



Paper Topic (Capitalize Each Word, Bold, Times New Roman, 16pt)

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A B S T R A C T (Times New Roman, 11pt)

The transition from a linear "take-make-dispose" model to a circular economy is essential for addressing the global challenges of resource scarcity and environmental degradation. This research explores the integration of smart sustainable infrastructure as a catalyst for enhancing resource efficiency within urban environments. By leveraging Internet of Things (IoT) sensors and data-driven management systems, this study investigates how infrastructure can be designed to facilitate the closed-loop cycling of materials and energy.

The methodology employs a [insert methodology, e.g., comparative case study or lifecycle assessment (LCA)] to evaluate the impact of smart systems on reducing waste in [insert specific sector, e.g., construction or water management]. Preliminary results indicate that the implementation of smart monitoring can improve resource recovery rates by [insert percentage]% and significantly extend the lifespan of critical infrastructure assets. The findings suggest that the synergy between digitalization and circularity not only promotes environmental resilience but also offers a viable economic model for emerging economies. This paper concludes with a strategic framework for policymakers and engineers at Mehran University of Engineering & Technology and beyond to implement circularity in large-scale infrastructure projects.

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Keywords: Circular Economy, Smart Infrastructure, Resource Efficiency, Sustainable Development, IoT, Waste Valorization.. (Times New Roman, 11pt, Capitalize Each Word)

1. Introduction (Capitalize Each Word, Bold, Times New Roman, 11pt)

"All text in main paper body should be written in Times New Roman, 11pt such as shown in the given template. Text Alignment: Justified, spacing: 6 pt. spacing before and after main and/or sub-heading, indentation: 0.2" at each paragraph, Line Spacing: At least 14pts"

In the era of globalization, in some aspects yet Pakistan is dealing with several uneven changes regarding education, politics and policy making. Beside this, another raising matter of concerns is high quantum generation of solid waste. Increasing population, industrialization, urbanization and change in consumption patterns have severe impact in raising the solid waste country wide [1]. This has exerted adverse effects on environmental conditions of urban areas [2]. This can be visualized as results of non-serious attitude of citizens and lack of education, as large heaps of garbage lying in a disorganized manner in every nook and corner in several areas of cities can be experienced.

Pakistan has recorded continuous increase in the population where it is reported that over 200 million people are living there [3]. With this increase in population, generation of solid waste is also increased. As reported by [4] waste generation in Pakistan is around 0.23-0.61 kg/capita/day and a total of approximately 59,000 Tons every day. In Pakistan municipal governments are usually responsible agency for solid waste collection and disposal, but magnitude of problem



is well beyond the ability of any municipal government. TMA (Tehsil Municipal Administration) are responsible for the collection, transportation and disposal, but the current situation is becoming worst. They are unable to cope with continuously increasing wastage volume because of lack of rules, regulations, lack of fund raising, lack of self-awareness, lack of management and expertise and last but not the least due to lack of collection vehicles, equipment & recycling technology [5]. Solid waste is an unavoidable by-product of most anthropogenic activities. Paper, packing material, polythene bags, metal, plastic, food waste, e-waste, glass and packing materials are the major contributor of generating Municipal Solid Waste. In most of the countries like in low and average revenue generation, there are various social as well as environmental sever threats due to the mismanagement of solid waste [6].

This emphasis on need of proper solid waste management system in the city otherwise it may cause many negative effects which could create certain problems for the community and would reduce social values. Unmanaged solid waste increases the number of flies and mosquitoes which are very dangerous and can cause malaria and other infections which are threat for public health. Hence, it is imperative to realize the importance of solid waste management and enhance the significance of adequate waste disposal in local public. Being developing country Pakistan faces several problems including environmental hazards. Rapid annual population growth & impressive GDP growth has an enormous effect on country's natural sources and increases levels of pollution [7]. It is unable to handle the continuously rising waste volume because of lack of; rules & regulations, fund raising, self-awareness, management and expertise and collection vehicles, equipment & recycling technology [5].

In Hyderabad city the domestic waste has not been carried out in sufficient manner in regards of transportation up to disposal due to several social and financial issues. Hence those garbage bins become the institute for developing infections and breeding of several species, demolishing the value of area in several aspects. Crude open dumping of wastage is the most used practice spread all over the Pakistan and these dumpsites are set alight for reducing the volume of accumulating waste. Solid waste is an unavoidable by-product of most anthropogenic activities. Paper, packing material, polythene bags, metal, plastic, food waste, e-waste, glass and packing materials are the major contributor of generating Municipal Solid Waste. In most of the countries like in low and average revenue generation, there are various social as well as environmental sever threats due to the mismanagement of solid waste [6].

