development of waste management infrastructure, such as Integrated Resource Recovery Centres (IRRCs) and waste-to-energy plants.*

Keywords: Integrated waste management, livelihood, sustainability, policy, Pakistan.

Introduction

The phrase "integrated solid waste management" refers to all of the processes involved in controlling garbage generated by a community. The term "integrated" refers to the

system's utilization of a variety of interconnected collection and treatment techniques at various habitat sizes (household, neighborhood, and city). Integrating

environmental and public health considerations with the general population's desire to reuse and recycle garbage is the fundamental aim of integrated solid waste management (Asase *et al.*, 2019).

An integrated includes an efficient sorting system and an optimized trash collecting system is based on the following procedures:

- Resources recycling, 3R: involve access to reprocessing services.
- Natural treatment of biological resources: the creation of energy-releasing methane.
- Thermal treatment: reduces volume, renders leftovers inert, and should incorporate energy recovery. Examples include Burning refuse-derived fuel (RDF), burning with energy recovery, and burning Paper and Plastic Derived Fuel (PPDF).
- Landfill: techniques can boost amenity in landfills, yet, a well-engineered site at least minimizes the loss of amenities and pollutants (Lino and Ismail, 2012).

IWM is an idea comprises of three sustainability factors that must be combined: Participants B. System components C. Aspects. The figure below shows how these three dimensions are calculated in greater detail. Countries which falls in low and middle income that Collaborative Working Group based on Solid Waste Management (CWG) further developed the ISWM in the mid-1990s. In 1980s the WASTE which is Dutch non-governmental organization and its collaborators was initially developed in developing countries. Since then, it has gained popularity as a method for achieving better, more long-lasting solutions for managing municipal garbage in poor nations (Van Barkel *et al.*, 2019).

Industrialization, urbanization, population growth, and economic development have all helped to increase the quantity of solid garbage created during the past few decades. Modern communities currently place a great importance on the effective management of produced solid wastes in cities due to the risk they provide for the degradation of surface and underground water, air pollution, soil pollution, and the

spread of illnesses. The World Economic Forum on East Asia, which took place on June 15, 2006 in Tokyo, Japan, informed participants that the century originally belonged to Asia, while at the same time, it serious action needs to handle several key of today's challenges with environmental pollution being one of the major issues. According to data from of the Japan's External Trade Organization, Asia's middle class is considerably booming. Asia's growing middle class is notable as a whole since it illustrates the region's developing consumer society. In truth, this massive consumer market growth has compelled a lot of business sectors and individuals responsible to disregard urbanization that is one of the most important environmental issues (Wilson, 2017).

Basically, the amount of solid waste produced has always been correlated with the economic standing and manner of life of a nation. This in turn has an impact on how the garbage produced is managed. Modern waste management has evolved over time from a rigid waste hierarchy idea known as 3R (reduce, reuse, recycle) regulations to a more flexible waste hierarchy model that no longer relies solely on landfills. Waste management is still an issue in both the developed and developing worlds today. Many major forms of urban pollution and health risks are brought on by insufficient and ineffective waste management in the great cities of emerging nations. Industrialized nations struggle to discover the best ways to dispose of the growing amounts of trash they are producing and face severe issues with waste management. Finding solutions for sustainable waste management with the overarching objective of reducing trash's impact on the environment in a manner that is both economically feasible and socially acceptable is undoubtedly the largest challenge facing the waste industry now and, in the decades, to come (Cohen, 2014).

According to latest statistics on urbanization, most of world's population currently lives in cities on the beginning of the 21st century, four hundred cities had populations of at least a million, with almost three Compared to the six states at the starting of the 20th century, when the huge majority of people of them belong to the

industrial nations, every four urban cities out of five are found in low income and middle-income countries. The rapid and unplanned growth has made it hard for national and local governments to offer SWM facility at the required rate due to severe planning for land use and infrastructural challenges. When coupled with highly slow and ineffective institutional processes, this has had a catastrophic impact on the effectiveness of SWM facilities in many areas of the world, and it is anticipated that in future this will become worse (Tacoli, 2012).

