

Policy Evaluation of Solid Waste Management Rules (2016) in the Context of Religious Tourism Zones in Rajasthan

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Abstract—Rajasthan's prominent pilgrimage destinations - Pushkar, Ajmer Sharif, Nathdwara, Khatu Shyamji, Govind Devji, Jeen Mata Sakthi Peeth and Ranakpur Jain Temple collectively receive millions of visitors annually, generating substantial solid waste loads that municipal bodies lack the capacity to manage effectively. Despite the Solid Waste Management Rules (2016), notified by India's Ministry of Environment, Forest and Climate Change, providing a comprehensive regulatory framework, their implementation at religious tourism zones remains poorly examined in the literature. This study undertakes a policy evaluation of the SWM Rules (2016) as applied to these destinations, drawing on secondary data from the Central Pollution Control Board, Rajasthan State Pollution Control Board, National Green Tribunal orders, and published academic sources. Findings reveal consistent compliance deficits in source segregation, door to door collection, scientific waste processing, Extended Producer Responsibility, and user-fee mechanisms across all sites studied. Benchmarking against Tirupati and Shirdi two comparatively better-managed pilgrimage towns exposes structural barriers rooted in institutional fragmentation, fiscal constraints, infrastructural gaps, and low behavioral compliance among waste generators. The study contributes to the environmental governance literature by documenting implementation failure at the intersection of religious tourism and urban waste management, and offers evidence-based policy recommendations to strengthen regulatory compliance and accountability at Rajasthan's religious tourism destinations.

Index Terms—Solid Waste Management Rules (2016), Religious Tourism, Environmental Governance, Waste Management Compliance, Pilgrimage Destinations, Institutional Fragmentation, Sustainable Tourism.

I. INTRODUCTION

Rajasthan, known as the land of maharajas and magnificent forts, is equally significant for its rich spiritual heritage. The state hosts hundreds of temples, dargahs, Jain tirthas, and shakti peethas, attracting an estimated 50 to 60 million domestic pilgrims annually (Ministry of Tourism, 2023). Key sites like Pushkar - home to the only Brahma temple in the world, Ajmer Sharif Dargah, Nathdwara Srinathji Temple, and Khatu Shyamji collectively attract tens of millions of devotees, making religious tourism the backbone of Rajasthan's tourism economy.

However, the very scale that defines religious tourism in Rajasthan also creates an acute environmental crisis. The convergence of millions of pilgrims in towns with limited urban infrastructure results in the generation of colossal volumes of solid waste including floral offerings, prasada packaging, single use plastics, and food waste that overwhelm the capacities of local Urban Local Bodies (ULBs) and Gram Panchayats responsible for waste management. In response to India's growing waste management crisis, the Government of India replaced the Municipal Solid Waste (Management and Handling) Rules, 2000 with the Solid Waste Management Rules (SWM Rules), 2016 a comprehensive framework that mandates source segregation, door to door collection, scientific processing, Extended Producer Responsibility (EPR), and user fee collection. These rules apply universally to all urban local bodies and, by extension, to the towns in which religious tourism operates. Despite the existence of this regulatory framework, anecdotal evidence and periodic reports from the Central Pollution Control Board (CPCB), the

Rajasthan State Pollution Control Board (RSPCB), and the National Green Tribunal (NGT) point to widespread non-compliance at pilgrimage destinations. This paper systematically evaluates the implementation gap, identifies structural barriers, and proposes policy remedies based on an analysis of secondary data.

1.1 Objectives of the Study

- To assess the key provisions of the SWM Rules (2016) relevant to religious tourism zones.
- To evaluate the extent of compliance with these provisions at major pilgrimage sites in Rajasthan.
- To document the existing waste generation patterns and infrastructure deficits at selected sites.
- To benchmark Rajasthan's religious tourism waste management against leading practices in India.
- To identify barriers to effective implementation and propose evidence-based policy recommendations.

