

A Study of Solid Waste Management in Karachi City

Wardah Sabir * Syed Noman Waheed † Adil Afzal †
Syed Muhammad Umer † Saad Rehman †

Abstract: *There is a growing problem of waste management faced by developing countries. Karachi is the biggest city of Pakistan having a population of approximately 24 million. Statistics indicate that on a daily basis, about 12,000 tons of solid waste is generated in Karachi alone, of which forty percent can be found on the city streets. Improper management of solid waste is causing the spread of infectious diseases and environmental pollution. This study examines how the solid waste management process is implemented in Karachi and the challenges faced by the responsible authorities. Solid waste management combines all activities performed in order to keep the city clean on a regular basis and handle waste collection and disposal, sewerages, water treatment, recycling, and health and hygiene issues. This study is qualitative in nature and the mediums of observations and interviews were used to collect data. A total of twenty respondents were interviewed using both structured and unstructured questions. These included residents of selected areas of Karachi as well as municipal officials who are responsible for solid waste management in the city. Results revealed that the citizens are dissatisfied with the current strategies of solid waste management implemented by the municipalities. The public thinks that the municipalities are ill-equipped to handle the developing situation of substantial waste in the city due to which they have to confront many problems. The municipalities, on the other hand, were found to be underfunded and ineffective in the department of solid waste management and therefore, they lack the proper instruments to ensure their efficiency. Residents of Karachi were also a contributing element in the growing waste problem by means of their participation in activities such as illegal dumping and violation of laws. With the ratio of solid waste, increasing per day in the urban center, there is an immediate need to implement major steps to improve the current situation. A more consolidated strategy for solid waste management needs to be designed and implemented which streamlines the processes of waste collection and disposal. Citizens of Karachi also need to be educated on how they can play their part in reducing the quantity of solid waste through the promotion of habits such as recycling.*

Keywords: Solid waste management, municipalities, illegal dumping, waste disposal, recycling.

Introduction

The major problems of any developing city include the handling of solid waste. Nowadays a massive challenge for urban areas is efficient solid waste management (Abas & Wee, 2014). The rate of generation and composition of solid waste has changed in recent years due to

*Research Associate, IQRA University, E-mail: wardah.sabir@iuk.edu.pk

†Business Graduates, IQRA University

booming populations, infrastructural development, lifestyle changes, and increasing trends of urbanization (Paracha, 2014).

Karachi is the greatest urban center of Pakistan and the second largest Muslim city in the world (Cox, 2014). It is a metropolitan city having a population around 24 million (Paracha, 2014). The trend of urbanization has been rapidly increasing in Pakistan since the 1970s, with the majority of the population shifting to the urban centers of the country from the rural regions, in order to seek better employment opportunities (Sharif & Raza, 2016). Located on the southern coast, it is considered as the business hub of Pakistan. The city of Karachi generates more than 12,000 tons of solid waste every day, which has been increasing over time. Sixty percent solid waste is discarded in landfills and the other forty percent remains on the streets (Shahid, Nergis, et al., 2014). The various types of waste generated include household, office, commercial and industrial, litter, parks and gardens waste (Jilani, 2007).

Solid waste management creates a huge challenge for local governments because of a steady rise in leftovers. Karachi is governed by a city district government and is split into six districts with further divisions into 18 sub-districts or tehsils. Every tehsil is administratively separated into 178 union councils which manage solid waste. Under City District Government Karachi (CDGK), there are two cantonment boards which include the Karachi Metropolitan Corporation (KMC) and District Municipal Corporation (DMC), which control the solid waste management system in Karachi. If these municipalities do not manage solid waste properly, it creates damaging environmental and health impacts.

