

Environmental Governance in Urban India: Solid Waste Management in Delhi: (1991-2011) Case Study

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Abstract: The high rate of urbanization and population increase has exacerbated environmental issues in the Indian cities, especially on the issue of municipal solid waste management. This paper will analyse how environmental governance can play its part in dealing with solid waste management in Delhi between the years 1991 and 2011. The study follows a qualitative case study methodology and examines the policy frameworks, the institutional structures and the waste management practices at the city. The resources used in secondary data like government reports, policy documents, municipal record, and academic literature were used to assess the development of waste governance mechanisms. The data obtained shows that the number of municipal solid waste generated in the city of Delhi grew substantially in the period of the study, and instead of about 4,000 tonnes per day in the beginning of 1990s, in 2011, the volume of the waste has reached more than 8,000 tonnes per day. Although there were regulatory frameworks in place to standardize the situation like the Municipal Solid Waste (Management and Handling) Rules, 2000, waste segregation, scientific treatment, and sustainable disposal practices were not implemented to a considerable degree. The complex institutional set up that seeks the involvement of various agencies like the Municipal Corporation of Delhi, Delhi Pollution Control Committee and Central Pollution Control Board where coordination issues would oftentimes have an impact on good governance is also pointed out in the study. The study also determines the undervalued but important role played by the informal recycling industry in the minimization of landfill wastes. The results indicate that, despite the introduction of environmental governance structures, the structural limitations confronting such structures in terms of poor policy implementation, poor infrastructures and extensive use of landfill as a disposal method curtailed their effectiveness.

Keywords: Environmental governance, Solid waste management, Urban sustainability, Municipal governance, Delhi, Urban environmental policy

INTRODUCTION

One of the greatest threats to environmental governance in India especially in the control of the municipal solid waste has been the rapid urbanization. The growth in population, the development of urban infrastructure and the rise in consumption habits in the Indian cities has been unprecedented since the early 1990s with the economic liberalization. These changes have brought about a great number and bulkiness of waste in the urban areas thereby exerting a lot of pressure on the municipal government and environmental bodies (Priti & Mandal, 2019). Delhi, the national capital of India, can be considered one of the most notable examples of this challenge. The city has experienced a tremendous increase in the amount of waste over the last decades with its rapidly growing population and an urban economy that has been

growing significantly. A good governance system is thus necessary to tackle the waste collection, treatment and environmentally friendly disposal concerns (Rengerla & Angamuthu, 2025).

Environmental governance can be viewed as the collection of rules, institutions, regulatory frameworks, and decision-making, which inform environmental protection and the management of resources. Governance in the field of urban waste management entails coordination of various stakeholders such as municipal authorities, regulatory institutions, contractors and civil societies (Post & Baud, 2003). The Policy initiatives in India like the Municipal Solid Waste (Management and Handling) Rules, 2000, set by the Ministry of Environment and Forests were important to segregate waste in urban areas, to promote the use of scientific land fill management, and to promote the practice of recycling in the urban areas. These regulations marked a great change in the conventional dumping methods of waste to more organized and sustainable waste disposal mechanisms (Mani & Singh, 2016).

The city of Delhi is a useful case study to shed light on how environmental governance works and fails in Indian cities. The city has undergone a fast demographic growth and economic transformation between 1991 and 2011 which had significant growth in municipal waste generation (Jain et al., 2015). Report by Municipal Corporation of Delhi and Central Pollution Control Board indicated that the volume of waste generated in Delhi is more than 8,000 tonnes/day as compared to 4,000 tonnes/day that was generated in the early 1990s (Kumar, 2019). This influx posed a massive strain on the current waste disposal systems and the necessity to have better systems of governance. Some of these landfills became overwhelmed by dumping untreated wastes continuously and the surroundings, i.e., groundwater pollution, bad smells, and air pollution were all felt by the communities around these landfills (Bhat, 2020).

Live cases can be given showing the long-term environmental impact of poor waste management in Delhi. As an example, the Ghazipur landfill collapse of 2017, which happened after the study period, clearly shows the effect of decades of unprocessed waste dumping on a large scale (Reddy, 2021). In the same manner, the Bhalswa landfill has been largely condemned among other things as a contributor of the serious air pollution and methane emission (Agarwal, 2025). These examples demonstrate how inadequate planning, absence of waste segregation and relying on landfill disposal have posed severe environmental and human health hazards in the metropolis.