1.2 Scope and Research Methodology

This study is entirely based on secondary data. The research scope covers six major religious tourism sites in Rajasthan: Pushkar, Ajmer Sharif Dargah, Nathdwara, Khatu Shyamji, Govind Devji Temple (Jaipur), and Jeen Mata Shakti Peeth. A seventh site, Ranakpur Jain Temple, is included for supplementary comparative data. Secondary data sources consulted include: Annual Reports of CPCB (2018–2023); RSPCB compliance monitoring reports; Ministry of Tourism India Tourism Statistics (2020–2023); State of Environment Reports for Rajasthan; National Green

Tribunal (NGT) case orders involving Rajasthan pilgrimage sites; Rajasthan Urban Improvement Trust and ULB records; peer-reviewed journal articles indexed in Scopus and Web of Science; and PRASAD and HRIDAY scheme implementation reports from the Ministry of Tourism.

Content analysis, trend analysis, and comparative benchmarking methods are employed. Data from government documents are triangulated with findings from published academic studies to ensure reliability.

II. BACKGROUND: SWM RULES (2016) AND THEIR APPLICABILITY TO RELIGIOUS TOURISM

The SWM Rules, 2016 represent a paradigm shift in India's approach to solid waste management. Unlike their predecessor (MSW Rules 2000), the 2016 Rules place explicit obligations not only on local bodies but also on bulk waste generators, producers, brand owners, and even pilgrimage-related event organisers. Rule 2(1)(f) defines "bulk generator" as any entity generating over 100 kg of waste per day, a threshold routinely exceeded by any pilgrimage site of moderate size. The Rules articulate a comprehensive waste management hierarchy: prevention and reduction first, followed by reuse, recycling, composting, energy recovery from waste, and finally sanitary landfill as the last resort. At religious sites in Rajasthan, however, the hierarchy is inverted in practice -open dumping and unsegregated landfilling remain the dominant disposal methods.

Table 1: Key Provisions of SWM Rules (2016) and Their Relevance to Religious Tourism Zones in Rajasthan

S. No.	Rule Provision	Key Mandate	Relevance to Tourism Zones
1	Rule 4 – Waste Segregation	Mandatory 3-bin segregation (wet, dry, hazardous) at source	Religious sites generate high wet & mixed waste; segregation largely absent
2	Rule 6 – Collection & Transportation	Door-to-door collection; vehicle tracking via GPS	Pilgrimage zones lack mechanized collection systems
3	Rule 11 – Processing & Disposal	Scientific processing within 12 months; no open burning	Open burning of floral offerings common at temples
4	Rule 12 – Extended Producer Responsibility (EPR)	Producers/brand owners responsible for packaging waste	Plastic packaging from prasad vendors unregulated
5	Rule 13 – User Fee	ULBs to levy waste user charges	No user fee collected at most religious town ULBs in Rajasthan
6	Rule 16 – Capacity Building	Regular training for SWM staff & IEC activities	Awareness campaigns minimal at pilgrimage centers
7	Rule 22 – State Policy	States to frame SWM policies within 2 years	Rajasthan SWM Policy delayed; notified only in 2021
8	Rule 24 – Hilly & Tourist Areas	Special provisions for high-footfall tourist areas	Religious tourism zones not separately classified or addressed

Source: Ministry of Environment, Forest and Climate Change (MoEFCC), SWM Rules 2016

A particularly significant gap is the absence of a specific provision for high-footfall religious or pilgrimage tourism areas, despite Rule 24 making special mention of hilly areas. This legislative lacuna has resulted in religious tourism zones being treated as ordinary urban areas in regulatory frameworks, overlooking the episodic and seasonal nature of pilgrim-generated waste, which can surge by 500–800% during festival seasons (CPCB, 2022).