It is a right of every citizen to live a better and clean life. Karachi is already facing countless problems currently due to the deficiency of a consolidated solid waste management system which is making the life of citizens complicated. Open dumping is one of the biggest factors present in every area of Karachi. Dumping municipal waste which includes household, office, and street litter as well as synthetic waste in streets, parks, and railway tracks give rise to diseases and pollutes the environment. Open burning of municipal solid waste emits smoke and contributes to air pollution. Open trucks used for collecting the solid waste from different areas of the city are unhygienic. Open sewerages can be found all around the city. During the monsoon season, blocked sewerage systems become problematic for municipalities (Ejaz & Janjua, 2012). Altogether these elements coalesce to boost waste management problems.

Municipalities have the obligation to maintain proper garbage and sewerage systems to keep the city clean and ensure environmental safety, but due to their mismanagement, the city of Karachi faces huge problems. The problem of waste management will continue if it is not handled appropriately, since it poses serious health and environmental hazards. There can be an outbreak of many diseases and epidemics due to unhygienic living conditions that will make the lives of citizens miserable.

Serious and suitable initiatives are required for waste management. The prime objective of this study is to analyze what initiatives municipalities currently take for solid waste management in Karachi and the challenges they face in doing so. The study will help to identify and outline a path that municipalities can follow in order to reduce the deficiencies in their system and implement what needs to be done in the future to manage the solid waste problem in the most efficient manner. The implementation of an appropriate solid

waste management system will not only help to reduce the solid waste around the streets of the city but will also be beneficial for the society and the environment as a whole. This research is a significant attempt to promote a clean and healthy environment in all areas of Karachi.

Literature Review

Government Policy Developments

In 1997, the Pakistan Environmental Protection Act was broadcast to the society which focuses on environmental protection from pollution, conservation of renewable resources, and protection of wildlife (Rahman, 2013). This framework permits local municipalities to charge penalties to all violators of the National Environmental Quality Standards (NEQS). With the same objective in mind, The National Sanitation Policies were established by the Federal Government in September 2006 (Ministry of Environment, 2006). The goal was to emphasize the three R's which are; recycling, reduction, and reuse. The encouragement of recycling habits among citizens was the primary target in order to salvage any materials which can be reused efficiently. This policy also outlined the initiatives to be taken pertaining to health policies in the urban sites of the country and guidelines for the efficient management of disposal landfills throughout the city for appropriate disposal of solid waste. The municipalities are responsible for the planning and disposal of household waste, chemical waste, industrial waste, and agricultural waste. For this purpose, an Integrated Sustainable Waste Management (ISWM) model developed in the 1990's as the first consolidated framework for the betterment of the urban environment in cities can be used to integrate all practices of waste collection, disposal, treatment, and recycling into one unified efficient waste management system (Guerrero, Maas, & Hogland, 2013). In a comprehensive effort to safeguard public safety, the Hazardous Substances Rule was passed in 2007 to ensure proper disposal of harmful and toxic wastes (Rahman, 2013). According to this law, all harmful waste material must be dumped in specific hazardous bins which are explicitly designed for the handling of dangerous waste materials.

Empirical Studies

Waste Management Issues in Developing Countries

Solid waste management is one of the most significant issues for developing urban areas because of the rising consumption pattern (Abas & Wee, 2014; Marshall & Farahbakhsh, 2013). Shahid et al. (2014) reasoned that all developing countries face problems in handling solid waste material which is rapidly escalating due to the rise in population and the rate of development. Municipal solid waste describes waste products generated from various activities of daily life and generally increases with the growth of population and personal income (Tseng, 2011). Another contributing factor to the increasing rate of solid waste is the people who migrate from other countries, especially in the Middle East (Al-Maaded, Madi, Kahraman, Hodzic, & Ozerkan, 2012). In a similar attempt to understand

the significance of solid waste management challenges for cities in developing countries, [Guerrero et al. \(2013\)](#) studied the waste material caused by the increasing population of more than thirty urban areas of 22 developing countries with the objective to target the responsible stakeholders and analyze the role they play in the waste management process. Results showed that the performance of municipalities alone is not enough to solve the problem of solid waste and every citizen has to perform his/her duty for the maintenance and cleanliness of their respective residential areas.