The next significant part of the waste management system in Delhi is the contribution made by informal recycling sector. The city has thousands of garbage collectors and scrap dealers who collect recyclable waste including plastic, paper, and metal in the households and landfill sites. Although they are not formally recognized in the institutions, these workers can substantially decrease the quantity of garbage going to landfills and help in the recovery of resources (Gidwani, 2015). Case studies have been performed in the regions like Seelampur and Ghazipur and these regions indicate that the informal waste workers are very instrumental in the recycling networks of urban areas, but they can be left out of formal waste management policies (Thakker, 2006).

Thus, studying the governance of solid waste management in the city of Delhi during the period of 1991 to 2011 can offer important insights into the effectiveness of environmental policies and sustainable efforts in the urban context. Through the analysis of developments in environmental policies and institutional arrangements, as well as practices of waste management in the city during the period, this research seeks to comprehend the strengths and weaknesses of environmental governance in responding to the challenges of urban waste management in India (Srivastava et al., 2015).

REVIEW OF LITERATURE

A number of researchers have studied the institutional, environmental as well as social aspects of waste management in India especially in big cities like Delhi. The current literature indicates an increasing environmental dilemma on urban growth, the role played by the institution of governance, and the sustainability of waste disposal plans.

Rahman et al. (2009) carried out an extensive research on urban environmental problems in Delhi based on the techniques of remote sensing and Geographic Information System (GIS). Through their study, they established the possibility of spatial analysis to track the process of environmental degradation, land use modification, and patterns of accumulated waste in urban regions. The paper emphasized the fact that the rapid urbanization and population growth has exacerbated environmental issues in the form of waste disposal and water contamination and degradation of land. The authors have highlighted that combined technological solutions such as remote sensing and GIS would help policymakers and urban planners to recognize environmental hotspots and enhance planning on waste management in urban cities.

Singh (2012) discussed the shifting outlines of solid waste management in India through the analysis of the changes in the waste governance policies and institutional structures. The research pointed out that the growing rates of municipal solid waste in the Indian cities have posed a major problem to the urban local authorities. Singh has pointed out that policy measures like the Municipal Solid Waste (Management and Handling) Rules, 2000 was a significant step towards the modernization of the waste management systems. The study however also indicated that poor infrastructure and poor enforcement of regulations and lack of participation by the people are the reasons why effective implementation is usually not achieved. The author indicated that sustainable waste management would be attained by enhancing the governance capacity and increasing public awareness.

The article by Zimmer and Sakdapolrak (2012) examined social behaviors of environmental governance as applied to wastewater management at a slum settlement in Delhi. They gave priority to the daily relationship between the residents, informal service providers, and government institutions. The results showed that the governance of environment in informal urban settlements is not only practiced through official policies but also through local social practices and involvement of the communities. The authors held that the process of governance in developing cities tend to be hybrid and that they involve both formal and informal players, who jointly impact on the environment.

Tahir et al. (2015) examined the situation and perspectives of solid waste in Delhi today and in the future considering that solid waste generation is rapidly growing because of the population growth and economic development in urban areas. The research provided an estimation of waste production in Delhi to keep increasing substantially unless efficient waste reduction and waste recycling measures were introduced. The authors pointed out that the use of landfill disposal has posed a critical environmental issue such as air pollution, greenhouse gas emission, and groundwater pollution. They suggested the use of integrated waste management techniques, such as waste separation, recycling and energy recovery technologies.

Nandan et al. (2017) reviewed the latest case of solid waste management in India and found a number of structural challenges in the industry. Their study has highlighted the fact that landfill disposal remains a major way of waste management in most Indian cities because of the poor waste processing facilities. The paper has also indicated the significance of the informal sector in recycling and recovery of materials that greatly alleviates the pressure on

the municipal waste management systems. Nonetheless, the authors have stated that informal waste workers usually work without official recognition or social insurance, which means that there is a need to change the policies that would ensure that these people become a part of formal waste management systems.

Raju et al. (2018) presented a more comprehensive view of the urban environmental governance in India in terms of institutional frameworks, policy side, and governance issues. Their activity highlighted the importance of a coordinated approach of environmental governance in Indian cities among various stakeholders, such as the government agencies, actors in the private sector and civil society organizations. The authors said that enhancing governance capacity, enhancing regulatory processes, and promoting participatory strategies are essential in dealing with multifaceted environmental problems like waste management, water pollution, and urban sustainability.

