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“Solid-Waste Management: Comparing Indore and Nagpur”

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Solid-Waste Management: Comparing Indore and Nagpur

Abstract

This paper argues that Indore's experience in solid waste management demonstrates the critical role of stable revenue streams and institutional accountability in achieving sustainable urban waste systems. Indore's approach of adopting robust user fees, investing reliably in waste processing infrastructure, and generating revenue through resource recovery has enabled it to maintain high waste segregation and low landfill dependency. In contrast, Nagpur's struggles with poor fee compliance, insufficient investment, and dependence on landfills illustrate the economic and institutional challenges many Indian cities face. Using the Most Similar Systems Design (MSSD) and process tracing, this study compares the two cities' policy stages, such as agenda-setting, formulation, implementation, and evaluation, to uncover how differences in economic resource management and governance produce divergent outcomes. Despite concerns about local contexts, Indore's model offers adaptable lessons emphasizing steady economic investment and strong institutional mechanisms as key for improving solid waste management across Indian cities.

Introduction

Solid waste management (SWM) is a big problem for many cities in India (Zhu, 2007, p.9). Cities are growing fast and producing more waste. Managing this waste is difficult. Poor waste management harms public health, the environment, and the economy. For example, waste buildup can cause diseases and pollute water and air (Ministry of Urban Development, 2016). Waste systems that do not work well cost more money and lose chances to recycle and reuse waste. This paper studies the reasons behind different SWM results in Indore and Nagpur. Indore

is known for good waste management. Nagpur faces many problems. Studying these cities helps us learn why some succeed and others do not (*Solid Waste Management*, n.d.) (Environment Department, Government of Maharashtra & Maharashtra Pollution Control Board, n.d.).

Problem Statement

Even with national rules and more spending on SWM, Indian cities still have problems making these systems work well. Different cities have different results. Some have gaps in waste collection, sorting, processing, and disposal. These gaps cause health risks, pollution, and extra costs (Zhu, 2007, p.11). It is important to understand why some cities do well and others struggle. This paper will look at the economic, social, and institutional reasons for the big difference between Indore and Nagpur's SWM results.

Relevance of the Problem

SWM is key for a clean city, good health, and sustainability. In India, bad waste management causes pollution and health issues. It also raises government costs and makes cities less livable (Zhu, 2007, p.9). Good SWM lowers illness, creates jobs, and saves money by recycling and waste-to-energy methods (Ministry of Urban Development, 2016). Indore's success shows the benefits of good SWM. Nagpur's problems show what challenges many cities face. Studying these differences can help form better policies for SWM in other cities.

SWM is one of the most urgent city problems in India. Much waste is not treated or is dumped illegally (Zhu, 2007). Bad waste handling leads to more diseases, pollution in air and water, and high city spending on clean-up and emergencies (Ministry of Urban Development, 2016). When cities don't recycle or reuse waste well, they lose money and waste useful materials. This causes more costs and lost resources. Cities like Indore show that good, creative SWM improves health,

environment, and city finances. Knowing why cities have different results helps build strong and flexible policies for many growing Indian cities.

Comparative Policy Evaluation Theoretical and Methodological Framework

This paper uses a comparative policy evaluation with the Most Similar Systems Design (MSSD) and process tracing methods, as described in the "Handbook of Research Methods and Applications in Comparative Policy Analysis." MSSD selects cases that are alike in many ways but differ in the main outcome (Peters & Fontaine, 2020, p.33). Here, the main difference is SWM success. Indore and Nagpur have similar social and economic features but very different SWM results. This helps find the reasons for the difference.

Process tracing checks how policies were planned, used, and enforced by looking closely at each stage (Peters & Fontaine, 2020, p.277). This reveals how money, institutions, people's involvement, and law enforcement work together to cause success or failure in SWM.

Rationale

Most SWM research in India looks at single cities or big policies. Using MSSD and process tracing in the same country helps study why policies work well in some cities and not in others. This shows city-specific problems and what works best. It also finds lessons other cities can use. Studying the causes instead of just results gives good advice for city and national levels (Peters & Fontaine, 2020).

Choosing Indore and Nagpur lets us compare two cities in the same nation and reduce other differences. Using MSSD and process tracing is a strong way to study the complex reasons

behind SWM results. This helps find the economic and institutional causes of SWM success and problems. This study will help make smart policies for better waste management in Indian cities.