Reduce, Reuse, and Recycle

There is a need to generate a strong solid waste management (SMW) framework to optimize reduce, reuse, and recycle (3Rs), and diminish the rate of solid waste through implementation of proper strategies ([Trihadiningrum et al., 2015](#); [Yeheyis, Hewage, Alam, Eskicioglu, & Sadiq, 2013](#)). [Sakai et al. \(2011\)](#) conducted an international comparative study of the 3Rs and waste management policy developments in the European Union (EU), USA, Korea, Japan, China, and Vietnam finding that in the EU, the system of the 3Rs is relatively well developed and applied due to the effectiveness of their policymakers. The operation of recycling can help ward off the bulk of the environmental impacts of solid waste ([Pires, Chang, & Martinho, 2011](#)). Just a partial quantity of recyclables such as tins, plastics, bottles, and papers are stored in homes and later sold because government policies which encourage reuse and recycling are lacking. [Yoo and Yi \(2015\)](#) and [Senzige, Makinde, Njau, and Nkansah-Gyeke \(2014\)](#) examined the potential for solid waste recycling and demonstrated its evaluation and development process. Municipalities can implement policies like recycling and reuse to decrease the demand for raw material and reduce the quantity of solid waste. Successful solid waste management requires a holistic program that merges all the practical, economic, collective, national, and psychological factors which control the solid waste system ([Agunwamba, 1998](#)).

Environmental and Health Impacts

Open dumping of waste creates dangerous health issues in residential communities ([Ejaz & Janjua, 2012](#)). Public health and societal life are affected by health hazards, the proliferation of pests, and spread of diseases ([Yeheyis et al., 2013](#)). In Pakistan, there is poor management of solid waste due to a lack of resources and the careless conduct of the inhabitants. [Rahman \(2013\)](#) focused on the impact of rising carbon foot-printing, street dumping, delays in the disposal of solid waste, and ground water pollution in Pakistan and suggested the establishment of a National Solid Waste Management Institute funded by the government to operate solid waste management practices countrywide. Dumping of solid waste also negatively affects a region's environment. Solid waste's negative impacts on the environment include water, air, and soil pollution, climate change, and adverse effects on flora and fauna ([Yeheyis et al., 2013](#)). Cleaning up parks, schools, home and roadsides can help make the life of the poor communities better and healthier ([Henry, Yongsheng, & Jun, 2006](#)). [Muller, Mendelsohn, and Nordhaus \(2011\)](#) established a framework to include environmental externalities in a waste management system by studying air pollution

damages using Air Pollution Emission Experiments and Policy (APEEP) model to explore the Gross Economic Damages (GED) from each industry in the United States of America (USA) which make larger contributions to air pollution than the value they add via solid waste combustion, sewage treatment, stone quarrying, marinas, and oil and coal-fired power plants. [Jilani \(2007\)](#) concluded that proper management of solid waste would help cut down the amount of waste produced as well as furnish a healthy environment and fertilizer material which can be utilized to keep up soil richness and enhance dampness holding limit.

Methodology

This study was conducted using qualitative research techniques. Data were collected utilizing two primary mediums of observations and interviews. Observations were carried out and recorded by means of visiting several regions of the city to identify and witness the existing solid waste management practices in those areas. In-depth interviews were also conducted to gather information from relevant target populations about solid waste management in their respective residential areas. The emphasis of these interviews was on gathering and reflecting a wide range of perspectives on the topic of solid waste management. Thematic analysis was employed to analyze the data through generating initial codes and then searching for recurrent themes. Thematic analysis is a method of identifying, analyzing, and reporting patterns or themes within the data ([Braun & Clarke, 2006](#)).