III. WASTE GENERATION AT PILGRIMAGE SITES: SCALE AND COMPOSITION

3.1 Quantitative Overview of Waste Generation

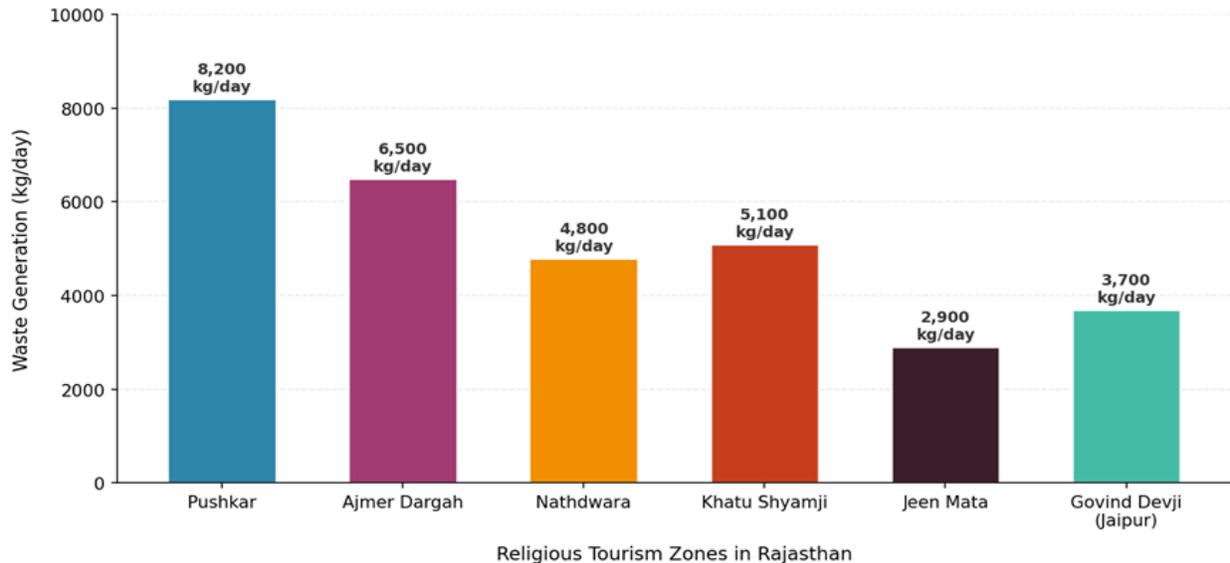
The scale of solid waste generated at religious tourism destinations in Rajasthan is staggering when examined relative to the capacity of administering local bodies. Table 2 provides an overview of pilgrim footfall and corresponding waste generation estimates derived from available secondary data from CPCB Annual Reports, RSPCB monitoring data, and published academic literature.

Table 2: Pilgrim Footfall and Solid Waste Generation at Major Religious Tourism Sites in Rajasthan

Religious Site	Annual Footfall (Lakhs)	Peak Day Footfall	Waste Gen. (kg/day Avg)	Waste Gen. Peak Day (kg)	ULB Category
Pushkar (Brahma Temple)	45–50	1.5–2 Lakh	8,200	42,000	Town Council
Ajmer Sharif Dargah	60–65	2–3 Lakh	6,500	38,000	Municipal Corporation
Nathdwara (Srinathji)	40–45	1.2–1.5 Lakh	4,800	28,000	Municipal Board
Khatu Shyamji	50–55	3–4 Lakh	5,100	55,000	Town Council
Govind Devji (Jaipur)	30–35	80K–1 Lakh	3,700	18,000	Municipal Corp.
Jeen Mata Shakti Peeth	20–25	1–1.5 Lakh	2,900	24,000	Gram Panchayat
Ranakpur Jain Temple	8–10	20–30K	1,200	6,000	Panchayat Samiti

Source: CPCB Annual Reports (2021–23); RSPCB Monitoring Reports; Ministry of Tourism India Tourism Statistics (2023); Rajasthan Tourism Handbook (2022–23).

Figure 1: Daily Solid Waste Generation at Major Religious Tourism Sites in Rajasthan (Estimated Average, 2022-23)



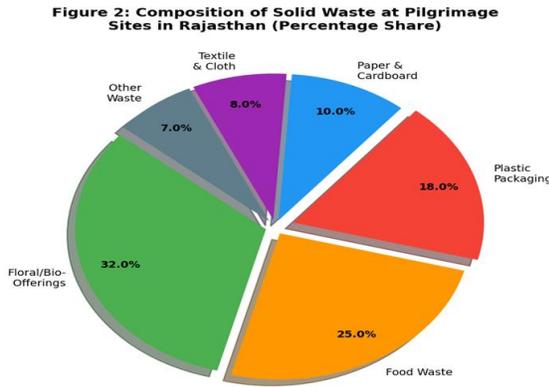
The data reveals that Pushkar, despite having a relatively smaller year-round population, generates approximately 8,200 kg of waste per day escalating to over 42 tonnes during its famous camel fair. This far

exceeds the processing capacity of the Pushkar Town Council, which operates no scientific waste processing facility of its own. Similarly, Khatu Shyamji presents one of the most acute cases of waste management

failure in the state: on peak festival days, the site witnesses footfall exceeding 3–4 lakh pilgrims, generating over 55 tonnes of waste in a single day in a town administered by a town council with severely limited resources (RSPCB, 2022).