On the same note, Ahluwalia (2019) investigated the general design of urban governance in India, and the administrative and institutional problem of the urban local bodies. The paper has highlighted that the fast urbanization has been exerting massive pressure on the municipal infrastructure and service delivery systems including the waste management. Ahluwalia contended that in order to enhance environmental service delivery in urban centers, there is the need to strengthen the local governance institutions, enhance financial capacity and use innovative approaches in urban management.

RESEARCH METHODOLOGY

- a) The research design used in this study was a qualitative case study design which focused on the development of environmental governance as far as solid waste management in Delhi is concerned in the years 1991 to 2011. The study was directed towards knowing the policy progressions, system of governance, the institutional functions and ultimate environmental impacts relating to the waste management activities in the city. The choice of a case study approach was considered to be justified due to the possibility to explore the issues of governance structures and policy implementation in a particular context (urban) in a more in-depth manner. The chosen period was the post-liberalization era in India that did not go without any changes in the urban governance, environmental policies, and municipal management systems.

- b) The research was mainly based on secondary sources of data collection of the relevant information. Government reports, government policies and municipal documents and environmental regulations by government authorities like the Municipal Corporation of Delhi (MCD), Delhi Pollution Control Committee (DPCC) and the ministry of Environment and Forest (MoEF) were checked. Furthermore, academic journals, books, environmental policy reviews, reports by international organizations and non-governmental organizations in the area of urban environmental governance were also used to collect data. Newspaper archives and official statistics were also examined which were in regards to waste production, collection, disposal regime, challenges and trends in landfill management in the chosen period.
- c) The research had a descriptive and analytical study to interpret the information it collected. The policy analysis was made to determine the formulation and enforcement of solid waste management laws including the Municipal Solid Waste (Management and Handling) Rules, 2000. There was also an institutional analysis to assess the roles and responsibilities of various actors in governance like the municipal authorities, the environmental agencies, the private contractors as well as the civil society organizations. The discussion aimed at determining the gaps in governance, the administrative issues as well as the effectiveness of the environmental regulations in solving the problem of waste management in urban areas.
- d) In addition, the paper used the thematic analysis method of classifying major problems associated with environmental governance including policy implementation, institutional coordination, community participation, and environmental sustainability. Using the policy goals and the real performance in the waste management practices, the study intended to determine the strengths and weaknesses of the governance mechanisms in the period under the research. The approach taken in the methodology aided in drawing insights into the way the urban environmental governance frameworks affected the solid waste management practices in Delhi and indicated areas where changes can be applied to the policy in the future.

RESULTS

a) Municipal Solid Waste in Delhi (1991-2011) Growth.

The review of the municipal records and the environmental reports showed that the amount of solid waste produced in Delhi over the period of 1991 to 2011 was rising tremendously. Rapid urbanization, population increase, and altering consumption patterns led to the increment in the quantity of waste. Reported by the Municipal Corporation of Delhi and the Central Pollution Control Board, the daily waste production rate rose to almost 8,000-8,500 tonnes per day as of 2011 by a margin of almost 4,000-5,000 tonnes per day in the early 1990s. This expansion put a lot of strain on the city infrastructure and brought into focus the struggle of the municipal governance institutions in ensuring waste sustainability.

Table 1: Estimated Growth of Solid Waste Generation in Delhi (1991–2011)

| Year | Estimated Population (Million) | Waste Generated (Tonnes/Day) | Per Capita Waste (kg/day) |
|-------------|---|---|--------------------------------------|
| 1991 | 9.4 | 4,200 | 0.45 |
| 1996 | 11.0 | 5,200 | 0.47 |
| 2001 | 13.8 | 6,000 | 0.50 |
| 2006 | 15.9 | 7,200 | 0.52 |
| 2011 | 16.8 | 8,360 | 0.55 |

Sources: Central Pollution Control Board (CPCB, 2000; 2013); Municipal Corporation of Delhi Annual Reports.

The findings showed an increase in total waste generation and per capita waste production, which indicated that economic development and consumer behaviour were important factors in waste generation.

b) Institutional Structure of Solid Waste Governance

The results showed that there were various institutions that were involved in the management of solid waste in Delhi, and it was a complex system of governance. At the time of conducting the study, the main institution that was involved in the management of solid waste, such as its

collection, transportation, and disposal, was the Municipal Corporation of Delhi (MCD). However, the regulation of solid waste management was done by other institutions, such as the Delhi Pollution Control Committee and the Ministry of Environment and Forests.