The sample size of the study was twenty respondents. The qualitative data were collected through interviews using a combination of structured and unstructured questions. The interview respondents included residents from the areas of Gulshan-e-Iqbal, Gulistan-e-Johar, Gulzar-e-Hijri, and F. B. Area, keeping in mind that these areas of Karachi include residents from all social classes. A total of twenty respondents were interviewed who were selected using non-random sampling. Municipality officers were also included in the sample size as they work in the key positions which represent the agencies in charge of solid waste management in Karachi. All interviews were audiotaped and transcribed. The structured questionnaire for the interview was validated by the academic experts. Every question was established to address significant research objectives. Abiding by ethical considerations, all the information collected from the respondents were kept confidential and used specifically for the purposes of this study only. All participants were informed of the research intent. Furthermore, participation by respondents was on a voluntary basis.

Table 1
Interview Themes

Households Interview	Municipal Officers Interview
People's perception and contribution towards solid waste management	Responsibilities and duties of municipalities
Opinions towards municipalities	Collection of waste procedures
Monetary issues / affordability	Illegal dumping
Introduction of new laws and policies for the betterment of solid waste management practices	Challenges facing solid waste management
	Strategies for improving waste management

Data Analysis

A comprehensive analysis of the accumulated data was conducted using the thematic analysis process. This revealed the following overall recurrent key themes, which emerged from the interviews conducted with all the respondents.

Responsibilities and Duties of Municipalities

The municipal officers interviewed for this study included a Karachi Municipal Corporation (KMC) Officer, an Environmental Health Officer and a Karachi Water Board Officer. The KMC Officer explained that Karachi is divided into six districts, each of which has a District Municipal Corporation (DMC) which is responsible for the collection of waste and its transportation to the designated KMC dumpsites. The director of solid waste management in KMC has the responsibility for supervising the existing designated dump sites of KMC and to develop new treatment plants for waste. Every day an estimated average of 400 tons of solid waste is generated per district and DMC has the responsibility to collect waste from all commercial, residential, and industrial areas, whereas KMC provides dumping sites to DMCs, where all the collected solid waste can be discarded. KMC is also responsible for providing transportation support to the DMCs for solid waste collection all over the city. For this purpose, they are provided with trucks, tractors, and dumpers from the KMC who also look after the maintenance and repairs of all transportation vehicles.

The Environmental Health Officer (EHO) deals with numerous issues regarding environmental health, such as food investigation, environmental safety, pollution reduction, safety and health for workers, and solid waste management. The primary objective of an EHO is to maintain public health, provide a safer environment for the people, and protect the prosperity of the city of Karachi. Likewise, the Karachi Water Board Officer (KWBO) elucidated that the different departments are working under the KWB and dealing with controlling and purifying water. In the context of solid waste management, a major duty of the KWB includes the maintenance of all the sewerage systems throughout Karachi which control all the underground sewerage water operations and supply to the residents of the entire city.

Residents' Opinions about Municipalities

There was a consensus observed among households regarding their views and attitudes towards municipalities accountable for the solid waste management problem in Karachi. The most popular opinion was that KMC and DMCs were inefficient and not performing their duties to the best of their abilities which was escalating the garbage problem in most areas. Occupants of Gulistan-e-Johar said that KMC did not collect waste from their area, therefore, they hired third-party sweepers who collect garbage door-to-door and throw it at any nearby convenient place. Residents are satisfied as this arrangement is much cheaper than that of KMC. Another complaint by the citizens was that even if they throw their garbage in the designated KMC dumping areas, the waste just keeps piling up and no one comes to collect it which causes unpleasant odors and spoils the

environment. A resident of F.B Area elaborated that KMC is not picking up waste from all areas and their main focus is only where VIPS live. In doing so, they ignore areas largely inhabited by the middle and lower classes, even though everyone alike pays their bills and taxes, therefore, everyone deserves equal treatment. Furthermore, some households claimed that the KMC was fooling the citizens by not actively participating in the collection and management of waste. They believe that the authorities have an extremely non-serious attitude towards this critical issue and that even when approached, KMC does not help citizens and only makes false promises. However, one person from Gulistan-e-Johar had a different perspective in that even though the KMC and DMCs are stagnant, people are only willing to speak ill of these corporations and do not know how dependent they are on government funding. He was confounded how the system can be rectified, if the people of Karachi are reluctant to pay money for the improvement of DMCs but ready to pay third-party sweepers instead.