Analysis and Discussion: Economic Aspects of Solid Waste Management in Indore and Nagpur

Indore and Nagpur provide a strong basis for comparison in solid waste management using the Most Similar Systems Design (MSSD). Both cities have comparable sizes and waste challenges but show very different outcomes. This method helps us focus on economic choices, policy mechanisms, and their results, removing broader differences from the analysis (Peters & Fontaine, 2020, p.33).

Economic Mechanisms in Indore

Indore collects about 1,115 TPD[1] of solid waste and spends nearly ₹200 crore yearly to manage it (*Solid Waste Management*, n.d.) (NDTV, 2024). The city treats waste as a resource. With user fees collected from more than 650,000 homes and businesses, Indore has built financial autonomy. Over 95 percent of waste goes to processing centers. A 1,000 TPD waste-to-energy plant and a 200 TPD composting facility support this system, and 850 vehicles ensure collection is regular and wide-reaching (Earth5R, n.d.).

Indore's financial stability is reinforced by its ability to generate approximately ₹11 crore per year from compost, recyclables and carbon credits. A bio-CNG facility pays out ₹2.52 crore in annual royalties, carbon credit sales amount up to ₹9 crore annually, and dry waste processing adds another ₹1.43 crore (NDTV, 2024). Because nearly all waste is processed or reused, landfill costs are low and old dump sites have been restored (*Solid Waste Management*, n.d.).

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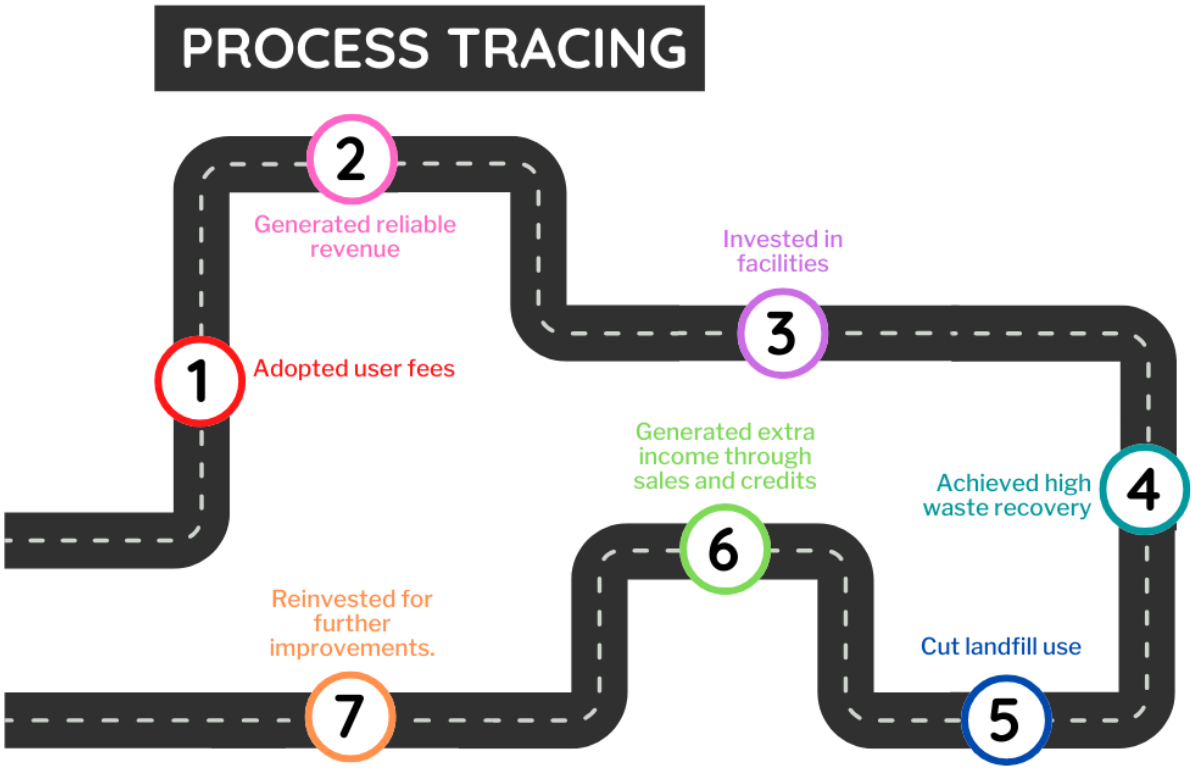
[1] TPD stands for Tonnes per Day

The city then used this extra income to make further upgrades and improvements to its waste management system. By maintaining a steady loop of collecting fees, investing in plants and technology, and continually recovering resources, Indore's cycle of improvement has stayed strong over time. The following process tracing illustrates how Indore's choices translated into sustained improvements.