Table 2: Key Institutions Involved in Solid Waste Management in Delhi

| Institution | Major Responsibilities |
|--|---|
| Municipal Corporation of Delhi (MCD) | Waste collection, transportation, landfill management |
| Delhi Pollution Control Committee (DPCC) | Environmental monitoring and compliance |
| Ministry of Environment and Forests (MoEF) | National policy and regulatory framework |
| Central Pollution Control Board (CPCB) | Technical guidance and monitoring |
| Private Contractors | Waste transportation and landfill operations |

Source: MCD 2010

The findings indicated that although the presence of multiple institutions improved regulatory control, there was a lack of coordination among the institutions, which caused inefficiencies in implementation.

c) Implementation of Municipal Solid Waste Rules (2000)

The formulation of the Municipal Solid Waste (Management and Handling) Rules, 2000, was a major turning point in the management of environmental issues. There was a focus on segregation, management of landfills, and better collection methods. However, the results showed that there was partial implementation of these rules during the initial years.

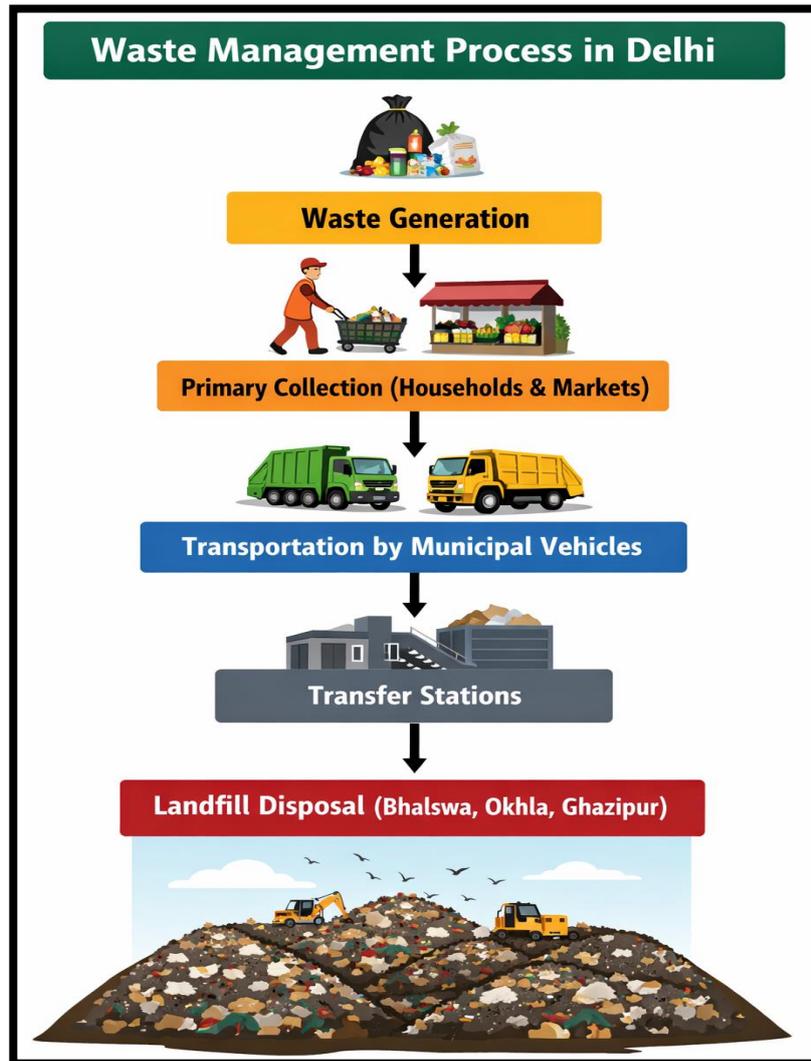


Figure 1: Waste Management Process in Delhi

Source: MoEF, 2000

Nevertheless, despite all these changes in the policies, most of the waste continued to be disposed of in open landfills like Bhalswa, Okhla, and Ghazipur, which later on exceeded their capacity. Studies revealed that the landfill sites were the causes of environmental issues like groundwater and air pollution.

d) Practices in Waste Treatment and Disposal.

The findings also established the fact that Delhi relied on landfill disposal a lot during the time of the study and there was minimal usage of waste processing mechanisms like composting and waste-to-energy facilities. In fact, by the year 2011, more than 80.85% of the waste generated was being disposed of through landfill sites instead of being treated or recycled.

Table 3: Waste Treatment and Disposal Methods in Delhi

| Disposal Method | Share (%) |
|-----------------------------|------------------|
| Landfill Dumping | 82% |
| Composting | 10% |
| Recycling (informal sector) | 6% |
| Waste-to-Energy | 2% |

Source: MoEF, 2000

These findings highlighted the significant role played by the informal recycling sector, including waste pickers and scrap dealers, who contributed to material recovery despite limited institutional recognition.

e) Governance Problems Found.

