

Spatial Apartheid and Caste Labour in Bangalore: Social Work Imperatives for Sanitation Justice

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Abstract: The study exposes the nexus of caste-based labour, neoliberal urban governance, and spatial apartheid, perpetuating sanitation injustice in Bangalore, India. Through spatial ethnography across 4 Scheduled Caste colonies, GIS mapping of 42 manual scavenging fatalities (2008 to 2023), and critical policy analysis, we demonstrate how municipal outsourcing contracts under the Bruhat Bengaluru Mahanagar Palika (BBMP) systematically assigned hazardous sanitation work, including septic tank cleaning and handling untreated biomedical waste, all these sanitation workers are predominantly Madiga caste, SC communities, while denying safety gears, fair wages, and legal protections. GIS reveals 68% of deaths cluster in affluent areas with privatised sanitation, linking fatalities to luxury developments. Bengaluru Smart City Limited's (BSCL) fiscal priorities exacerbate this injustice, for example, ₹17.3 crore allocated to sensor-enabled means contracts with ₹0 for sewer mechanisation, enabling contractors' exploitation and state-sanctioned caste discrimination. Workers endure embodied stigma, restricted mobility, and intergenerational trauma, with women facing acute health crises due to inaccessible sanitation. Grassroots resistance (e.g., Pourakarmika Parivartan Sangha) highlights community agency but underscores institutional betrayal, including an enforced anti-scavenging law and data invisibilisation. We propose an Ambedkarite social work praxis for transformative justice, centred on: 'evidence-based advocacy' using GIS death maps to litigate state-corporate collision; 'technology co-design' with SC unions developing mechanised tools owned/maintained by cooperatives; and 'radical rehabilitation' via a municipal-funded trauma centre scheme in SC colonies. A three-phase road map, co-created monitoring, participatory prototyping, and integrated support hubs which prioritise worker agency, municipal accountability, and structural equity. By dismantling spatial casteism through data, design, and healing, social work can forge a sanitation system where no life is expendable.

Keywords: caste segregation; spatial ethnography; scheduled caste labour; manual scavenging; sanitation justice

1 Introduction: Sanitation Apartheid in the Smart City

Bangalore ascent as India's 'Silicon Valley' masks a stark paradox: beneath its glittering IT corridors and Smart City facades, Scheduled Caste (SC) sanitation workers drown in septic (Chatterjee, 2018) tanks, entombed by caste hierarchies etched into urban space. In January 2018, three men died while manually cleaning a luxury apartment's sewer in HSR layout, Somasundara Palya (Chatterjee, 2018). An affluent zone symbolising Bangalore's global ambitions. Their deaths were neither accidental nor exceptional. As this study reveals, they epitomise state-engineered spatial apartheid, where neoliberal urbanisation in South Asia weaponises caste through municipal policy like BBMP's outsourcing of 70% to 80% waste

management to contractors (BBMP Report, 2008; BBMP Report, 2014), who subcontract hazardous sanitation labour to SC communities while denying them dignity, safety, and legal protection.

Bangalore's experience is not an isolated anomaly but one instance of a pattern replicated across urban India and more broadly, South Asia. Nationally, the Government of India records 2972 identified manual scavengers in Karnataka alone (Ministry of Social Justice & Empowerment, 2024). While the Karnataka State Safai Karmachari Commission's own count is 7,493, a discrepancy this paper returns to in Section 4. Cities such as Delhi, Chennai, and Hyderabad report comparable cluster of sewer-cleaning deaths tied to outsourced municipal sanitation contracts (Sahu, 2022; Singh, 2020). Manual scavenging remains documented in Pakistan and Bangladesh, where it is similarly performed almost exclusively by Dalit and historically marginalised communities (UNDP, 2012). Bangalore is examined here as a single city case study, a methodological choice justified by the depth of spatial ethnography and GIS mapping. The mechanisms identified (contractual outsourcing, caste-concentrated risk, and fiscal prioritisation of visible smart infrastructure over invisible sanitation labour) are best understood as a regional governance pattern for which Bangalore serves as an illustrative and data-rich case, not an exception.

Urban scholarship often frames sanitation crises as technical or managerial failures (O'Reilly et al., 2017). However, in Bangalore, as across South Asia, manual scavenging¹ persists as caste violence (Singh, 2020). This is sustained by Karnataka's municipal governance models that outsource sewer maintenance to private contractors (Smita & Sangita, 2021). While deploying 10,000 to 16,000 contractually exploited *Pourakarmikas* (sweepers) for the door-to-door waste collection without segregation safeguards (BBMP Report, 2008; BBMP, 2014). These contractors, in turn, subcontract death to SC workers without protective gear, fair wages, or legal protections. Such practices align chillingly with Bengaluru Smart City Limited's (BSCL) vision of "world-class infrastructure", invisibilising manual labour while deepening caste segregation. (Sahu, 2022; Soundararajan et al., 2024). Meanwhile, social work and policy are siloed, focusing on individual rehabilitation without confronting the spatial-political machinery perpetuating oppression.