Process tracing in Indore

Figure 1: Process Tracing - Indore



Source: Author's Analysis

Indore started by implementing user fees, which helped build a stable revenue foundation (Smart City Indore, 2022). With regular income from households and businesses, the city financed modern waste processing infrastructure, such as a large waste-to-energy plant and a composting plant (Earth5R, n.d.).

Once these plants became operational, Indore could process more than 95 percent of daily waste, keeping landfill use below five percent. The sale of compost, recyclables, and bio-CNG, along with carbon credits, generated close to ₹9 crore each year (NDTV, 2024).

This extra revenue was not used for unrelated purposes but was reinvested directly into the city's waste system. This loop of user fees generating revenue, revenue funding better plants, better plants raising income and lowering costs created a self-sustaining cycle.

Through this sequence of clear steps, Indore improved its environmental results, created jobs in recycling and composting, and reduced public health risks (Ministry of Urban Development, 2016).

In other words, this process tracing shows how each clear policy and economic step led to the next, resulting in stable finances, better infrastructure, and higher recovery rates. Indore's model demonstrates that with reliable revenue and reinvestment, better results follow at each step (Peters & Fontaine, 2020, p.277) (Ministry of Urban Development, 2016).

Economic Mechanisms in Nagpur

Nagpur generates about 1,200 TPD of waste (Environment Department, Government of Maharashtra & Maharashtra Pollution Control Board, n.d., p.3). Unlike Indore, Nagpur collects fewer fees and struggles to recover costs from residents. In 2016, only about 150-200 TPD of waste was processed, and about 1,000 TPD was dumped at the Bhandewadi landfill. Recently, 750-800 TPD is processed, but nearly half is still landfilled (Patel, 2023).

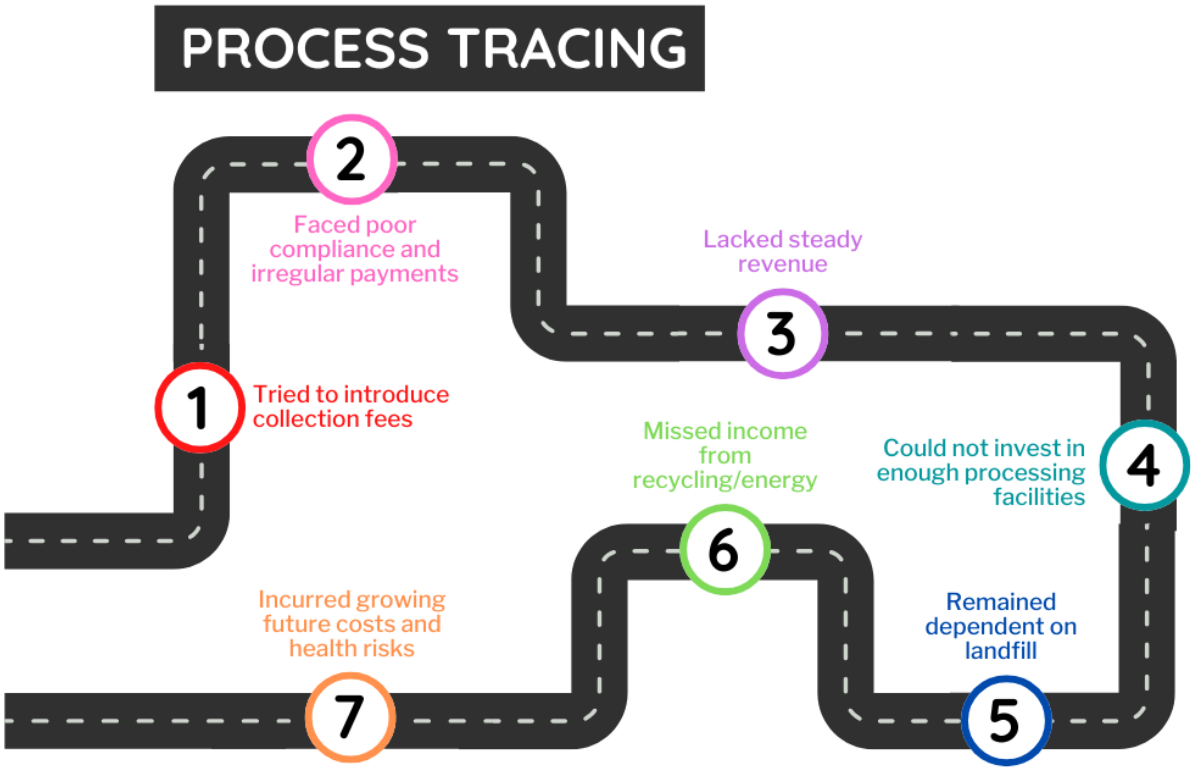
Nagpur spends most of its resources on collection and landfill management. The city has four landfill sites totaling 4 million tonnes capacity, with Bhandewadi alone holding nearly half of the daily waste (Chakraborty, 2025).