Livelihood is one of the most notable and important features in rural life. Livelihood can be defined as a process through which people develop and organize their daily life and social relations and varied activities to improve their income level as well as to better survive and strive in emergency situations (Jibril et al., 2012)

Livelihoods are a significant piece of country individuals' approach to everyday life. Additionally, it should be understood and perceived that livelihoods are implanted in individuals' narratives, societies, customs, connections and the climate, all of which change after some time (Chamber et al., 1992).

Around 21,000 garbage pickers, also known as scavengers, are employed by Karachi Metropolitan Corporation (KMCP) in Pakistan alone. They make a living by recycling trash including paper and plastic from KMCP areas. A total of 1,500 t of recyclable material is recycled daily in the informal sector. There are around 90,000 garbage pickers or scavengers in total, most of whom work in the waste paper and plastic recycling sector and are frequently Afghans between the ages of 10 and 25. Most recyclable materials are segregated at the point of origin before being sold to rubbish merchants. In the city, there are about 400 industrial recycling facilities that are part of the unofficial economy. Above 5,500 families earning their livelihood from the recycling business, according to surveys done by an NGO.

Municipalities now operate without engaging in any sort of recycling activities. The majority of recyclable materials, including metals, glass, paper and plastic are often kept through the

general public and afterwards sold to trash dealers or street vendors for recycling. Scavengers often visit rubbish dumps two to three times daily and make 100–200 Indian rupees (RS) per day (Kiron, 2021). To assist the pickers in their labor, Karachi Metropolitan City (KMC) Waste management staff and transporter do not collect waste on regular basis. The contractor compensates the KMC Karachi Metropolitan City) staff members and drivers between RS. 50 and RS. 150 per day in return. The garbage is manually separated and placed into distinct containers at the sorting location. After being packaged, the garbage is subsequently delivered to primary recycling factories from Sher Shah or to Sher Shah-based sellers for fine-grained sorting.

Alternatively, in a rare instance, it is transported straight to recycling plants in the industrial cities of Punjab, such as Korangi, New Karachi, Aorangi, and Sher Shah itself. The two primary materials that are taken from the dumps are paper and bones. Housewives remove and sell other materials like plastic, glass, and metal to the kabari while they are still at home (Junkman). Bones are boiled to eliminate grease, and paper is converted into cardboard. In addition to creating soap, the grease is used to clean soap factories. The bones are minced and added to the chicken feed. Pickers raid all city markets after they close at approximately 7:30 pm, including in high income regions, in addition to selecting from landfills. Here, the pickers and sometimes the contractors pay the market managers, keepers, or shops on behalf of the trash they collect. Recycling Campaign 2003 was started to encourage waste management in young people and recycle post-consumer garbage (Oldenziel & Weber, 2013).

1. Review of Literature:

Gorai & Jana (2007) reported that education has a great influence on people. It helps people learn to think and make the right choices. If a country wants to progress and improve, it must invest in education. Raj (2009) explained that men and women have different indicators of development and opportunities. He said that this variable (gender) influences a country's performance and women empowerment as well as socio-

economic development, but it influences how people use media and how social capital is formed.

Love & Knott (2010) concluded that a family is a group of close friends who are emotionally and biologically linked. Families in Pakistan and the West have different rules, ways of living, and even cultures. In Pakistan, there are many distinct forms of family structures, such as joint, nuclear, and extended. But in Pakistan, the most popular types of family are joint and nuclear. Most people in Pakistan live in what is called a "joint family system," although this is slowly changing as more people move to cities and modernize their lives. Teenagers and young adults in a nuclear household can simply use the internet.