3.2 Composition of Waste at Pilgrimage Sites

The composition of solid waste at religious tourism sites is markedly different from regular urban municipal solid waste, a distinction that has critical implications for processing technology choices and SWM Rule applicability. As Figure 2 illustrates, floral and bio-offerings constitute the largest fraction, followed by food waste both of which are biodegradable and present significant composting or biogas generation opportunities that remain almost entirely unexploited.



The 18% plastic packaging share is particularly alarming from a regulatory standpoint. A significant portion of this plastic consists of single-use packaging for prasada, puja items, and food sold by informal vendors on temple approach roads precisely the category that the Extended Producer Responsibility provisions of Rule 12 of the SWM Rules 2016 are designed to address, yet implementation of EPR at these sites remains virtually absent.

The floral waste fraction comprising marigolds, roses, and other flowers holds significant potential for upcycling into incense, dyes, and vermicompost. Initiatives like Help Us Green in Kanpur and Phool.co have demonstrated this model at Vrindavan and other UP pilgrimage sites, but Rajasthan has yet to implement comparable programs at scale (Joshi & Pawar, 2021).

IV. COMPLIANCE EVALUATION OF SWM RULES (2016) AT RELIGIOUS TOURISM ZONES

4.1. Compliance Status Matrix

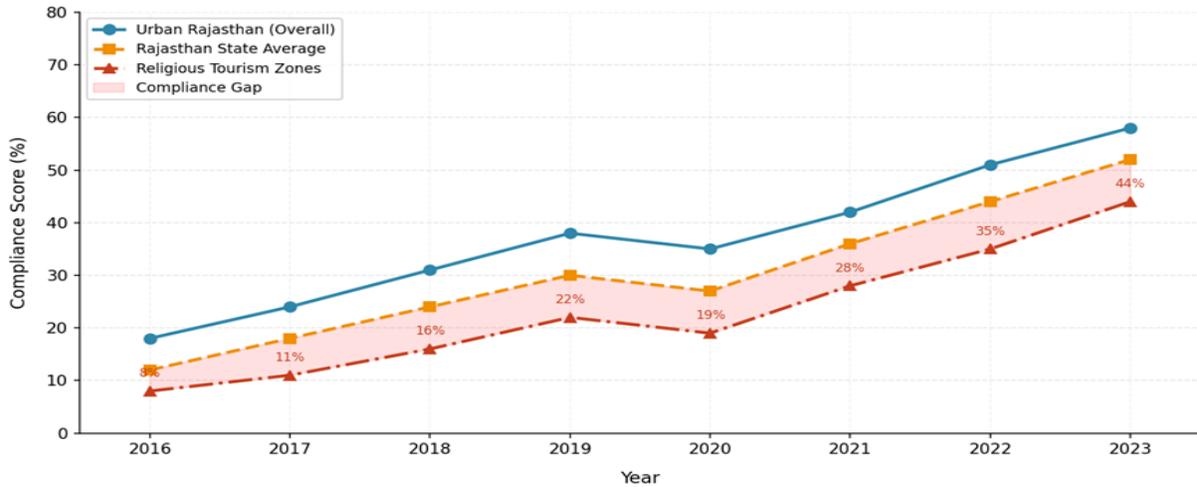
A systematic evaluation of SWM Rule compliance across the selected sites, based on CPCB annual assessments, RSPCB inspection reports, NGT orders, and ULB self-reporting data, reveals a pattern of pervasive non-compliance. Table 3 presents a consolidated compliance matrix, while Figure 3 tracks compliance score trends over the post-2016 period.

