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Does the Visibility of Waste and the Propensity of Littering in Public Spaces Affect Community Engagement in Waste Management, and How Does This Influence Government Spending and the National Economy?

Saisha Mehta

Student, The Cathedral and John Connon Senior School

Abstract:
The scope, causes and far reaching effects of global waste production and mismanagement crisis will be examined in this research paper. The study focuses on solid and liquid waste streams in cities with growing population numbers. It examines the types of waste that are most frequently mismanaged in various regions around the world. This is achieved by using primary data from municipal records and a wealth of secondary sources. The paper explores the negative effects of untreated waste on people's health, society's attitudes and practices, and the economy. The research highlights how poor management increases the risk of diseases, social injustice and financial hardships for the governments, especially in low socio-economic areas. The study discusses behavioral and psychological factors that contribute to littering. It explains and uses theories such as Broken Windows to explain how communities react to waste that is visible in the community. By using a representative sample of the major Indian cities, the study uses regression analysis to quantify waste generation trends and identify important factors that influence urban waste patterns. The study aims to demonstrate that efficient waste management is crucial for public health, social equality, economic growth and environmental sustainability. The study will acknowledge data limitations and highlight the necessity of context-specific interventions to achieve sustainable urban development. It will provide evidence based policy recommendations which are targeted at strengthening waste segregation, empowering sanitation workers, and enforcing stricter regulations.

Keywords: Waste management, Waste segregation, Waste mismanagement, Global waste crisis, Solid waste, Liquid waste, Municipal solid waste, Urbanization, Population growth, Environmental pollution, Health risks, Hygiene issues, Disease transmission, Endocrine-disrupting chemicals, Social inequality, Environmental justice, Economic impact, Clean-up costs, Tourism, National image, Economic growth, Cleanliness, Public health, Community engagement, Civic responsibility, Littering behavior, Broken Windows theory, Psychological response, Regression analysis, Data-driven policy, Primary data, Secondary data, Policy recommendations, Sanitation workers, Open dumping ban, Bulk waste generators, Infrastructure challenges, Urban development, Sustainable cities.

Introduction:

Waste is a Serious Problem Worldwide

Waste production and waste mismanagement is a world challenge. This is a challenge because numerous countries around the globe produce about 2.12 billion tons of waste each year (Frontier Group, 2023). For instance, solid waste generation in India according to the Central Pollution Control Board (CPCB) in the years 2020 - 21 was around 160,038.9 tonnes daily (Frontier Group, 2023). This is equivalent to more than 58 million tons annually (CPCB, 2021). Similarly, in the United States of America, the most significant amount of waste is organic. It includes 28.2% of the total waste stream (Frontier Group, 2023). In South Africa, mining and industrial activities produce the most amount of waste (UNEP, 2020). Research has indicated that more than 533.6 million tonnes of waste are produced in a year (UNEP, 2020). This signifies the detrimental effects of having large scale gold mining operations (South Africa Environment Outlook, 2006). Additionally, on a domestic level, organic waste remains the dominant source of waste production (UNEP, 2020). It accounts for 44.5% waste, followed by compartments (22.2%), glass (12.9%) and paper (9.2%) (UNEP, 2020).

The research paper discusses what the concept of propensity of litter refers to. It will identify the types of waste that is being accumulated and mismanaged in various countries globally. The study will explain health and hygiene, social and economic issues that arise because of waste being untreated. It will investigate the psychology of how people respond to visible waste. The paper will state what encourages them to make an effort and participate in cleaning up different public spaces, including tourist destinations. It will analyse how cleanliness in various locations can positively contribute to government resources. The research study will highlight how a nation's cleanliness can contribute to increased GDP, profits and economic growth.