Recycling and composting facilities are limited: 174 composting units, 8 biogas centers, but no refuse-derived fuel plants. Source segregation is weak, so 24 plastic collection centers rarely generate meaningful revenue. The city operates 738 vehicles, but gaps in service remain (Environment Department, Government of Maharashtra & Maharashtra Pollution Control Board, n.d., p.5).

This dependence on dumping rather than resource recovery caused Nagpur to incur growing future costs. The city must now spend more on cleaning up landfills, faces higher health expenses due to pollution, and lacks job creation from recycling sectors seen in Indore. The following process tracing illustrates how Nagpur's choices translated into continuous decline.

Process tracing in Nagpur

Figure 2: Process Tracing - Nagpur



Source: Author's Analysis

Nagpur also tried to introduce collection fees, but compliance was poor and payments were irregular. Because income from user fees was weak, the municipal corporation could not invest enough in new processing units (Environment Department, Government of Maharashtra & Maharashtra Pollution Control Board, n.d.).

As a result, Nagpur remained reliant on landfill dumping. Even as newer composting and biogas centers were set up, weak enforcement and low waste segregation limited their use.

The city missed out on revenue from recycling, compost, and energy recovery because most waste never reached these facilities.

Nagpur's cycle became one of dependency. Not having enough money led to weak facilities, weak facilities meant high dumping, and high dumping led to greater future costs and health risks (India Sanitation Coalition, 2023).

To put it simply, by tracing each step, we see that the lack of steady income from user fees directly limited investment, which in turn meant a system reliant on dumping and unable to break the cycle of cost and waste. Process tracing makes clear how missing one link, reliable user charge payment, resulted in a failure to move forward through each needed economic step (Peters & Fontaine, 2020, p.278).

Counterarguments and Opposing Views

Some experts claim that Indore's strong performance cannot be easily replicated in other Indian cities. They suggest Indore benefits from unique leadership, high political commitment, and consistent citizen engagement. Some scholars also emphasize that the city attracts more private investment and is better at collecting user fees than most urban centers in the country (NDTV, 2024; Ministry of Urban Development, 2016). There is doubt that large investments in

advanced waste-to-energy or composting plants are practical or affordable for towns with limited budgets or weak technical support (Earth5R, n.d.).

Additionally, critics argue that Indore's strict rules and compliance measures depend on a culture that values collective action, making it hard for other cities to follow the same path. In contrast, Nagpur's struggles to enforce user fees, change public habits, and deliver projects on time, reflect barriers that are widespread across Indian municipalities (India Sanitation Coalition, 2023). Some point out that, for resource-constrained urban local bodies, dumping waste in landfills remains a fallback due to its lower upfront costs.

However, it is also important to note that Nagpur demonstrates leadership in certain other waste-related areas. Recent news reports show that Nagpur has become a national model in converting sewage into significant revenue, earning nearly ₹300 crore annually by selling treated wastewater for industrial use and producing bio-CNG from organic waste (The Logical Indian, 2025). These achievements prove that with the right financial partnerships and technology, Indian cities can innovate even if their municipal solid waste management still faces challenges.

Despite these concerns, the case evidence and process tracing in this comparative study suggest that incremental adoption of user fees, targeted investment, and stepwise expansion of treatment capacity can help other cities adapt aspects of the Indore model over time, even under tighter constraints.