Table 3: SWM Rules (2016) Compliance Matrix for Religious Tourism Zones in Rajasthan

SWM Rule Provision	Pushkar	Pushkar	Ajmer Dargah	Nathdwara	Khatu Shyamji	Jeen Mata
Rule 4: Source Segregation	Non-Compliant	Non-Compliant	Partial	Non-Compliant	Non-Compliant	Non-Compliant
Rule 6: Door to Door Collection	Partial	Partial	Partial	Non-Compliant	Partial	Non-Compliant
Rule 11: Scientific Waste Processing	Non-Compliant	Non-Compliant	Partial	Non-Compliant	Non-Compliant	Non-Compliant
Rule 12: EPR Implementation	Non-Compliant	Non-Compliant	Non-Compliant	Non-Compliant	Non-Compliant	Non-Compliant
Rule 13: User Fee Collection	Nil	Nil	Partial	Nil	Nil	Nil
Rule 16: IEC & Capacity Building	Partial	Partial	Partial	Non-Compliant	Non-Compliant	Non-Compliant
Rule 24: Special Tourist Zone Plan	Non-Compliant	Non-Compliant	Non-Compliant	Non-Compliant	Non-Compliant	Non-Compliant

Source: CPCB SWM Assessment Reports (2021–23); RSPCB Inspection Reports (2022); NGT Orders No. Original Application 606/2018 and related; ULB Annual Reports. Compliance coding: Compliant = >75% adherence; Partial = 30–75%; non-compliant = <30%; Nil = No action taken.

Figure 3: SWM Rules (2016) Compliance Score Trend in Rajasthan (Religious Zones vs State Average, 2016-2023)



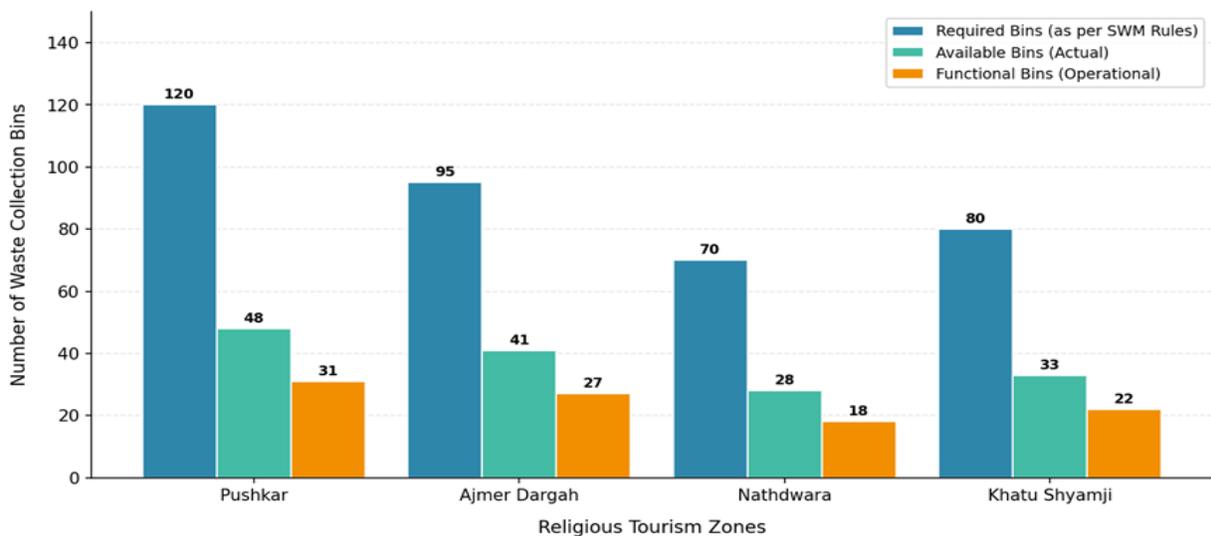
The compliance trend data (Figure 3) reveals that while the Rajasthan state average compliance has improved modestly from approximately 12% in 2016 to 52% in 2023, religious tourism zones have consistently lagged 15–20 percentage points behind the state average. This persistent gap underscores that the challenges faced at pilgrimage sites are not merely extensions of general urban governance deficits, but reflect unique site-specific barriers requiring targeted policy interventions. The single area of partial compliance at Ajmer Dargah the most notable exception is attributable to the active involvement of the Dargah Khwaja Saheb Committee (a central government body), which provides a degree of

institutional continuity and central oversight not available to temple towns administered solely by state-level ULBs.