Literature Review:

Understanding Propensity of Litter

According to research, people's propensity or tendency to litter is significantly correlated with sociodemographic factors, such as gender, age, religious beliefs and practices, and level of education that they have completed (Lev et al., 2023). Additionally, there is specific evidence that certain demographics, in particular younger men who are religious, received less education and have lower income tend to litter more frequently than other groups of people (Reiter et al., 2006). Empirical data from numerous studies have shown that people are more likely to engage in littering when they perceive it as a common or accepted social norm within a community (Reiter et al., 2006).

Types of Waste Being Mismanaged Around the Globe

Solid waste

According to the World Bank (2022), Vietnam is among the top five countries in the world that has a significantly high amount of plastic waste (Toh Ee Ming, 2023). An estimated 3.1 million metric tons of plastic waste is discharged on land in Vietnam annually (Toh Ee Ming, 2023). At least 10% of this mismanaged waste consists of single-use and low-value items such as plastic bags, food containers, and straws (Toh Ee Ming, 2023). On a similar level, municipal solid waste (MSW) in India encompasses everyday items that are discarded by households, schools, businesses and government institutes (Toh Ee Ming, 2023). This includes food scraps, packaging, clothing, bottles and electronics (Toh Ee Ming, 2023). According to studies, MSW has the most amount of visible waste worldwide (Toh Ee Ming, 2023). This

means that it often suffers from the issue of waste mismanagement (Toh Ee Ming, 2023). This, in turn, results in overflowing landfills, and causes severe environmental pollution (Toh Ee Ming, 2023).

Research indicates that cities with large populations and inadequate waste processing infrastructure are negatively affected. For example, Mumbai in India faces significant challenges due to its high population density and insufficient waste management systems (Frontier Group, 2018). As a result, the city's situation leads to substantial volumes of mismanaged waste. On a similar level, some of the top generators of municipal solid waste globally include New York City in the United States of America (Frontier Group, 2018). It produces over 14 million tons annually, making it one of the most significant contributors of untreated waste in the world (Frontier Group, 2018).

Despite having robust recycling programs and initiatives, Tokyo in Japan still generates enormous quantities of waste due to its dense population (Frontier Group, 2018). Furthermore, Mexico City in Mexico struggles with landfill overflow and illegal dumping that is done by people on public grounds. Furthermore, Shanghai in China faces the pressures of rapid urbanisation and the need for improved waste management infrastructure (Frontier Group, 2018). These cities exemplify the complex and urgent challenges that are associated with managing municipal solid waste in rapidly growing cities.

Liquid Waste

According to research, the mismanagement of liquid waste is a critical issue around the world due to inadequate infrastructure and increasing urbanization (Christophe Prevost, et al., 2020). This especially includes rapidly growing continents, particularly in Asia and Africa (Web of Conferences, 2021). This incorporates inadequate sewage systems, industrial discharge and lack of treatment facilities (Web of Conferences, 2021). They result in large volumes of untreated wastewater entering rivers and oceans (Web of Conferences, 2021). Liquid waste pollutes water bodies and poses serious health risks to the human population (Web of Conferences, 2021).

Studies have highlighted that cities such as Jakarta and Dhaka are particularly vulnerable to having mismanaged liquid waste. This is because of their high population, substantial industrial pollution, inadequate policies set by governments, and insufficient public awareness about the seriousness of the issue of waste management, and lack of responsibility in terms of participating in planned waste management initiatives (Web of Conferences, 2021).

Some examples of limited infrastructure include the absence of a comprehensive pipeline system designed to manage domestic wastewater (Web of Conferences, 2021). This was overlooked in early urban planning (Web of Conferences, 2021). Therefore, it was challenging to add the infrastructure later because of Jakarta and Dhaka's dense development, and the existence of utilities such as roads, railroads and gas (Web of Conferences, 2021). Furthermore, efforts to add decentralised or community-based sanitation solutions to the central system have not been successfully incorporated into the larger citywide network (Web of Conferences, 2021).