Ahmad & Zurbrugg (2012) said that a profession may be defined as any activity that possesses some value on the market and pays individuals money so that they can continue engaging in their social and economic activities. It has a direct influence on the quality of life that people can lead. People who are employed are in a better position to provide for their families and to socialize with their children, both of which are beneficial to the future development of the state. Regrettably, Pakistan is one of those countries that does not place nearly as much emphasis on empowering young people and offering women equal access to the labor sector. Problems arise when the government doesn't care as much about people's welfare and ability to help themselves.

Livelihood diversification is increasingly recognized as a critical strategy for enhancing resilience and reducing vulnerability. Ellis (2000) argues that diversification into non-farm activities provides rural households with additional income streams, reducing dependence on agriculture. Migration, both seasonal and permanent, has emerged as another important livelihood strategy, enabling households to access better opportunities and remit income back to their families (De Haan, 1999). While diversification can improve livelihood security, it often requires access to education, skills, and capital, which are not equally available to all.

The concept of sustainable livelihoods

underscores the importance of balancing economic development with environmental conservation. The overexploitation of natural resources to support livelihoods can lead to ecological degradation, threatening long-term sustainability (Scoones, 1998). Integrating sustainable practices into livelihood strategies, such as agroforestry and conservation agriculture, has been shown to enhance resilience while preserving the environment (Chambers and Conway, 1992). Achieving sustainable livelihoods requires concerted efforts from governments, non-governmental organizations, and communities to address systemic barriers and promote equitable resource access.

Integrated Waste Management (IWM) has emerged as a vital strategy for addressing waste-related challenges while simultaneously creating livelihood opportunities. IWM encompasses waste reduction, recycling, reuse, composting, energy recovery, and proper disposal, emphasizing sustainability and resource efficiency (Tchobanoglous and Kreith, 2002). By integrating these processes, IWM systems not only mitigate environmental hazards but also generate employment across various stages of waste management, particularly in waste collection, sorting, processing, and recycling (Wilson et al., 2010). These livelihood opportunities have become particularly significant in developing countries, where informal waste sectors play a crucial role in managing urban waste streams.

The informal waste sector has demonstrated its potential to support livelihoods, especially for marginalized populations. Informal waste pickers, who collect, sort, and sell recyclable materials, provide essential services that often go unrecognized in formal waste management systems. Studies have highlighted that informal recycling can generate significant economic value while providing employment for vulnerable groups, including women and migrants (Medina, 2007). However, despite their contributions, informal waste workers often face precarious working conditions, lack social protection, and are excluded from formal policy frameworks (Wilson et al., 2006).

Integrating these workers into formal IWM systems can enhance their livelihoods while improving waste management efficiency.

Recycling and resource recovery within IWM have been identified as key areas for livelihood generation. The recycling industry provides employment opportunities ranging from small-scale collection to large-scale material processing. For instance, in India, waste pickers and small enterprises have played a pivotal role in diverting significant amounts of recyclable waste from landfills, creating income-generating opportunities in urban areas. Similarly, composting organic waste has emerged as a viable livelihood option in rural and urban contexts, particularly for farmers and small-scale entrepreneurs, by producing nutrient-rich

compost for agricultural use (Zurbrugg et al., 2012).

2. Objectives:

Keeping in view these special features of the present study the following objectives are made:

- To study the socio-economic conditions of individuals involved in the waste management sector
- To explore the livelihood opportunities of the respondents through integrated waste management (IWM).
- To provide some policy measurement to enhancing the role of Integrated Waste Management (IWM) in promoting livelihood.

3. Results and Discussions

- **Table 4.1: Distribution of respondents according to their age**

Age in Years	Frequency	Percentage
18-27	56	31.1
28-37	80	44.5
38 and above	44	24.4
Total	180	100.0

Table 4.1 shows the split of responses by age group. Nearly half of the poll respondents were between the ages of 28 and 37. Following that, 31.1% of respondents were between the ages of 18 and 27, with 24.4% being over the age of 38. Results had linked with the study conducted by Bloom et al., (2014) who defined there are young people in the Pakistan are greater in number and this opportunity for made over a time period of about forty to fifty years during which, the proportion of dependent children is

reduced and the population with the age of youth significantly increases. As a result, young people are more attract and expert in the internet communication technologies that make them a hub of networks and relationship in this modern and digital world. Youth try to explore the globe through social networking sites that is important factor in the social capital formation because youth on social media make friendship ties with the people across the globe according to their own interest and will.