Comparative Analysis

Despite valid concerns, the evidence shows that Indore's methods of investing in facilities, enforcing user charges, and reinvesting revenue create financial autonomy and better environmental outcomes. Nagpur's reliance on ad-hoc allocations and landfill management, in contrast, leads to persistent resource shortages and missed opportunities.

Unlike Indore, Nagpur's weak fee collection prevents regular upgrades and keeps the city trapped in a cycle of landfill growth and environmental risks. Process tracing shows that when each step, (such as user fee, investment, facility, enforcement), is missing, the city cannot break out of this cycle.

Theoretical Engagement

MSSD helps to focus closely on why two similar cities have very different results. By controlling for size and basic economic profile, differences can be attributed primarily to policy choices, economic mechanisms, and institutional actions. Process tracing provides a way to map these decisions step by step, making clear how each causal link impacts overall outcomes (Peters & Fontaine, 2020, p.277).

Comparative Economic Outcomes

Indore's system is stable and innovative because it leverages fees and private partnerships to sustain its waste management. Waste is converted to products and energy, which returns money to both the municipality and citizens. Nagpur, with similar waste volumes, spends mostly on dumping and collection. This not only limits income, but also raises health and environmental costs in the long run. Indore's recovery and reinvestment keep improving performance, while Nagpur's system is slow to change and remains vulnerable to crisis.

Both Indore and Nagpur are large Indian cities generating over 1,100 tonnes of solid waste per day, but their results in waste management are very different. In the table below, a clear comparison between Indore and Nagpur's solid waste management systems is provided. This highlights key economic, infrastructural, and operational differences that explain their diverging outcomes:

Figure 3: Comparative Table of Indore & Nagpur

Aspect	Indore	Nagpur	Sources
Population (approx.)	3.2 million	2.5 million	Smart City Indore (2022), Environment Dept. Maharashtra (2021)
Waste Generated (TPD)	1,115 tonnes per day	1,200 tonnes per day (393 dry, 655 wet)	Smart City Indore (2022), Environment Dept. Maharashtra (2021)
Annual SWM Spending	₹200 crore	Not publicly available; primarily on collection/landfills	NDTV (2024), Environment Dept. Maharashtra (2021)
User Charges (Conservancy Fees)	Collected regularly from 6.5 lakh households/businesses	Poor collection and compliance	NDTV (2024), India Sanitation Coalition (2023)
Waste Processing Rate	>95% processed, <5% landfill	60–65% processed, 35 - 40% landfill	Earth5R (2024), Environment Dept. Maharashtra (2021)
Major Waste Treatment Plants	1,000 TPD waste-to-energy, 200 TPD composting plant	174 composting units, 8 biogas units, no RDF plant	Smart City Indore (2022), Environment Dept. Maharashtra (2021)
Revenue from Waste (Annual)	Approx. ₹11 crore (compost, recyclables, carbon credits)	Minimal revenue from recycling or composting	NDTV (2024), India Sanitation Coalition (2023)
Waste Collection Vehicles	About 850 vehicles	738 vehicles (172 trolleys, 489 mini trucks, 77 bulk trucks)	NDTV (2024), Environment Dept. Maharashtra (2021)
Landfill Dependency	Very low (only 5% to landfill, old dumps remediated)	High landfill use, Bhandewadi landfill with >0.4 million tonnes buildup	Earth5R (2024), Environment Dept. Maharashtra (2021)

This comparison shows how financial choices, revenue models, and investment in new plants can shape better or worse outcomes. It demonstrates that Indore's sustainable economic model with steady fee collection, strong investment in waste processing infrastructure, and multiple revenue streams supports high recovery rates and low landfill use. Nagpur's limited revenue generation, less processing infrastructure, and higher landfill dependency reflect economic and institutional weaknesses.

The combined qualitative and quantitative differences explain the contrasting waste management success between the two cities. The evidence suggests that without stable funding and consistent follow-through, other cities will have difficulty reaching Indore's level of performance, but incremental reforms and tested investments can create stepwise progress even under constraints.

Discussion

The comparison of Indore and Nagpur's solid waste management shows how crucial stable revenue collection, local governance, and investment decisions are for success. Indore collects user fees from most city households and businesses, which provides reliable funds for waste processing and facility upgrades (NDTV, 2024; Smart City Indore, 2022). This model allows the city to process more than 95% of waste, sell compost and recyclables, and use energy produced from organic waste to create new income streams (Earth5R, n.d.).