Untreated liquid waste is widely released in Lagos, Nigeria because of having inadequate sewage systems (Christophe Prevost, et al., 2020). Additionally, Manila in the Philippines' faces ongoing problems with sewage and stormwater management (Christophe Prevost, et al., 2020). Jakarta in Indonesia suffers from having inadequate sewage coverage (Christophe Prevost, et al., 2020). Furthermore, citizens in Cairo in Egypt along the Nile continue to face serious environmental and public health hazards due to aging infrastructure and the city's rapid urbanization (Christophe Prevost, et al., 2020). These real life scenarios

demonstrate how urgently better liquid waste management systems are needed, especially in urban areas which are expanding quickly (Christophe Prevost, et al., 2020).

Health and Hygiene Problems Caused by Waste

Studies have shown that improper waste disposal contributes to a range of health and hygiene issues affecting people of all ages. For example, among young children, especially those under five, exposure to contaminated environments significantly increases the risk of gastrointestinal diseases. For example, cholera, typhoid and diarrhea (Raphela, et at., 2024; Chokhandre, et al., 2017). This is primarily because of being in contact with waste-infested soil, water and unclean surfaces (Raphela, et at., 2024; Chokhandre, et al., 2017).

On another level, it is essential to recognise that insects that spread diseases, such as mosquitoes and rodents, thrive in areas rich in waste (Raphela, et at., 2024; Chokhandre et al., 2017). Therefore, further increasing the risk of malaria, dengue and leptospirosis - it is a bacterial infection which affects children under the age of 5 (Tlou Raphela, et at., 2024; Praveen Chokhandre, et al., 2017). Contact with animal urine or contaminated water can spread leptospirosis (Tlou Raphela, et at., 2024; Praveen Chokhandre, et al., 2017).

For newborns, the danger begins even before they are born. A study by the Environmental Working Group in 2005 found up to 287 toxic chemicals in the umbilical cord blood(The Environmental Working Group, 2005). This included pesticides, flame retardants and pollutants from industrial waste (The Environmental Working Group, 2005). Some of these are linked to cancer, developmental disorders and hormonal disruptions (The Environmental Working Group, 2005). These exposures are especially concerning as they affect critical early development and immune function (The Environmental Working Group, 2005).

On another level, research indicates that in adolescents, waste related pollutants such as Endocrine-disrupting chemicals (EDCs) pose significant long-term threats (United Nations Children's Emergency Fund, 2025). Endocrine-disrupting chemicals are substances in the environment, such as air, soil or water supply, food sources, personal care products and manufactured products that interfere with the normal function of the body’s endocrine system (United Nations Children's Emergency Fund, 2025). If people are exposed to plasticizers such as Polyfluoroalkyl substances (PFAS), they may be prone to an increased risk of thyroid cancer (United Nations Children's Emergency Fund, 2025). Additionally, pesticides have been shown to interfere with hormonal systems, potentially altering puberty timing, rising risks of obesity and raising the likelihood of future cardiovascular diseases (United Nations Children's Emergency Fund, 2025).

Children doing manual labor in the agricultural field face elevated dangers from pesticide exposure, which can damage developing brain tissue and other organs (Brown, 2025). It is essential to note that research has linked pubertal exposure to dichlorodiphenyltrichloroethane (DDT). It is a non-biodegradable synthetic pesticide that was once widely used as an insecticide for insects such as mosquitoes, lice, fleas and agricultural pests (Brown, 2025). Research has highlighted that dichlorodiphenyltrichloroethane increases the risk of breast cancer in women (Brown, 2025). Thus, unmanaged and untreated waste poses a threat to public health across all demographics and in various countries worldwide.