- **Table 4.2: Distribution of respondents according to their Education**

Level of Education	Frequency	Percentage
Illiterate	35	19.5
Up to middle	76	42.2
SSC	58	32.2
HSSC	11	6.1
Total	180	100.0

Table 4.2 shows the distribution of respondents by level of education. Of all respondents, 42.2% had finished at least some middle-level

education. Then came the 32.2% who had obtained their Secondary School Certificate. In comparison, 19.5% of the population was unable

to read or write, and only 6.1% had completed their HSSC. The conclusion that education has a major impact on people is in line with what Gorai & Jana (2020) found. In doing so, it instructs and guides people's minds to think rationally and make good decisions. According to Geol (2007), education is crucial for a

country's expansion and prosperity. Education is a tool for positively affecting behavior. Someone with training is obviously always ready and logical to build. Training is crucial if we want to achieve our goals in life. Education is a purposeful act that impacts people individually and collectively.

• **Table 4.3: Distribution of respondents according to their Marital Status**

Marital Status	Frequency	Percentage
Married	68	37.7
Unmarried	59	32.7
Divorced	25	13.8
Widow	28	15.5
Total	180	100.0

Table 4.3 shows the breakdown of respondents by marital status: 37.7% were married, 32.7% were unmarried, 13% were widowed, and 15% were divorced. Those who have been bereaved or divorced are underrepresented in comparison to the married population. The current study's findings were found to be extremely similar to Temesgen et al., (2010) conclusion that marriage plays a vital role in human existence since it gives people a new status and directs them toward new duties and responsibilities.

The family life is started by marriage, and in order for it to succeed, each member of the family must learn to take on a variety of responsibilities and duties. This improves maturity and equips people to function in a variety of contexts. It can be unreasonable to expect an unmarried person to have this sense of accountability and duty fulfillment. Thus, in light of family upgrading, job happiness, incomes, and socioeconomic progress, this characteristic is thought to be significant.

• **Table 4.4: Distribution of respondents according to their Monthly Income of Family from all sources**

Income in PKR	Frequency	Percentage
Up to 20,000	33	18.3
20,001 – 30,000	23	12.8
30,001 – 40,000	76	42.2
40,001 and above	48	26.7
Total	180	100.0

Table 4.4 shows the breakdown of respondents according to the total monthly income of their families. Nearly half (42.2%) of those surveyed said their monthly income was between PKR 30,001 and 40,000. The percentage of families with an income of PKR 40,000 or more was 26.7%, while the percentage with an income of 20,000 or less was 18.3%. Only 12.8% of people said they made between PKR 20,000 and 30,000.

According to these numbers, the salary band of PKR 30,001 to 40,000 was the most popular

among the respondents. According to the data, unemployment is prevalent among respondents, who come from a wide range of vocational backgrounds. The findings of this study were in agreement with those of Ahmad & Zurbrugg (2012), who defined a profession as any activity having a monetary value that allows individuals to participate in socioeconomic activities. The general public's level of living is directly impacted by it. Working parents provide for their families' nutritional needs and spend quality time with their children, who in turn

contribute to the economic development of the state.