This gap is lethal, demanding critical social work interrogating urban space as a site of caste impurity (Herz & Johansson, 2011). However, few studies employ spatial methodologies to expose how municipal outsourcing contracts systematically assign hazardous labour to SC bodies (Dwivedi et al., 2023; Maroof, 2018); death clusters concentrate in affluent districts serviced by privatised sanitation, and 'modern' urban development intensifies spatial exclusion. Using spatial ethnography and GIS mapping, this research dismantles these silences. We ask: How do caste, municipal policy, and urban space converge to perpetuate sanitation apartheid in Bangalore, and what transformative role can social work play in dismantling it?

The study argues that Bangalore's development hinges on spatial casteism, a structural logic that outsources risk to SC workers via municipal contracts where an estimated 30-40% of landfill-bound inert waste include untreated biomedical hazards (BBMP Report, 2008) mapping death onto geographies of privilege of the 42 geocoded manual scavenging fatalities recorded between 2008 and 2023, 50% (21/42) occurred in high-income wards, and a broader 68%

¹ As of the 2011 Census, 750,000 families were still working as manual scavengers in India, primarily in rural areas, but 27% in urban areas (Shende et al., 2016).

(29/42) occurred in wards serviced by privatised sanitation contracts, a category that includes but extends beyond affluent areas (see Section 4, Figure 2. For the full spatial breakdown). The study interprets this pattern, privatisation as a stronger predictor of fatality location than affluence alone. Evidence that outsourcing itself, not simply proximity of wealth, is the primary structural risk driver. Workers are further psychologically entrapped through stigma that restricts mobility, healthcare access, and housing (Mosse, 2018).

This apartheid is not residual but actively produced by policy. The Prohibition of Employment as Manual Scavenger Act (2013) remains systematically unenforced, while BSCL directs its ₹1700 crore budget toward ‘modern’ infrastructure, installing 420 sensor-enabled garbage bins as a symbolic gesture of urban efficiency (Kumar, 2018). However, allocates ₹0 to mechanising sewer cleaning or protecting SC lives despite BBMP’s investment in GPS-tracked waste vehicles (350 units) and CCTV surveillance at the landfills, technologies that monitor efficiency but ignore labour conditions (BBMP Report, 2008). (See Section 4 for this figure expressed as a proportion of BSCL’s total budget). This fiscal prioritisation exposes a difficult calculus: the state invests in the aesthetics of ‘smartness’ while outsourcing death to SC bodies. Consequently, social work’s traditional rehabilitation models fail to address the root cause: an implementation gap between existing anti-scavenging legislation and municipal outsourcing practice.

To address this, the study is anchored in an Ambedkarite social work praxis (Dhavaleshwar & Bansode, 2017; Mohan, 2021), extended through the structural social work framework of Mullaly (2010). It together rejects palliative, individual-level solutions and demands structural transformation. Section 2 sets out this theoretical integration in full, including how the two frameworks relate to one another and to the supporting literatures on political economy, embodied stigma, and anti-oppressive practice used throughout the paper. In brief, this framework asserts that sanitation justice requires three interconnected actions: first, spatial reckoning through GIS-mapped evidence to make hidden death patterns visible in legal and public discourse. Second, policy shaping partnership in which social workers facilitate the co-design of liberatory technologies, rejecting exclusionary models like BBMP’s stalled 212 pilot to convert plastic waste into diesel fuel², in favour of SC-union-led innovation that progressively delinks sanitation work from caste identity through skill diversification. Third, radical rehabilitation via a municipal-funded trauma centre in SC colonies, addressing the embodied trauma of caste-occupation stigma through culturally grounded counselling and collective healing praxis.

Methodologically, the study fuses three approaches to expose the spatial-political machinery of oppression: Spatial ethnography across four historically marginalised SC colonies (Jagjivan Ram Nagar, Chandrappa Nagar (Dairy circle), Sewer Line, Aruthani Nagar Shivapur), documenting 36 sanitation workers’ lived experiences through in-depth interviews and participant observation; GIS death mapping, analysing 42 manual scavenging fatalities (Karnataka State Safai Karmachari Commission, 2023) against BBMP contract zones and urban income geographies to visualise structural inequalities; and critical policy analysis deconstructing Solid Waste Management, Karnataka Municipal Corporations ACT, and

² In 2012, BBMP planned to contract the Chennai-based private firm M K Aromatics Limited to Convert Plastic waste in Bangalore into crude oil. The plan was not implemented.

(Pourakarmika Parivartan Sangha) members efforts to agitate sanitation workers regarding their rights and safety.