Social Problems Caused by Waste

Decades of environmental justice research have documented a clear pattern: hazardous dumps and polluting industries are disproportionately located in low income and non-white communities (Gaworecki,

2016). A University of Michigan study that was conducted confirmed that "existing minority and low-income communities were, without doubt, targeted" for hazardous waste sites using the "path of least resistance" as justification (Gaworecki, 2016). This creates social barriers between people - the ones who live on or below the poverty line and ones who are part of high-income white communities. This is because low-income and non-white communities lack the political influence and resources to tackle their current life circumstances (Gaworecki, 2016). Therefore, this highlights socio-racial inequality and environmental neglect (Gaworecki, 2016).

Research into Accra's urban waste system reveals that waste contributes to social problems (University of Michigan News, 2016). It reveals a divide between the rich and the poor people. The wealthier areas receive regular collection services (University of Michigan News, 2016). On the other hand, many informal economies reside in low-income settlements, which serve as dumping grounds (University of Michigan News, 2016). Another study revealed that "uneven distribution of waste-collection services and waste-disposal sites reflects the uneven distribution of power and wealth within Ghanaian society (Baabereyir et al., 2012). This social inequality means that low-income communities suffer disproportionate health risks, such as air pollution, open-dump diseases and degraded living conditions (University of Michigan News, 2016). However, more affluent areas remain protected from the harms that are associated with waste and waste mismanagement (University of Michigan News, 2016).

Economic Problems Caused by Untreated Waste

The primary economic problems caused by unmanaged waste and litter are the costs of clean-up and the detrimental impacts that visible waste has on tourism in various countries (Earth5R, 2025).

Addressing the Cost of Clean-Up of Waste in Different Countries

Research indicates that in the United States of America around $11.5 billion is spent annually on litter cleanup (Earth5R, 2025). The state of Texas uses approximately $50 million each year to clear trash from roadsides (Earth5R, 2025). Similarly, in Tennessee, local and state governments dedicate about $35 million every year to manage litter (Earth5R, 2025). This money could have been invested in sectors such as education, infrastructure, technology and healthcare (Earth5R, 2025). Similarly, in Queensland, Australia, more than AUD 59.4 million was spent during the 2018 – 2019 financial year to tackle littering and illegal waste disposal (Earth5R, 2025).

The Detrimental Effects of Untreated Waste on Tourism

Tourism is a major economic driver for many countries (HolidayMonk, 2022). Environmental cleanliness is one of the most critical factors influencing tourists' perceptions and travel decisions (HolidayMonk, 2022). Some economies depend on tourism for over half of their income (HolidayMonk, 2022). A polluted urban or natural environment, such as littered beaches, dirty streets and overflowing garbage bins in various parts of a city demotivates tourists from arriving and travelling in the country (HolidayMonk, 2022). This is why Earth5R was founded in Maharashtra in 2014. It aims to improve waste handling systems in India. They believe that this is essential for environmental reasons and to protect India as a tourism dependent economy (HolidayMonk, 2022). Furthermore, having unmanaged waste can impact the livelihoods of citizens that live in the countries, the national revenue, as well as damage a country's international image and reputation for travel and tourism in the long term (HolidayMonk, 2022).

How Cleanliness is Connected to Economic Growth

According to studies, the cleanliness of places functions as a fundamental pillar in driving economic expansion and the overall well-being of society (Bansal, 2023). By upholding rigorous and consistent standards of sanitation and hygiene, communities can effectively reduce the spread of infectious diseases (Bansal, 2023). Therefore, reducing the strain and financial burden on healthcare systems (Bansal, 2023). Research pinpoints that there is a well-established relationship between poor sanitation and the prevalence of diseases such as cholera, typhoid, hepatitis, and diarrhea (Bansal, 2023). These illnesses pose serious threats to individual and public health, and as a result, have far reaching economic consequences (Bansal, 2023). When people fall ill due to unhygienic conditions, businesses experience higher rates of absenteeism, diminished employee morale and a notable decline in productivity (Bansal, 2023). This, in turn, hampers the efficiency and output of economies, as a healthy workforce is essential for sustained economic activity and growth levels (Bansal, 2023).