- **Table 4.5: Distribution of respondents according to their most potential for creating livelihoods**

Creating livelihoods	Frequency	Percentage
Compositing organic waste	36	20.0
Recycling plastic, metal or paper	28	15.5
Up cycling or creating products	34	18.8
Collection or transportation of waste	38	21.1
Selling recyclable material	44	24.5
Total	180	100.0

Table 4.5 Response Distribution Based on Their Estimation of the Most Lucrative Opportunity "Selling recyclable material" was the most promising alternative for 24.5% of those who completed the survey. This demonstrates this group's solid belief that there is a good probability of profiting from the direct selling of recycled materials. "Collection or transportation of waste" is the area where 21.1% of respondents see the most opportunity. All the more incentive to prioritize these duties because of the benefits they bring to waste management and the money they can generate. 18.8% of respondents believe that "upcycling or creating products" has the most promise. This development indicates that people are becoming more aware of the financial benefits of finding new applications for obsolete materials and adding value. Twenty percent of poll respondents believe "Compositing organic waste" has the best probability of success. This demonstrates that you are aware of the potential for profit from vermicomposting and manufacturing your own organic fertilizers. "Recycling plastic, metal, or paper" is the most promising approach, according to 15.5% of poll respondents. This demonstrates that, while recycling is recognized as a significant activity, not all respondents believe it is the most

profitable way to produce cash.

According to Zhao et al. (2010), garbage can have different meanings to different individuals. For the people who engage in rubbish picking, it can be a source of income or a way of making a living. On the other hand, for most people, waste is seen as a bigger issue that requires attention. Several variables impact the attitude and behavior, such as a lack of knowledge and education on effective waste management, insufficient public involvement, inefficient methods of waste management, and societal norms.

As a result of this chasm, there is now a divergence in public opinion on the environmental dangers presented by trash. The existence of littering and open rubbish disposal in most developing nations is indicative of careless actions related to solid waste management. The reasons for this careless conduct include insufficient environmental concern, a lack of societal pressure, and the absence of reasonable consequences or consistent enforcement. Public views about garbage can be influenced by several cultural and geographical variables.

- **Table 4.6: Association between Challenges in IWM and Livelihood**

Challenges	Livelihood			Total
	To Great extent	To Some extent	Not at all	
To great extent	17	15	10	42
	9.4%	8.3%	5.5%	23.3%
To some extent	19	14	16	49
	10.5%	7.7%	8.8%	27.2%
Not at all	45	25	19	89

	25.0%	8.3%	10.5%	49.4%
Total	81	54	45	180
	45.0%	30.0%	25.0%	100.0%

Test	Value	D. F.	Level of Sig.
Chi-Square	232.43	4	0.000**
Gamma	0.543	--	0.000**

Table 4.6 investigates the correlation between challenges in IWM and livelihood opportunities, and the chi-square value of 232.43 suggests that these two variables are highly significant. The independent and response variables have a significant positive association, as evidenced by the gamma value of 0.543. As a result, we support the hypothesis that challenges in IWM badly effects the livelihood opportunities.

To summarize, the research demonstrates that the scavenging community suffers a complicated set of issues, including structural issues, economic difficulties, concerns about health and safety, and social stigma. To overcome these challenges, we must improve trash management infrastructure, increase access to resources, boost safety measures, and develop social inclusion and appreciation for scavengers' jobs.

- **Informal Sector Dominance:** A significant portion of waste management in Pakistan is handled by informal waste pickers who lack proper training, equipment, and legal recognition. This exposes them to health risks and exploitation by middlemen who control recycling markets (Zia et al., 2017).
- **Lack of Infrastructure:** Most cities lack proper facilities for waste segregation, recycling, and composting. Open dumping and burning are common practices, leading to environmental pollution and missed economic opportunities. The absence of waste-to-energy plants and efficient recycling systems further limits the scope for job creation.
- **Policy and Governance Gaps:** The

country lacks cohesive policies to regulate waste management or support livelihoods in this sector. Fragmented responsibilities among municipal authority's result in inefficiency and underfunded programs.

- **Social Stigma:** Waste picking is often viewed as a low-status job, discouraging many from entering the sector. This cultural bias, combined with a lack of awareness about the economic potential of waste, hinders progress.
- **Market Barriers:** Fluctuations in the demand and prices for recycled materials make it challenging for small businesses and cooperatives to sustain their operations.