Illegal Dumping

Through the course of this study, it was observed that many areas in Karachi city favor unethical and illegal dumping of solid waste. The general attitude of the majority of citizens is to throw trash at any nearby convenient point where there is any garbage already accumulated. Another important aspect of illegal dumping involves people throwing litter on footpaths, roads, family parks, and empty plots. The representative of the Karachi Water and Sewerage Board (KWSB) reported another common practice among citizens which is that supermarkets handover goods in polyethene bags to customers who, when emptied throw away these plastic bags randomly on the streets from where they are blown away by the wind and moved into gutters and sewerages. This creates problems such as drain pipe blockages. On the other hand, most household residents felt that overall the dumping sites of municipalities are allotted along the main roads of the city due to which public transport and pedestrians face movement difficulties, as it causes traffic jams during rush hours. However, one respondent believed that every individual plays an important role in our society and that it is the citizen's mistake when they find feasibility in throwing garbage at any nearby litter alley or giving it to irresponsible sweepers who dump the garbage at whatever spot they want, just because it is a matter of their convenience. An additional contributing factor is that a large portion of the population living in the city, falls below the poverty line and cannot meet the expense of waste collectors. Consequently, they engage in illegal dumping such as throwing trash roadside or in front of other people's houses. By such acts, citizens do not realize that they are increasing pollution in the city which ultimately is the cause of diseases and epidemics which can be hazardous for their own children.

Challenges Facing Solid Waste Management

The KMC official claimed that they are equipped with heavy dumpers and loaders which aid in waste collection from different areas, since citizens of this metropolis ubiquitously dump waste without worrying about how increasingly dirty their city is getting. KMC can only

collect litter from main roads and streets because their large trucks cannot enter housing areas, and due to the lack of resources and funds, they cannot afford smaller trucks which can enter narrow alleys and streets. The vehicles in use are also outdated and frequently breakdown. In addition, they take a long time to get repaired, creating a shortage in the availability of waste collection vehicles. For municipalities, it is problematic to provide continued maintenance of all vehicles, so they can follow their scheduled garbage collections. A household in Johar Town also pointed out this problem saying that the municipalities do not collect waste regularly and when the garbage is not collected, it starts to decay and pollute the environment. Perhaps, one of the biggest challenges for the KMC is that they have yet to acquire a formal solid waste disposal area (landfill) to facilitate the growing waste needs of the city. An area has been provided to the DMCs to be used as landfill for solid waste. However, an environmental impact assessment conducted after the land was provided concluded that it was a wetland which was a source of water for the community in that region, therefore this land cannot be used as a landfill, as it is hazardous for people's health. A new landfill area is yet to be obtained.

Introduction of New Laws and Policies for Betterment of Solid Waste Management Practices

There is a need for new policies to be formulated and implemented regarding the growing issues of solid waste management in Karachi. Interview data revealed that the majority of citizens do not trust the officials working in the KMC and DMCs for solid waste management generally, because they do not possess the work ethics required to do the job properly. Since waste piles in some areas have grown out of control, most residents agreed that there was a need to implement new policies for garbage collection and disposal immediately, as its accumulation negatively affects public health, the quality of life, and the environment. The DMCs complain that they do implement laws and rules related to solid waste management, but the citizens of Karachi do not follow them. Since there is no strict implementation of rules imposed by the authorities, people are in the habit of not following them. One resident from Gulshan-e-Iqbal suggested that people should be fined for breaking the law. Another respondent from F.B Area shared his opinion that residents are not habitual of following rules and frequently spit on roads and throw garbage out of their car windows, because they are not aware of the consequences. The majority of household respondents agreed that all citizens should abide by the rules and regulations in order to keep the city clean and safeguard themselves from diseases in the long-run.