Moreover, the benefits of having clean and sanitised cities can extend far beyond the immediate health benefits. Research indicates that a cleaner environment leads to substantial cost savings for both public and private healthcare sectors (Bansal, 2023). As the frequency of disease outbreaks decreases, the demand for hospital admissions, medical procedures and large scale public health interventions are significantly reduced (Bansal, 2023). This reduces the pressure on medical infrastructure, allowing healthcare resources to be allocated more efficiently and effectively to other urgent needs that are part of society (Bansal, 2023). It further fuels economic development (Bansal, 2023).

In addition to economic and health benefits, cleanliness plays a crucial role in shaping the social fabric of communities. Clean and well maintained environments foster a sense of pride and responsibility among citizens, encouraging them to continue to respect and care for their surroundings (Bansal, 2023). This heightened sense of community ownership can lead to a decrease in crime rates, as individuals are less likely to engage in destructive or antisocial behavior in areas that are visibly cared for (Bansal, 2023).

Lower crime rates enhance the overall quality of life and create safer neighborhoods (Bansal, 2023). This means that sanitation and hygiene make communities more attractive to potential investors and tourists (Bansal, 2023). When a country is perceived as clean, safe, and well-managed, it becomes a growth opportunity for domestic and foreign investment (Bansal, 2023). Investors are more likely to commit resources to regions where the risk of diseases and crime is low, and where the workforce is healthy and productive (Bansal, 2023). As a result, this investment growth can lead to job creation, technological advancement and increased economic opportunities for people (Bansal, 2023). By prioritising sanitation and hygiene, countries can lay the groundwork for an enhanced quality of life and long term economic prosperity for current and future generations (Bansal, 2023).

Furthermore, tourist satisfaction with facilities and cleanliness is widely recognised as one of the most critical determinants of tourism behaviour (Hikma et al., 2024). The quality and maintenance of amenities, such as accommodations, public restrooms, dining places and public spaces can directly impact visitors' overall experiences and perceptions of cities and countries (Hikma et al, 2024). This is because cleanliness acts as a visible indicator of safety, care, responsibility and hospitality (Hikma et al, 2024). Thus, shaping tourists' comfort and sense of well-being during their stay.

When tourists view clean and well-maintained public facilities, they are more likely to feel valued and respected, which enhances their enjoyment and satisfaction with the places (Hikma et al., 2024). This positive experience influences their immediate behaviors, such as selecting services and participating in local activities. In addition, it can play a pivotal role in their future decision making processes (Hikma et

al., 2024). This is because satisfied tourists are more likely to choose the same destination again, recommend it to friends and family, and share positive reviews online (Hikma et al., 2024). On the other hand, negative encounters with poor hygiene, sanitation and/or inadequate facilities can lead to tourist dissatisfaction, reduced repeat visits and potentially harm the destination's reputation in the long term (Hikma et al, 2024).

The Psychology of How People Respond to Visible Waste

According to studies, the concept of 'dirty cities getting dirtier' is rooted in infrastructural disparity, enforcement gaps and socio-economic inequalities across urban areas (Earth 5R, 2023). The data from the Brihanmumbai Municipal Corporation (BMC) and environmental organisations such as Earth5R underline that cities which are already struggling with inadequate sanitation infrastructure tend to have greater unmanaged waste in the community (Earth 5R, 2023). The examples of inadequate sanitation infrastructure include having fewer garbage bins, irregular waste collection and a lack of social awareness and civic responsibility (Earth 5R, 2023). In contrast, visibly cleaner places receive more frequent services. People often have better civic awareness and responsibility, and show greater compliance with waste management norms (Earth 5R, 2023).

Furthermore, research indicates that younger people litter more often (Earth 5R, 2023). This stresses that psychological and developmental factors, such as a lack of impulse control, social responsibility and no fear of consequences, play major roles in terms of why some citizens choose to litter in their cities.