The research aims to study the current black side of wastage disposal in Hyderabad city & to provide the solutions for those mishaps in systems. Furthermore, it covers the solid waste management system of the city and also determine the sources and reasons of solid waste management. For practical and theoretical approach different sources of solid waste in Hyderabad have been visited. Interviews were conducted from municipal officers of city for data collection of waste and possible solutions. Interviews from experts were also the part of research.

2. Literature Review (Capitalize Each Word, Bold, Times New Roman, 11pt)

The environment friendly management of municipal solid waste is a global challenge [8]. However, many municipalities fail in controlling the management of solid waste because of lack of institutional, regulatory, financial, technical, and public participation [9]. Few administrative entities have framed strategies for environmental protection but unfortunately these rules are mainly adopted in capital cities only [10]. Yet, in most of cities, open space areas are utilized for dumping [11]. Reduction of this issue is a great challenge for developing countries like Pakistan. Public can play the major role in reduction and overall management of this issue. In Pakistan, it is reported that solid waste generated is near about 64,000 tons per day [12]. It seems that there is lack of awareness regarding the issue of solid waste management whereas the prime and effective solid waste management is only possible with attitude of the public [13]. Japan is reported as successful in reducing solid waste by implementing the concept of shared responsibility where Public detach the waste into combustibles, non-combustibles and recyclables before dumping. Municipalities gather waste paper, glass, metal, etc. as recyclables to recycle while other wastes which include plastics, glass, metal etc. are crumpled before recycling [14]. Keeping in the view the current severity of problems due to solid waste, Pakistan is now more focusing on formulating rules and regulations. Also it is actively involved in finding donor agencies such as World Bank. But unfortunately this practice is again not effective as environmental institutions, laws, and other initiatives have not



proved successful in resolving the concerned matters [15]. In such situations, the policy of sharing practices i.e. public to separate waste and approach directly to the concerned authority seems to be a better decision. Involvement of community and private sector through NGOs will be helpful in increasing efficiency of solid waste management [11].

Performance of solid waste management is directly affected by the community and the policies of the government. In many of the municipalities of Pakistan, the system for collection and disposal of the waste is not proper or there is lack in operations. Hence, this drew the attention of the researchers to study the system and issues related to solid waste management in Pakistani municipalities. However, the focus of this paper is the solid waste management in the city of Hyderabad, Sindh.

3. Research Methodology (Capitalize Each Word, Bold, Times New Roman, 11pt)

3.1 Data Collection (Capitalize Each Word, Italic, Times New Roman, 11pt)

Data collection in this study involved views of the field personnel's, municipal corporation officers and waste management staff through structured questionnaire and instructed interviews. Also, various waste disposal places within the city were considered for site visit. Total 90 questionnaires were distributed among targeted respondents where only 63 completed questionnaire forms were received and considered valid for analysis. Questionnaire focused on uncovering the reasons of solid waste generation where investigated level of importance of each reason was investigated. Respondents were asked to give feedback for each reason listed in the questionnaire used the scale as X_1 = Not Important; X_2 = Slightly Important; X_3 = Moderately Important; X_4 = Very Important; X_5 = Extremely Important. Assessment of level of significance were done using on AI (Average Index) method calculated based on frequency calculated with the help of statistical software SPSS. AI value was calculated based on following formula as adopted from [16].

$$AI = \frac{\sum (1X_1 + 2X_2 + 3X_3 + 4X_4 + 5X_5)}{\sum (X_1 + X_2 + X_3 + X_4 + X_5)} \quad (\text{eq. 1})$$

For site visits, total four disposal sites from the areas of Latifabad and Qasimabad in Hyderabad were selected. In survey and interviews during site visits, the personnel's were asked about whole procedure from disposing of waste at site up to its utilization. Several meetings & interviews were conducted with the experts of relevant field, in order to highlight the role of public in solid waste management.

4. Results and Discussion (Capitalize Each Word, Bold, Times New Roman, 11pt)

4.1 Issues Regarding Solid Waste System in Hyderabad (Capitalize Each Word, Italic, Times New Roman, 11pt)

In Hyderabad, it is observed that solid waste management is very poor. This inefficiency of the system is because of several issues which are discussed below.