Nagpur's situation is different. Despite making efforts to introduce user fees, the city faces poor compliance and inconsistent payment from residents (India Sanitation Coalition, 2023). As a result, Nagpur cannot invest steadily in new waste processing plants, and nearly half its waste ends up in landfills (Environment Department, Government of Maharashtra & Maharashtra Pollution Control Board, 2021). This creates higher costs over time due to landfill pollution and missed opportunities for income and job creation.

The evidence from Indore shows that user fees and strong enforcement are foundational for sustainable waste management. Facility investments only work when there is stable, predictable funding. Indore's continuous benefit–fund–improve cycle has helped the system endure, regardless of changes in leadership or economic conditions. Process tracing confirms that

each policy step, from policy design to revenue and to reinvestment in infrastructure, produces measurable improvements in output and financial performance.

On the other hand, Nagpur's process broke down after the introduction of fees, due to low compliance and lack of steady revenue. This single failure led to a chain of problems: underfunded infrastructure, heavy landfill use, missed income from composting and recycling, and rising costs for cleanup and healthcare. The analysis suggests that these challenges are not unique to Nagpur, but are present in many Indian cities with similar institutional and financial weaknesses.

National policies like the Swachh Bharat Mission (Urban) and the Municipal Solid Waste Rules (2016) have set standards for segregation, collection, and processing. Yet, how cities apply these rules, secure funding, and adapt to challenges is what determines results (Ministry of Urban Development, 2016). Indore's record suggests that success is possible if cities match national guidance with local economic discipline and public engagement.

Finally, it is important to address counterarguments: some claim that Indore's high performance is due to political leadership, more private investment, or unique civic culture, and is thus hard to copy elsewhere. However, as evidence shows, stepwise reform in user fees, accountability, and public-private investment can be adapted in phases, even in cities facing constraints. Recent innovations in sectors like sewage treatment in Nagpur demonstrate that Indian cities can make progress with committed leadership and the right incentives, even if not every step follows the Indore blueprint (The Logical Indian, 2025).

Conclusion

This comparative research confirms that financial discipline, planning, and regular reinvestment are essential for effective urban waste management. Indore's example shows that

stable funds, strong facilities, and continuous system upgrades can transform waste from a liability into a resource, while reducing environmental risk and public health costs. Nagpur's struggles highlight the importance of following through on every link in the policy chain.

For India's expanding cities, the key lesson is that progress is gradual. Built on clear economic choices, persistent engagement, and accountability at every level. With focused leadership and community participation, even cities starting from behind can move to better waste management systems.

Recommendations

1. Strengthen User Fee Collection and Enforcement:

   Municipalities must build systems that make fee payment regular and simple for all households and businesses. Transparent, accountable fee processes should be linked to effective communication campaigns showing the benefits of participation (Ministry of Urban Development, 2016; Earth5R, n.d.).

2. Reinvest Revenue in Local Infrastructure:

   Waste collection and treatment fees should be earmarked for direct reinvestment in new waste processing plants, door-to-door collection, and recovery units. This ensures sustained facility upgrades and public trust in the system (NDTV, 2024; Smart City Indore, 2022).

3. Promote Public-Private Partnerships:

   Cities can partner with experienced companies to deliver facility operation, new technology adoption, and processing efficiency. Clear contracts, outcome-based payments, and regular evaluation can strengthen these partnerships (India Sanitation Coalition, 2023).

4. Focus on Incremental, Phased Reforms:

   Instead of trying to copy every Indore practice at once, cities should begin with one or two core reforms: for example, set up regular user fee collection in a single ward, or pilot small compost and recycling units. This gradual method lowers risk and earns public buy-in (Ministry of Urban Development, 2016).

5. Build Local Accountability and Transparency:

   Municipalities should use open dashboards and annual reports to show progress, highlight spending and income, and build ownership among residents. Community feedback forums and third-party audits can reinforce accountability (Earth5R, n.d.).

6. Create Intercity Learning Networks:

   States and national agencies should support knowledge sharing, so urban leaders and technical teams can visit, study, and adapt lessons from models like Indore (Smart City Indore, 2022).

By following these recommendations, grounded in both macro-level policy and local city experience, Indian urban centers can move toward cleaner, more sustainable, and more resource-efficient futures.

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