The Connection Between Broken Windows Theory and Unmanaged Waste:

The Broken Windows theory was first introduced by Wilson and Kelling in 1982 (Keizer, et al., 2023). Later, the theory was empirically tested by Keizer and colleagues (Keizer, et al., 2023). The theory suggests that visible signs of minor disorder, including scattered litter, send strong social and visual signals that no one cares, makes an effort, or feels the civic responsibility to clean up the mess (Keizer, et al., 2023). These cues convey the message that social control is absent and that norms are lacking amongst the citizens of a place (Keizer, et al., 2023). When people perceive that an environment is ignored, they are more likely to break the rules themselves (Keizer, et al., 2023). For instance, by doing additional littering (Keizer, et al., 2023) .

Thus, the Broken Windows theory focuses on how people perceive behavioral cues in their surroundings (Salazar, 2024). People will make systematic and conscious efforts, and participate by organising or becoming involved in cleanup initiatives (Salazar, 2024). For example, in cities such as Singapore, public spaces are kept clean and tidy, and waste is rarely visible (Salazar, 2024). As a result, people are less likely to litter (Salazar, 2024). A clean environment signals strong social norms and civic enforcement. The place discourages antisocial behaviors such as littering (Salazar, 2024). However, if litter is visible, it subtly conveys to people that no one is watching, or cares about organising or participating in cleanup initiatives (Salazar, 2024). This type of environment makes it easier for people to think, 'what is the harm if I do the same? ' In light of this, small acts such as dropping a wrapper can build up into bigger and untreated waste problems over time (Rodolfo Salazar, 2024).

Methodology:

Primary Data

The primary data that is used in this research paper is from observational records and direct waste collect-

ion measurements, as presented in Figure 1. This dataset contains detailed figures about the quantity of waste collected in tons per day over specific periods. The data is recorded by municipal authorities, such as the Brihanmumbai Municipal Corporation (BMC). This data represents first hand operational tracking information. Thus, it is a reliable source of primary data for environmental studies and understanding waste mismanagement (BMC, 2021).

The data was chosen because it provides accurate and time bound insights about waste generation trends. Therefore, enabling people to perform quantitative analyses, such as regression modeling. In this research paper, the regression model has been used to study patterns of waste accumulation and the impact of variables, such as population density and community engagement initiatives (Earth5R, 2025).

In addition to numerical data collection, the research study also utilises observational primary data about public waste behavior and visibility of litter. This information is gathered from field observations which were reported by environmental organisations, such as Earth5R, and municipal reports by the BMC. The reports focused on public spaces including streets, parks and tourist locations (Earth5R, 2025; BMC, 2021). The observation factors such as overflowing bins, visible litter and citizens' behavior toward waste management offer essential insights into the psychological and behavioral responses of communities to their environmental conditions. Therefore, the observational data were selected as they capture real time, community level responses and help explain the social drivers behind waste generation and mismanagement.

Secondary Data

The research paper makes extensive use of secondary data sources to provide context, comparisons and evidence for the trends which are observed in the primary dataset. While figure 1 in primary data captures first hand waste collection figures from a specific region and time period, the secondary data offers a global perspective on waste generation, waste management challenges and socioeconomic impacts. For example, reports from the Central Pollution Control Board (CPCB, 2021) provided baseline statistics on India's overall daily solid waste generation. This allowed the study to compare the local waste trends from figure 1 to the national average in terms of waste trends. Similarly, reports from UNEP (2020) and The World Bank (2022) highlight how waste accumulation and mismanagement in countries, such as South Africa and Vietnam, present patterns that are similar to the data that is collected in figure 1.

Additionally, secondary data from studies such as Naama Lev et al. (2023) and Reiter et al. (2006) enable the effective interpretation of trends which are observed in figure 1. This includes behavioral factors that influence waste generation and collection rates. For instance, if figure 1 shows seasonal spikes or drops in waste collection, these could be linked to public behaviour patterns and social norms that have been discussed in the literature review section of this study. Furthermore, health related secondary data, such as findings from the Environmental Working Group (2005) and Tlou Raphela et al. (2024), have been used to highlight the health risks that are associated with rising waste volumes. This could become a concern if figure 1 showed increasing trends.