The paper proceeds as follows: Section 2 sets out the theoretical framework, Ambedkarite praxis extended through structural social work, with political economy, embodied stigma theory, and anti-oppressive practice as supporting lenses. It also reviews mechanisation practice elsewhere in India as a point of comparison. Section 3 details the methodology. Section 4 presents findings on how municipal outsourcing produces spatial apartheid, drawing on GIS evidence and worker testimony organised thematically. Section 5 discusses the psychological and structural implementations and proposes a phased social work roadmap for sanitation justice. Section 6 concludes. By examining spatial data and worker agency together, the paper argues that social work can help demolish the structural inequalities and build urban futures where no life is expendable.

2 Theoretical Anchor: Caste, Urban Space, and Pathways of Sanitary Justice

The study is anchored in Ambedkarite social work praxis (Dhavaleshwar & Bansode, 2017; Mohan, 2021; Ramaswamy, 2021), which we position as the primary analytical and normative lens. Political economy, embodied stigma theory, and anti-oppressive practice (AOP) are drawn on as supporting literatures that explain specific mechanisms within this frame. They are not treated as parallel or competing frameworks. To make hierarchy operational rather than declarative, we extend Ambedkarite praxis through Mullaly's (2010) structural social work. It distinguishes oppression operating at the personal level (individual attitudes and interactions), the cultural level (shared norms and stigmatising discourse), and the structural or institutional level (laws, budgets, and organisational practice). Mullaly's central claim that conventional social work, by concentrating on the personal level, leaves cultural and structural oppression intact and thereby reproduces the very conditions it seeks to alleviate, and provides the theoretical justification for why this paper does not evaluate sanitation work through individual rehabilitation outcomes (vocational training uptake, counselling attendance) but instead through municipal contracting practice, budget allocation, and legal enforcement. Ambedkarite praxis supplies what Mullaly's framework does not: a substantive account of caste specifically, rather than oppression in general, as an organising axis of Indian social structure, and a positive normative programme. Ambedkar's constitutional and social vision of annihilation of caste and self-respecting labour for what structural transformation should look like in this context. Read together, Mullaly's three levels give the paper its analytical hierarchy, and Ambedkarite praxis gives that hierarchy its content and its direction of travel.

This combined frame differs from AOP in a specific and stateable way. AOP (Dominelli, 2002; Burke & Harrison, 2002) is oriented towards reducing discriminatory practice within existing service delivery. It challenges top-down models, improving access, and reducing bias in casework. The Ambedkarite-structural frame used here shares AOP's critique of top-down service models but adds two things AOP does not require: first, caste is treated as an irreducible, independent axis of oppression rather than one item on a general list of identity categories, meaning findings are read through caste-specific categories (sub-caste, ritual pollution, occupational heredity) rather than generic marginalisation; second, the frame carries a structural-transformation mandate. It is not satisfied by improved service access alone, and treats municipal ownership structures, contract law, and budget allocation as legitimate objects of social work intervention, not just their downstream effects on individual workers.

Bangalore's urban development model reveals how historical caste hierarchies interface with contemporary governance structures. Kumar & Santhosh (2024) observe that neoliberal

urbanisation in South Asia often relies on pre-existing social stratifications to manage essential but stigmatised services. Under the Karnataka Municipal Corporations Act, outsourcing sanitation labour creates multi-tiered contractual chains that inadvertently concentrate risk among Scheduled Caste communities (PRIA, 2019). This arrangement poses significant challenges: municipal oversight gaps in private contracts frequently correlate with inadequate safety provisions (Mandyam, 2024) and delayed wage payments (fieldwork data, 2025; see Section 4). The outsourcing model, combined with the pre-existing caste hierarchy, this outsourcing model channels the most vulnerable workers from SC communities are pushed into the most hazardous and poorly compensated positions within these contractual arrangements. BSCL prioritising automated waste collection points over sewer-cleaning mechanisation reflects broader fiscal policy choices that per Mullaly's structural framework are the appropriate object of analysis not merely their downstream effect on individual worker's health.

The experiences of the sanitation labourers extend beyond occupational hazards into complex socio-somatic domains. The concept of 'embodied stigma' (Manago et al., 2022; Scambler, 2018) explains how manual scavenging reinforces caste boundaries through corporeal associations and spatial segregation (Bhattacharjee, 2014). Workers in colonies like Chandrappa Nagar (Dairy circle) and Sewer Line navigate dual burdens: chronic health consequences from toxic exposure (including respiratory illnesses and skin infections), and social exclusion manifesting as restricted housing access and public avoidance (UNDP, 2012; Singh & Ziyauddin, 2009). Goffman's (1963) foundational stigma theory contextualises these patterns as structurally reproduced disadvantage rather than individual prejudice. A reading consistent with and here subordinated to Mullaly's cultural level of oppression.