4.2. Infrastructure Gap Analysis

A crucial determinant of SWM Rule compliance is the availability and functionality of physical infrastructure. Figure 4 examines the gap between required and actual waste collection infrastructure at four major sites, based on norms prescribed under the SWM Rules (2016) and supplementary CPHEEO (Central Public Health and Environmental Engineering Organization) manual on SWM.

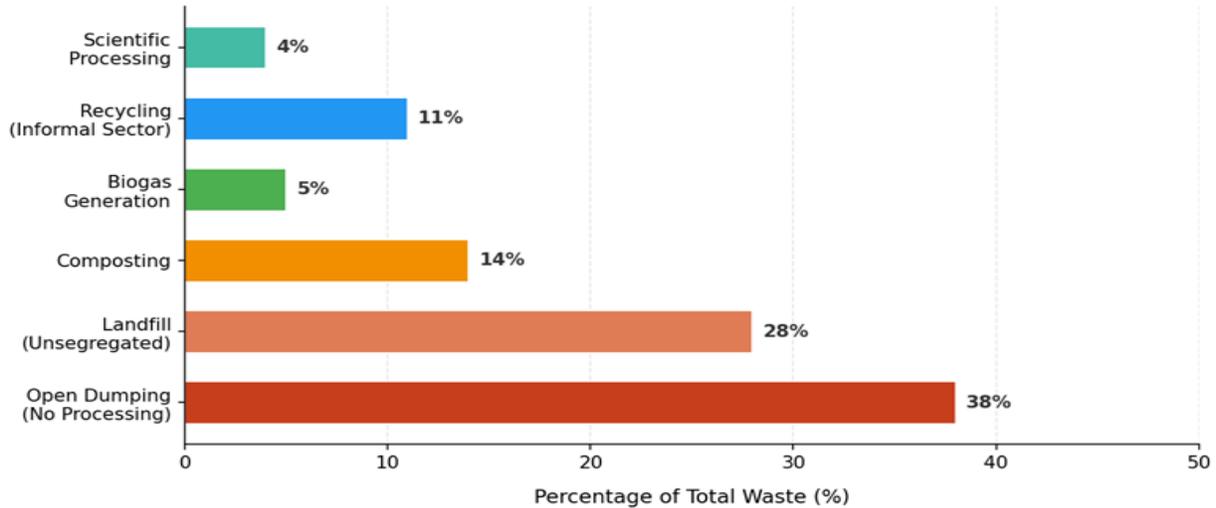
Figure 4: Infrastructure Gap Analysis - Waste Collection Bins at Major Pilgrimage Sites (2022-23)



The infrastructure analysis reveals a three-layered deficit: not only is the number of available bins far below the required number, but a significant proportion of the available bins are non-functional due to poor maintenance, vandalism, or overflow. At Pushkar, for instance, only 31 of 48 available bins

were found to be operational during RSPCB inspection representing just 26% of the required number. For Khatu Shyamji, the situation is equally stark, with functional capacity meeting less than 28% of requirements even on non-peak days.

Figure 5: Waste Disposal & Processing Methods at Pilgrimage Zones in Rajasthan (2022-23)



The waste disposal and processing methods employed at these sites further illustrate the compliance gap. As Figure 5 shows, open dumping and unsegregated landfilling account for over 66% of waste disposal both clearly prohibited under the SWM Rules 2016.

V. COMPARATIVE BENCHMARKING: RAJASTHAN VS. LEADING PILGRIMAGE DESTINATIONS

To contextualize Rajasthan's performance and identify transferable best practices, Table 4 benchmarks key SWM indicators at major Rajasthan pilgrimage sites against leading pilgrim cities of Tirupati (Andhra Pradesh), Shirdi (Maharashtra), and Varanasi (Uttar Pradesh). These cities have been recognized in CPCB reports and academic literature for relatively better SWM practices at their religious sites.