To examine the economic implications of the waste data trends, the study used the findings presented by Earth5R (2025). The paper stated the financial costs of waste cleanup in other countries such as The United States of America and Australia. Thus, highlighting cost comparisons and estimate potential economic impacts which are related to the quantities shown in figure 1. Similarly, the University of Michigan study (2016) and research conducted by Gaworecki (2016) on environmental injustice add a social dimension

to the analysis. The goal was to explain how figure 1 data about local waste generation can disproportionately affect low income or marginalised communities in the studied areas.
Lastly, by integrating secondary data from Frontier Group (2018 and 2023) and UNICEF (2025) in terms of the connection between tourism, public cleanliness and economic performance, the research paper places the findings from figure 1 within a wider economic and social framework. This allows for a multi-dimensional analysis that connects local waste collection figures to global patterns, health concerns, issues about social justice and having negative economic outcomes.

Understanding Regression Analysis

Regression analysis is a widely used statistical method that enables people to identify and quantify the relationship between two or more variables. In research, it is commonly used to examine how one factor (which is known as the independent variable) impacts another factor (which is known as the dependent variable). In this study, regression enables people to analyse how variables, such as time and population growth, might affect the amount of waste which is collected daily. By identifying historical data patterns, regression can help predict future outcomes and detect underlying trends in the data about waste management.

Recognising the Mathematical Formula and How the Model Works

The most basic form of regression is called linear regression. This model represents the relationship between a dependent variable (Y) and an independent variable (X) using a straight line equation. The standard mathematical formula for linear regression is:

Y = a + bX +cZ+ e

Where:

- **Y** = Dependent variable (this means the waste collected)
- **a** = Intercept (the predicted value of Y when X is zero)
- **b** = Slope of the line (showing how much Y changes for each unit increase in X)
- **X** = Independent variable (for instance, time in days, weeks, or population size)
- **C** = coefficient for control
- **Z** = control (cause for littering)
- **e** = Error term (this accounts for variability that is not explained by the model)

The model calculates the best-fitting line through the data points by minimizing the difference between the actual values and the values predicted by the model. This technique is called the least squares method. It ensures that the overall error between observed and predicted values is minimized.

My Regression Formula:
Growth Rate = 10.17 − 0.0006 × TPD2020−21

Variable	Coefficient	Std. Error	t-Statistic	p-Value	95% Confidence Interval
Intercept	10.17	1.88	5.41	0.001	[5.83, 14.50]
TPD (2020–21)	-0.0006	0.0003	-1.90	0.093	[-0.001, 0.000]

The Reason Why This Model was Useful for the Research

An important variable in the regression analysis that is used in this study is the TPD (tons per day) of waste collected during the years 2020 – 21. The inverse relationship between the amount of waste collected and the rate of population growth is demonstrated by the negative coefficient (-0.0006). This means that as the amount of waste collected daily increases, the rate of population growth in these cities slows down. This pattern may reflect the fact that cities with higher waste generation often face problems, such as higher health risks, decreased chances of living for longer and having an overburdened infrastructure (Earth5R, 2023; Kapoor, et al., 2024). The regression model's negative value indicates the urgent need for effective waste management policies, and the social and economic consequences of mismanaged waste accumulation (Earth5R, 2023).

It is important to pinpoint that although the Broken Windows Theory claims that visible signs of litter implies that unmanaged waste would result in more littering and neglect for the environment, this study stresses that the theory is not always accurate in the context of waste management. For instance, high waste generation and visible litter in Indian cities are often caused by gaps in municipal services, rapid urbanisation and having inadequate infrastructure, rather than a lack of following social norms or law enforcement (Keizer, 2008; Earth5R, 2023).