Strategies for Improving Solid Waste Disposal and Management

The EHO was of the opinion that the citizens of Karachi do not take any positive steps themselves for the reduction of solid waste in the city. He elaborated that they are directly or indirectly involved in generating 12,000 tons of waste per day. He suggested that waste reduction could be made possible, if people avoided consuming plastic goods and used paper bags in lieu of polyethene bags. He explained this by giving an example of a plastic bottle. If individuals purchase a water bottle, instead of throwing it away when empty,

they can take it home, wash and reuse it for storing drinking water. The EHO also gave a detailed plan about how residents can help in the improvement of the ecosystem of Karachi by recycling organic foods consumed for agricultural purposes. The process is simple in that, rather than throwing the peels of fruits and rotten vegetables, people can give them to animal owners. These animals can eat the decayed food and peels which result in the excreted food becoming rich fertilizer, which can be used on farms for agricultural purposes. He stressed the need to promote healthy recycling habits within the society to minimize the amount of solid waste produced. Apart from this, DMCs should also provide a dedicated dumping site where hazardous waste from hospitals can be disposed off, because such wastage can generate dangerous health issues, therefore, there is a need to take special precautions for its disposal.

The most popular opinion among households and individuals was that municipalities should provide certain services to help motivate the public to participate in the management of solid waste. One of the residents of Gulistan-e-Jauhar recommended that a particular site should be established by the municipality in every area where people can throw their waste near to their homes in order to get them to stop dumping their garbage in random places. On a regular schedule, DMC and KMC can then come and collect that wastage to help make the city clean again. However, a resident of Gulzar-e-Hijri believed that such a measure would not be successful as the people of Karachi are very careless and irresponsible. Municipalities can, therefore, also provide garbage collection services by visiting different areas to collect waste individually from each and every house. Another resident also agreed that a door-to-door collection service would be most convenient and people would be willing to pay a nominal fee for it. Some residents also suggested that the DMC place large container boxes for waste disposal along every street so it is accessible to people near their homes from where the KMC can collect the waste and dispose of it at their dumping site.

Discussion and Conclusion

Karachi generates more than 12,000 tons of waste per day across its six districts. Most developing cities are confronting the rising problem of solid waste management. In Karachi, municipalities allot different sites for dumping of waste, but they are all out of capacity and garbage flows out on the roads. This study found that illegal dumping is one of the largest issues faced by the society. In every DMC, there is a lack of dumping sites which encourage illegal dumping habits among residents. Certain hazardous wastes, such as hospital waste, are also dumped openly along with other wastes instead of being disposed in an appropriate way. This can lead to widespread diseases and epidemics and is also harmful to the environment. Outdoor burning of garbage was also observed in various areas which cause extreme smoke and environmental degradation.

Due to the shortage of financing and improper management of solid waste, the outcome of solid waste management process becomes ineffective. The equipment and machinery for waste collection and disposal are insufficient in Karachi. Considering the huge population of Karachi, the number of bins allocated to a local area is too few, most of which are not

situated strategically to provide accessibility to the general public. People do not throw their garbage in the KMC allocated points, because they do not find them convenient to access from their homes. Transportation for the collection of garbage from the dumping sites is too infrequent and inappropriate, as the big trucks are exclusively capable of picking up trash from main roads and are unable enter housing areas with narrow streets. Along with this, a major problem is that whenever any heavy machinery breaks down, it requires a long time to be repaired which causes disruptions in the garbage collection routine.

Findings from the study also exposed the poor relationship that exists between the citizens and the solid waste management municipalities. The bulk of the population is of the opinion that the municipalities are not playing their part effectively in solid waste management in the city. On the other hand, the municipalities feel that the citizens do not abide by the rules and regulations set by them and throw their garbage freely wherever they desire. The citizens of a city also have a prime responsibility to play their role in helping to reduce the amount of solid waste produced. However, in Karachi people are mostly critical of the authorities but do not make any effort themselves to try and reduce their household waste or to keep their areas and the surrounding environment clean. The citizens of Karachi have very low awareness about the process of recycling, the types of recyclable materials, and their uses. Most households usually separately sell scraps like newspapers, plastic, and glass, but they are not cognizant about the most efficient ways of separating scrap and recyclable materials from other unsalvageable garbage, and as a result, they just throw them away together with the other waste. There is a low degree of social campaigning to create awareness among the people.