Table 4: Comparative Benchmarking of SWM Parameters – Rajasthan vs. Leading Pilgrimage Destinations in India

Parameter	Tirupati (AP)	Shirdi (MH)	Varanasi (UP)	Rajasthan Sites (Avg)
Waste Segregation at Source (%)	72%	68%	55%	14%
Door-to-Door Collection Coverage (%)	94%	89%	76%	38%
Scientific Processing (%)	61%	58%	42%	8%
Dedicated SWM Budget (Rs. Cr/yr)	18.5	12.2	8.4	1.8
Bins per 1,000 Pilgrims	6.2	5.1	3.8	1.4
No. of SWM Staff (Dedicated)	320	210	185	42 (avg)
Compost Plant Operational	Yes	Yes	Partial	No
Mobile Sanitation Units	45	32	28	6 (avg)
SWM NGT/Court Orders Pending	0	1	3	8

Source: CPCB Annual Reports (2022–23); Tirupati Tirumala Devasthanams (TTD) Annual Report 2022–23; Shri Saibaba Sansthan Trust (Shirdi) Annual Report 2022–23; Varanasi Nagar Nigam Reports; Rajasthan ULB Data

The benchmarking exercise reveals a dramatic performance gap between Rajasthan's pilgrimage sites and comparable destinations in other states. Tirupati, managed by the Tirumala Tirupati Devasthanams (TTD) a dedicated religious trust with substantial financial resources achieves 72% source segregation and 61% scientific processing, compared to a mere 14% and 8% respectively in Rajasthan's religious tourism zones. The dedicated SWM budget of Rs. 18.5 crore per year at Tirupati contrasts sharply with the average of approximately Rs. 1.8 crore across surveyed Rajasthan sites.

The key success factors at Tirupati and Shirdi include: a centralized institutional structure (dedicated religious trust/authority); substantial dedicated budgets; integration of SWM within the broader service delivery framework of the religious institution; active community and volunteer engagement; and long-term partnerships with private waste processors.

Rajasthan lacks analogous institutional models for its temple towns. Sites like Nathdwara and Pushkar are administered by multiple overlapping agencies temple trusts, ULBs, state archaeology departments, and tourism boards with no unified entity responsible for SWM. This institutional fragmentation is identified as the primary governance failure in the literature on pilgrim waste management (Sharma & Gupta, 2020; Mehta, 2022).

VI. BARRIERS TO EFFECTIVE IMPLEMENTATION OF SWM RULES (2016)

Based on a synthesis of CPCB reports, academic literature, NGT proceedings, and state government documents, the barriers to SWM Rule implementation at Rajasthan's religious tourism zones can be organized into six interconnected categories, as presented in Table 5.

Table 5: Barriers to SWM Rules Implementation at Pilgrimage Zones and Suggested Remedies

S. No.	Barrier Category	Specific Challenges Identified	Suggested Remedies
1	Institutional & Governance	Fragmented authority (temples, ULBs, tourism dept); no unified agency; Gram Panchayat capacity deficit	Dedicated Religious Tourism Waste Authority (RTWA); single-window clearance model
2	Financial Constraints	Low own-source revenue of pilgrimage town ULBs; no dedicated budget head for SWM at tourist sites	Dedicated PRASAD/AMRUT grants for pilgrimage SWM; tourist levy fund
3	Infrastructural Deficits	Only ~40% of required bins available; absence of transfer stations; inadequate vehicles	PPP-based infrastructure provisioning; mobile compactor units for peak seasons
4	Behavioral & Cultural	Ritual practices involving non-biodegradable materials; open burning of offerings; resistance to change	Community-driven Green Pilgrimage campaign; eco-friendly puja alternatives
5	Legal & Regulatory Gaps	SWM Rules 2016 do not explicitly cover religious tourism zones; EPR not enforced for temple vendors	Amendment to SWM Rules to include pilgrimage zones as special category; vendor licensing
6	Monitoring & Data	No real-time waste data system; limited CPCB/RSPCB monitoring at pilgrimage sites	IoT-enabled bin sensors; GIS-based waste tracking; quarterly RSPCB audits

Source: Author's synthesis from CPCB Reports (2021–23); RSPCB Inspection Reports; NGT Orders; Sharma & Gupta (2020); Mehta (2022); Ministry of Housing and Urban Affairs (MoHUA) SWM Implementation Status Report (2022).