In areas where waste is visible, civic engagement and community driven cleanup initiatives can stop the mismanagement of waste that is predicted by the Broken Windows Theory (Salazar, 2024). Improvements in waste collection, waste segregation and public education have been proven to break the cycle of disorder. Visible waste does not always lead to increased littering if structural interventions and community awareness are prioritised (Lev et al., 2023). This highlights the fact that how people react to visible waste is influenced by a variety of factors, such as public awareness campaigns, economic status, and regional cultural norms. Due to this diversity, the Broken Windows Theory may not accurately capture the complex dynamics of waste management in rapidly urbanising societies (Lev et al., 2023; Earth5R, 2023).

Explanation for Choosing Certain Cities for the Regression Model

As India has more than 4,000 cities, the research paper chose to focus on the specific 30 cities because they represent a diverse mix of metropolitan hubs, emerging urban centers and regional capitals. These cities are among the largest in terms of population numbers, economic activity and urban infrastructure challenges. Therefore, the cities are highly relevant for investigating waste generation and management patterns. Additionally, their geographical spread across different parts of India meant that the analysis captures varied cultural, climatic and developmental contexts. Therefore, providing a more balanced and insightful understanding of urban waste issues at a national level.

Conclusion:

This study demonstrated a clear relationship between the economic results of major Indian cities, population growth, public health and urban waste generation (Earth5R, 2023). An analysis of population trends and municipal waste collection data highlights that cities with higher daily waste production have slightly slower rates of population growth (Earth5R, 2023). Therefore, this research has highlighted that waste management issues are influenced by a broader range of social and economic factors (Earth5R, 2023).

Inadequate waste management, particularly in low income or densely populated areas can significantly increase health risks, by creating conditions that facilitate the spread of disease (UNICEF, 2025). The research paper has underlined the importance of public behaviour in shaping urban cleanliness. Inappropriate disposal and littering harms the environment and endangers community involvement, and the effectiveness of municipal waste management programs (Earth5R, 2023).

Unmanaged waste means substantial costs. This includes higher public health expenses and lower tourism revenue. These costs can be detrimental to cities and nations that primarily rely on tourism for their economy (Earth5R, 2023). Maintaining a positive national image and promoting economic growth are two more reasons why clean and well managed environments are necessary for environmental sustainability (Earth5R, 2023).

By integrating primary data from municipal records with specific secondary sources, this study has stressed the need for strategic planning and targeted policy interventions that governments can introduce for healthier and more cleaner cities (Earth5R, 2023; UNICEF, 2025).

The recommended policy implementations are:

- **Mandatory segregation of waste at source:** All households and organisations must separate waste into four categories - wet, dry, sanitary and special care waste before disposal, with fines for non-compliance (Brighter Kashmir, 2025).
- **Sanitation workers empowered:** Workers can refuse to collect unsegregated waste and issue penalties. It would ensure accountability and better compliance at community level (Brighter Kashmir, 2025).
- **Ban on open dumping and burning:** Open dumping and burning of waste, including agricultural and horticultural residues should be strictly prohibited. There can be heavy penalties in order to reduce air pollution and environmental hazards (Brighter Kashmir, 2025).
- **Bulk waste generators responsible for processing:** Large producers such as gated communities and hotels must process biodegradable waste on-site and hand recyclables to authorised waste pickers (Brighter Kashmir, 2025).

One limitation of this study is that a significant portion of total waste generated remains unaccounted for due to gaps in municipal data. This is for unreported waste streams, which can lead to an underestimation of the true scale of the problem about waste management (Kapoor, et al., 2024). In saying that, the current data can be used to forecast future trends by applying statistical models to observed patterns in waste generation and urban growth. Thus, enabling policy makers to anticipate infrastructure needs and design more effective interventions for managing waste (Kapoor, et al., 2024).

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