The research found out that there were a number of governance issues that influenced solid waste management in Delhi in the course of the study:

- Blistering development of urban population, which results in growing amounts of waste.
- Lack of adequate waste segregation, treatment and disposal systems.
- Weak implementation of environmental policies.
- Inadequate coordination of agencies of governance.
- Reliance on landfill disposal, which has environmental and health hazards.

These issues implied that despite the existence of environmental governance frameworks based on both national policies and municipal regulations, the efficiency of the proposed implementation was low (Kumar et al., 2017).

DISCUSSION

The above discussion on results indicates that there has been a strong relationship between the increase in the municipal solid wastes in Delhi during this period between 1991 and 2011 due to rapid urbanization, growth in population, and consumption patterns due to economic

liberalization. Figures in Table 1 above indicate that there has been a steady growth in the total wastes generated as well as in the per capita wastes generated, which has risen to more than 8,300 tonnes per day compared to 1991, when the total wastes generated as well as those generated per capita stood at 4,200 tonnes per day and 0.45 kg/day, respectively. This is part of the urbanization of this city's life, which has seen an increase in income levels, consumer goods packaged to such high levels, and commercialization, which has seen more wastes being generated.

The institutional analysis further reveals that the solid waste management in Delhi is in the midst of a complex system of governance in the presence of a number of agencies such as the Municipal Corporation of Delhi (MCD), Delhi Pollution Control Committee (DPCC), Ministry of Environment and Forests (MoEF), and Central Pollution Control Board (CPCB). Despite the fact that the presence of these institutions ensured a high level of regulatory control in the system, the analysis revealed that duplication of roles and lack of coordination among the agencies have a negative impact on the implementation process. The Municipal Solid Waste (Management and Handling) Rules, 2000 is an important intervention in the system towards better segregation of waste, scientific management of landfill sites, and a systematic collection machine. However, the analysis revealed that the implementation and compliance were minimal in the early years of the implementation.

Therefore, it is evident that their waste management system still heavily relied on landfill disposal sites such as Bhalswa, Okhla, and Ghazipur, most of which were already overloaded and were a major contributor to environmental pollution in various ways such as groundwater pollution, methane emissions, air pollution, etc. Moreover, it is evident from the disposal methods shown in Table 3 that most of the municipal waste, i.e., around 82 percent, was discarded by utilizing a landfill method, while a small amount of waste was subjected to composting, recycling, and waste-to-energy methods. The informal recycling sector comprising waste pickers and scrap dealers may not have been formally recognized but was extremely instrumental in reclaiming the waste and thereby reducing pressure on the municipal system.

Generally, the results indicate that the implementation of environmental governance structures was done by national policies and regulatory institutions although the structural constraints of poor infrastructure, the failures of enforcement, low levels of technological application, and low levels of coordination amid governance agencies played a significant role of limiting the

success of solid waste management system during the time of the study. These findings are consistent with the findings of earlier research that proves that sustainable urban environmental governance involves not only the ability to establish a policy but also a greater institutional cooperation, investments in technologies, and engagement with the community to efficiently respond to the emerging issues of urban waste management (CPCB, 2013; Kumar et al., 2017).

CONCLUSION

The research analyzed the development of environmental governance in the management of municipal solid waste in Delhi during 1991-2011 and concluded that rapid urbanization, population increase, and changes in consumption patterns have contributed substantially to the increase in the quantity of municipal solid waste in the city. During this period, municipal solid waste has almost doubled, which has put immense pressure on the city's infrastructure and waste management systems. Despite the formulation of policies such as the Municipal Solid Waste (Management and Handling) Rules, 2000, aimed at enhancing waste segregation and scientific disposal, the implementation of these policies was limited due to institutional and administrative constraints. The governance system was complex, involving various institutions such as municipal bodies, regulatory bodies, and private contractors, but lack of coordination among them weakened the policy system. The waste management system was mainly dependent on landfilling at locations such as Bhalswa, Okhla, and Ghazipur, which raised serious concerns about environmental and health issues. The paper also emphasizes the importance of the informal recycling sector in the recovery of recyclables, despite the sector receiving little formal recognition. In general, the results indicate that improving the enforcement of institutional coordination, promoting recycling and waste treatment technology, and incorporating the informal sector are important for achieving sustainable urban waste management in a rapidly growing city like Delhi.

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