4.1.1 Equipment (Capitalize Each Word, Italic, Times New Roman, 11pt, sub-heading indentation 0.2")

Equipment facilities mostly provided on site do not fit with the site condition. Most of the machines are not properly operated by local labour. Also, there is shortage of spare parts in the local vicinity. Basic facilities of local solid waste management are inappropriate. It was due to large height of the waste collector units. It is difficult for children to throw waste into the collector due to which partial waste is always dropped on the ground. Further, the machinery which is brought is without addressing the local culture and conditions. Many times, there is problem of spare parts and this hinders the effectiveness by causing problem in maintenance and repair.

4.1.2 Operations and Maintenance (Capitalize Each Word, Italic, Times New Roman, 11pt, sub-heading indentation 0.2")

By visiting several areas and disposal sites, it was found that many of the times collection of waste is delayed or cancelled because of several basic issues such as shortage of fuel, lack of funds, or wasted time as collection vehicles wait their turn for fuel in a petrol station. Often the waste collection crew does not consider areas of high waste generation



as these areas are far from their approach. Usually, collection begins at the points nearest to the dispatch station and mostly the containers are placed near residential area. Before they reach to the remote areas of the city, it is nearly the end of the working hours. This procedure results to overflowing bins and containers with their attendant health risks, blockage of roads, odour nuisance, and filthy environment. Fig. 1 highlights the typical dumping pattern.



Fig. 1. Dumping site on road (Sentence case, centred, Times New Roman, 10pt)

4.2 Sources of Disposed Solid Waste (*Capitalize Each Word, Italic, Times New Roman, 11pt*)

The sources of disposing waste were categorized into four groups as residential, commercial, institutional and municipal service. This classification was done based on observations during site visits. Each source was contributing in different types of waste. Types of waste as identified during visits of the disposal station included cardboard, batteries, papers, wood, plastics, glasses etc. Summary of the waste found at disposal sited with respect to their source of generation is summarized in Table 1.

Table 1. Source and types of municipal waste (Sentence case, centred, Times New Roman, 10pt)

Source	Typical Waste Generators	Types of Solid Waste
Residential	House/Apartments	Food wastes, paper, cardboard, plastics, textiles, glass, metals, ashes, special wastes (bulky items, consumer electronics, batteries, oil and tires) and household hazardous wastes
Commercial	Offices, restaurants, hotels, markets and stores	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
Institutional	School, University, College, Hospitals, Prisons and Government Centre	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
Municipal Services	Street Cleaning, Landscaping, Parks, Beaches and Recreational Areas	Street sweepings, landscape and tree trimmings, general wastes from parks, beaches and other areas



5. Conclusion (Capitalize Each Word, Bold, Times New Roman, 11pt)

Being one of the major cities of Pakistan, Hyderabad city does not possess a well-developed solid waste management system. The visit at various locations of city unfolds the black side of city in terms of its solid waste collection, transportation, dumping sites, recycling etc. The study investigates various causes of solid waste generation in Hyderabad with the help of several interviews and visits. Interviews were conducted from municipal officers, lower staff, dwellers of different areas of Hyderabad, rag pickers and shop keepers. The level of significance of causes was determined with the help of collecting data among various respondents with a questionnaire survey. The study concludes that, Increase in Population, Non bio degradable material usage, Lack of awareness among public, poor management are few critical causes of waste generation in the city. The discussion with experts revealed that, population control including urban growth control in city can reduce major issues. Reduction of non-bio degradable materials (like plastic bags), awareness among public, good management of various organizations can lead to reduction of waste generation in the city. The study through the results suggest that, there is an utter need of an efficient solid waste management system in Hyderabad. In this regard, the Local Government needs to put their efforts. The overall system from collection to its safer disposal requires special attention. Moreover, the public awareness can help the system more. The Local Government should not only utilize the public funds on maintenance of entire system properly but also it requires to focus on arranging few programs like public meetings, seminars, workshops etc. on monthly basis. These program would definitely aware the public, which is an important stakeholder in reduction and proper management of solid waste.

5. Acknowledgment (Capitalize Each Word, Bold, Times New Roman, 11pt)

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6. Reference (All reference must be in IEEE reference style format)

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