The implementation of the Solid Waste Management (SWM) Rules in Rajasthan's religious tourism towns is constrained mainly by institutional fragmentation and financial limitations. Waste management responsibilities are divided among multiple agencies urban local bodies, district administrations, tourism departments, and temple trusts resulting in weak coordination and unclear accountability. For example,

in Pushkar, different institutions separately manage waste collection, tourism infrastructure, festivals, and temple premises. During large events such as the Pushkar Camel Fair, this fragmented governance structure often leads to serious waste management failures. Although the National Green Tribunal has directed states to prepare site-specific waste management plans for major pilgrimage destinations,

implementation in Rajasthan has remained limited and largely procedural.

Financial constraints further aggravate the problem. Urban Local Bodies in pilgrimage towns have limited revenue sources and low property tax collection, partly due to exemptions for religious and charitable properties. Additionally, funding under Swachh Bharat Mission (Urban) is allocated based on resident population rather than the large seasonal inflow of pilgrims. This mismatch results in inadequate financial resources and persistent gaps in waste management infrastructure.

VII. POLICY RECOMMENDATIONS

Based on the compliance assessment, benchmarking analysis, and barrier mapping, several policy measures are recommended to strengthen solid waste management (SWM) in Rajasthan's religious tourism destinations.

First, the SWM Rules (2016) should be amended to formally recognize high-footfall pilgrimage destinations as a special category. A new provision could mandate Religious Tourism Waste Management Plans (RTWMPs) for sites receiving more than five lakh visitors annually. These plans should specify waste generation norms, infrastructure standards, and implementation timelines, and be jointly prepared by urban local bodies (ULBs), tourism departments, and environmental authorities.

Second, Rajasthan should establish Religious Tourism Waste Authorities (RTWAs) at major pilgrimage clusters. Operating under the supervision of the District Collector, these authorities would coordinate activities among ULBs, temple trusts, tourism departments, and pollution control agencies. Dedicated funding could be ensured through state grants and a modest religious tourism cess collected from visitors.

Third, a dedicated funding window for pilgrimage towns should be created under Swachh Bharat Mission–Urban 2.0, with allocations based on adjusted population that accounts for seasonal pilgrim inflows. Performance-linked grants could incentivize compliance with waste management targets.

Fourth, the Extended Producer Responsibility (EPR) provisions under the Plastic Waste Management Rules should be enforced within pilgrimage retail markets by

registering vendors and promoting recyclable or biodegradable packaging for devotional items.

Finally, the state should promote floral waste upcycling enterprises, deploy IoT-based waste monitoring systems, and introduce a “Green Pilgrimage” certification program to encourage sustainable practices at religious sites.

VIII. CONCLUSION

The findings indicate that the solid waste management (SWM) crisis in Rajasthan's religious tourism destinations is primarily a governance issue rather than a technological one. Although the Solid Waste Management Rules (2016) provide an adequate legal framework, weak institutional capacity, fragmented responsibilities, and limited financial resources hinder effective implementation.

Comparative analysis with Tirupati and Shirdi shows that successful waste management depends largely on strong and well-resourced institutional structures with clear authority and accountability. In contrast, Rajasthan's pilgrimage towns operate under fragmented governance systems, making coordinated waste management difficult.

Another major challenge is the seasonal surge in pilgrim numbers during festivals, which significantly increases waste generation and overwhelms existing municipal systems. This highlights the need for festival-specific waste management plans, including temporary infrastructure, private sector participation, and community involvement.

Environmental justice is also a concern, as the environmental burden of pilgrim waste is often borne by local residents, particularly those living near dumping sites.

Overall, the study finds significant non-compliance with SWM Rules (2016) across major pilgrimage destinations such as Pushkar, Ajmer Sharif, Nathdwara, Khatu Shyamji, Govind Devji, and Jeen Mata. Improving waste management performance will require institutional reforms, dedicated financing, stronger monitoring systems, and greater stakeholder coordination. Implementing these measures can help transform Rajasthan's religious tourism destinations into environmentally sustainable pilgrimage centers that balance spiritual tourism with ecological responsibility.

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