One of the key challenges in IWM lies in the lack of infrastructure, particularly in low- and middle-income countries. Insufficient facilities for recycling, composting, and waste-to-energy conversion hinder the efficiency of waste management systems (Hoornweg and Bhada-Tata, 2012). Additionally, fragmented policies and lack of enforcement exacerbate the issue, often leading to inadequate waste segregation and illegal dumping (Guerrero et al., 2013). Regulatory frameworks frequently fail to address the complexities of modern waste streams, further complicating efforts to achieve sustainability.

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and illegal dumping (Guerrero et al., 2013). Regulatory frameworks frequently fail to address the complexities of modern waste streams, further complicating efforts to achieve sustainability.

Scavenger activities, particularly in the informal waste sector, are fraught with numerous challenges that impact the well-being of workers and the overall efficiency of waste management systems. One of the primary challenges is the health and safety risks associated with scavenging. Scavengers are often exposed to hazardous materials, such as sharp objects, toxic chemicals, and biohazardous waste, without proper protective gear. This exposure can lead to a range of health issues, including respiratory diseases, skin infections, and injuries from discarded items (Gutberlet et al., 2016).

The economic feasibility of IWM systems is another significant hurdle. High upfront costs for establishing advanced waste processing facilities, combined with low profitability from recycling markets, create barriers to adoption. Moreover, informal waste sectors, which play a crucial role in many developing countries, are often excluded from formal IWM frameworks, leading to inefficiencies and inequitable resource distribution (Wilson et al., 2006).

Public participation is critical to the success of IWM systems, yet achieving widespread behavioral change remains challenging. Lack of awareness, education, and incentives for proper waste segregation often leads to contamination of recyclable materials (Menikpura et al., 2012). Cultural perceptions and resistance to adopting new waste management practices further impede progress, particularly in regions where traditional waste disposal methods are deeply ingrained (Zaman and Lehmann, 2011).

4. Policy Measurement

A key suggestion for policy measurement for enhancing the role of Integrated Waste Management (IWM) in promoting livelihoods is the establishment of a clear and comprehensive policy and regulatory framework. The government of Punjab should introduce policies that not only regulate waste collection, segregation, and recycling but also incentivize

investment in sustainable waste management practices. Policies should prioritize the formalization of the informal waste sector, offering legal recognition and protection to waste pickers and other workers involved in waste management. Moreover, introducing tax incentives for private companies and public-private partnerships involved in recycling and waste-to-energy initiatives can foster further investment in the sector. These regulatory frameworks should also focus on ensuring environmental sustainability while simultaneously facilitating the creation of green jobs and economic growth.

The informal waste sector, consisting of waste pickers and small-scale waste handlers, plays a critical role in waste management but often operates in unsafe and exploitative conditions. Formalizing this sector should be a priority, and measures should be introduced to provide these workers with adequate social protection, such as health insurance, pensions, and access to social security benefits.

5. Conclusion:

In conclusion, the dissertation asserts that Integrated Waste Management in Punjab has the potential to play a transformative role in both improving waste management practices and creating sustainable livelihoods. However, the successful implementation of IWM requires a multi-faceted approach, including strong community involvement, formalization of the informal waste sector, investment in infrastructure, and supportive policies. By adopting such strategies, Punjab can move toward a more sustainable and inclusive waste management system that contributes to the well-being of its citizens and the environment.

The study highlights that the informal waste sector in Punjab, which includes millions of waste pickers, plays a crucial role in the waste management process despite operating under suboptimal conditions. Formalizing this sector and integrating informal waste workers into the formal waste management systems can create a pathway for better working conditions, stable incomes, and increased social inclusion.

In light of the findings, future research could

focus on evaluating the long-term impacts of IWM on livelihoods in different regions of Punjab, with an emphasis on the scalability of successful models and the challenges faced by marginalized communities. Moreover, further investigation into the policy and institutional frameworks that can support the transition from informal to formal waste management practices in Pakistan is essential to creating a more equitable and sustainable waste management system.

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