Recommendations

Keeping in mind the growing critical situation of solid waste management in Karachi, there is an immediate need for appropriate measures to be taken for the betterment of waste management throughout all districts of the city. Cleanliness can only be achieved, if KMC and DMCs have a sufficient labor pool. There is a need to hire additional employees to assist the municipalities in dealing with the growing waste situation in the city. Furthermore, the workforce must be competent in handling specialized heavy machinery and vehicles used for waste collection and disposal, such as dumpers. To implement an integrated and systematic solid waste management policy, waste management procedures must be carried out by adopting the latest technology and engineering techniques. For this purpose, employees must be provided with suitable training programs to aid in increasing their efficacy on the job. Current practice is that waste pickers collect the majority of recyclable leftovers from various dumping sites around the city using inappropriate methods that involve relatively no safety precautions. These waste pickers must be equipped with suitable tools and equipment, as well as proper clothing and gloves to ensure their health and hygiene. The same protocol should also be enforced for garbage collection vehicles and dump trucks. It is common practice that dumpers carrying garbage are generally not covered which creates unbearable aromas in the environment and can cause a spread of diseases, thus, it should be ensured that all garbage collecting vehicles are covered so that waste is contained in

one place.

The study found that municipalities in Karachi share an opinion that there is a deficiency of funds. Hence, a larger sum of funds should be allocated to their budget by the Provincial Government, which should be utilized towards the betterment of solid waste management in the city. Proper KMC and DMC dumping sites must be allotted in every area with a sufficient number of litter bins available, so that residents dump their garbage only at the sites assigned for waste disposal. Currently, designated landfill points are at capacity because the per day ratio of waste in the city is increasing rapidly. There must be regular collection and disposal of waste from these sites and if they are not sufficient, then new landfill sites must be purchased to dump the accumulated garbage. The municipalities should also invest in a recycling plant, so that all recyclable materials can be collected and processed in one place.

Two major problems that municipalities currently face are illegal dumping and open burning of garbage at various points around Karachi. These practices are severely harmful for the environment of the entire city as well as for the health and well-being of its residents. It is incumbent for municipalities to broadcast public service advertisements on television and erect billboards on the busy streets of the city to build awareness and encourage citizens to stop their current practices. The society must be educated and given the relevant information relating to the correct ways to dump waste at the nearest municipal dumping sites or bins in their areas. Solid waste management laws must be enforced and citizens should be aware about the penalties, such as fines, for breaking these laws. Such steps will be beneficial and valuable for the entire society in the long-term.

Research Limitations

This study was planned with the intent of gathering information and data about solid waste management in the city of Karachi, on the basis of which the researchers concluded their findings. These findings were based on sample taken from four areas of Karachi. The interview respondents were limited to lower and middle-class areas. Moreover, the study was restricted from a large-scale investigation due to limited resources and time. The small sample size renders this study exploratory and limits the generalizability of its findings to other cities. Respondents' answers were based on their perceptions and opinions which may be biased, in spite of the researcher's expectation that each of the respondents would answer sincerely and realistically.

References

- Abas, M. A., & Wee, S. T. (2014). The issues of policy implementation on solid waste management in Malaysia. *Issues*, 2(3), 1–7.
- Agunwamba, J. (1998). Solid waste management in Nigeria: Problems and issues. *Environmental Management*, 22(6), 849–856.
- Al-Maaded, M., Madi, N., Kahraman, R., Hodzic, A., & Ozerkan, N. (2012). An overview of solid waste management and plastic recycling in Qatar. *Journal of Polymers and the Environment*, 20(1), 186–194.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
- Cox, W. (2014). *Largest World Cities*. Retrieved from <http://www.newgeography.com/content/004280-largest-world-cities-2014>
- Ejaz, N., & Janjua, N. S. (2012). Solid waste management issues in small towns of developing world: A case study of Taxila City. *International Journal of Environmental Science and Development*, 3(2), 167–171.
- Guerrero, L. A., Maas, G., & Hogland, W. (2013). Solid waste management challenges for cities in developing countries. *Waste Management*, 33(1), 220–232.
- Henry, R. K., Yongsheng, Z., & Jun, D. (2006). Municipal solid waste management challenges in developing countries: Kenyan case study. *Waste Management*, 26(1), 92–100.
- Jilani, S. (2007). Municipal solid waste composting and its assessment for reuse in plant production. *Pakistan Journal of Botany*, 39(1), 271–277.
- Marshall, R. E., & Farahbakhsh, K. (2013). Systems approaches to integrated solid waste management in developing countries. *Waste Management*, 33(4), 988–1003.
- Ministry of Environment. (2006). *National Sanitation Policy 2006* [Government of the Islamic Republic of Pakistan].
- Muller, N. Z., Mendelsohn, R., & Nordhaus, W. (2011). Environmental accounting for pollution in the United States economy. *The American Economic Review*, 101(5), 1649–1675.
- Paracha, N. (2014). *Visual Karachi: From Paris of Asia, To City of Lights, To Hell on Earth*. Retrieved from <http://www.dawn.com/news/1134284>
- Pires, A., Chang, N.-B., & Martinho, G. (2011). Reliability-based life cycle assessment for future solid waste management alternatives in Portugal. *The International Journal of Life Cycle Assessment*, 16(4), 316–337.
- Rahman, M. A. (2013). Revisiting solid waste management (SWM): A case study of Pakistan. *International Journal of Scientific Footprints*, 1(1), 33–42.
- Sakai, S. I., Yoshida, H., Hirai, Y., Asari, M., Takigami, H., Takahashi, S., ... others (2011). International comparative study of 3R and waste management policy developments. *Journal of Material Cycles and Waste Management*, 13(2), 86–102.
- Senzige, J. P., Makinde, D. O., Njau, K. N., & Nkansah-Gyeke, Y. (2014). Factors influencing solid waste generation and composition in urban areas of Tanzania: The case of Dar-es-Salaam. *American Journal of Environmental Protection*, 3(4), 172–178.

- Shahid, M., Nergis, Y., et al. (2014). Environmental impact of municipal solid waste in Karachi city. *World Applied Sciences Journal*, 29(12), 1516–1526.
- Sharif, A., & Raza, S. A. (2016). Dynamic relationship between urbanization, energy consumption and environmental degradation in Pakistan: Evidence from structure break testing. *Journal of Management Sciences*, 3(1), 01–21.
- Trihadiningrum, Y., Laksono, I. J., Dhokhikah, Y., Moesriati, A., Radita, D. R., & Sunaryo, S. (2015). Community activities in residential solid waste reduction in Tenggilis Mejoyo District, Surabaya City, Indonesia. *Journal of Material Cycles and Waste Management*, 1(1), 1–10.
- Tseng, M.-L. (2011). Importance–performance analysis of municipal solid waste management in uncertainty. *Environmental Monitoring and Assessment*, 172(1), 171–187.
- Yeheyis, M., Hewage, K., Alam, M. S., Eskicioglu, C., & Sadiq, R. (2013). An overview of construction and demolition waste management in Canada: A lifecycle analysis approach to sustainability. *Clean Technologies and Environmental Policy*, 15(1), 81–91.
- Yoo, K.-Y., & Yi, S. (2015). Evaluation and development of solid waste management plan: A case of Seoul for past and future 10 years. *Journal of Material Cycles and Waste Management*, 17(4), 673–689.