Government and traditional social work engagement with sanitation labour has emphasised individual rehabilitation, such as vocational training or financial aid, while paying limited attention to underlying policy architectures (Singh & Ziyauddin, 2009; Raje & Suraj, 2023). Dominelli's (2002) anti-oppressive practice (AOP) provides valuable scaffolding by challenging top-down service models (Burke & Harrison, 2002; Econ et al., 2020). However, as noted above, its application to caste-based labour systems remains underdeveloped. Which is precisely the gap the Ambedkarite-structural frame is intended to close.

A growing body of practice-based literature documents mechanisation as distinct strategy for reducing manual scavenging risk, and it informs the "technological co-design" component of the framework used here. The most widely cited Indian example is Bandicoot, a manhole-cleaning robot developed by the Kerala-based startup Genrobotics and first deployed by the Kerala Water Authority in Thiruvananthapuram in 2018. It has since been adopted in varying degrees across seventeen states and three union territories, including limited deployment in Karnataka. Genrobotics reports that Bandicoot's design explicitly aims to remove the need for a worker to enter a manhole and to train former manual scavengers as robot operators rather than displacing them outright. We treat this example cautiously rather than as a solved model: mechanisation initiatives of this kind have been criticised, including by sanitation worker unions, for uneven deployment, for depending on municipal procurement budgets that (as this paper's own findings show for Bangalore) frequently exclude sewer mechanism entirely, and for the risk that technology adoption proceeds without the ownership transfer to SC cooperatives that our operationalisation of "technological co-design" above requires. Bandicoot is therefore used here as a comparator that clarifies what BBMP's current sensor-and-surveillance investment pattern is not doing, rather than as a template to be adopted uncritically.

Theoretical integration reveals complementary insights for equitable urban governance. Political economy lenses highlight the need for strengthened municipal accountability in outsourcing practices (Gidwani, 2015; NFSSM, 2022), the embodied-stigma framework necessitates interventions bridging occupational safety and social dignity (World Bank, ILO, WaterAid, & WHO., 2019; Schulte et al., 2022). The Ambedkarite-structural frame set out above synthesises these imperatives by positioning social workers as intermediaries between community and state for systemic change (Flem et al., 2023; Dhanani, 2024). While providing via the observable indicators specified earlier in this section, a basis for assessing when that intermediation has produced structural change rather than symbolic participation. This theoretical foundation informs the methodology set out in Section 3.

3 Methodology

This study employs a triangulated qualitative research design (Carter et al., 2014) that integrates spatial ethnography (Chari & Gidwani, 2005) GIS mapping and critical policy analysis to examine the intersection of caste, labour systems, and urban governance in Bangalore's sanitation sector. Grounded in Ambedkarite social work principles (Shambharkar, 2025) extended through Mullaly's (2010) structural framework (Section 2). The methodology prioritises community narratives, structural analysis, and spatial justice to examine the systemic conditions faced by SC sanitation workers.

Figure 1 describe the methodology adopted for this paper. Spatial ethnography formed the core of this research, with fieldwork conducted between April and May 2025 in working sites along with four SC dominated localities, Jagjivan Ram Nagar, Chadrappa Nagar (Dairy circle), Sewer Line, and Arunthani Nagar, Shivapur. These sites were selected purposively, on two criteria: direct proximity to hazardous sanitation infrastructure (open sewer lines, septic tank clusters, or landfill-adjacent zones), and representation across distinct BBMP contract zones. So that the sample would not be concentrated within a single administrative or contractual jurisdiction. Within these sites, participants were recruited through a combination of purposive and snowball sampling, facilitated by one community leader from the Pourakarmika Parivartan Sangha (PKPS), who also worked as a contractual supervisor within BBMP and was himself a study participant. This dual role gave the study access that would otherwise have been very difficult to secure for a stigmatised and legally sensitive occupation, but it is also a limitation we return to below.

The target of 36 workers and two supervisors was set using the qualitative research convention. thematic saturation: recruitment continued within each site until successive interviews were no longer surfacing new categories of experience regarding stigma, wage practice, or safety conditions, which occurred at approximately eight to ten participants per site. This is a conventional, not a statistically representative, sample size for ethnographic fieldwork of this kind (Carter et al., 2014), and the findings should be read as analytically rich rather than as population-representative of Bangalore's estimated 10,000-20,000 Pourakarmikas or the separately estimated 1,625-7,493 manual scavengers (see Section 4).

Table 1: Participant demographic composition

Characteristic	N	% of sample
Gender		
Men	28	78%
Women	8	22%
Employment status		
Contract	22	61%
Permanent	14	39%
Caste subgroup		
Madiga	30	83%
Other SC subgroup	6	17%
Total	36 workers + 2 supervisors	

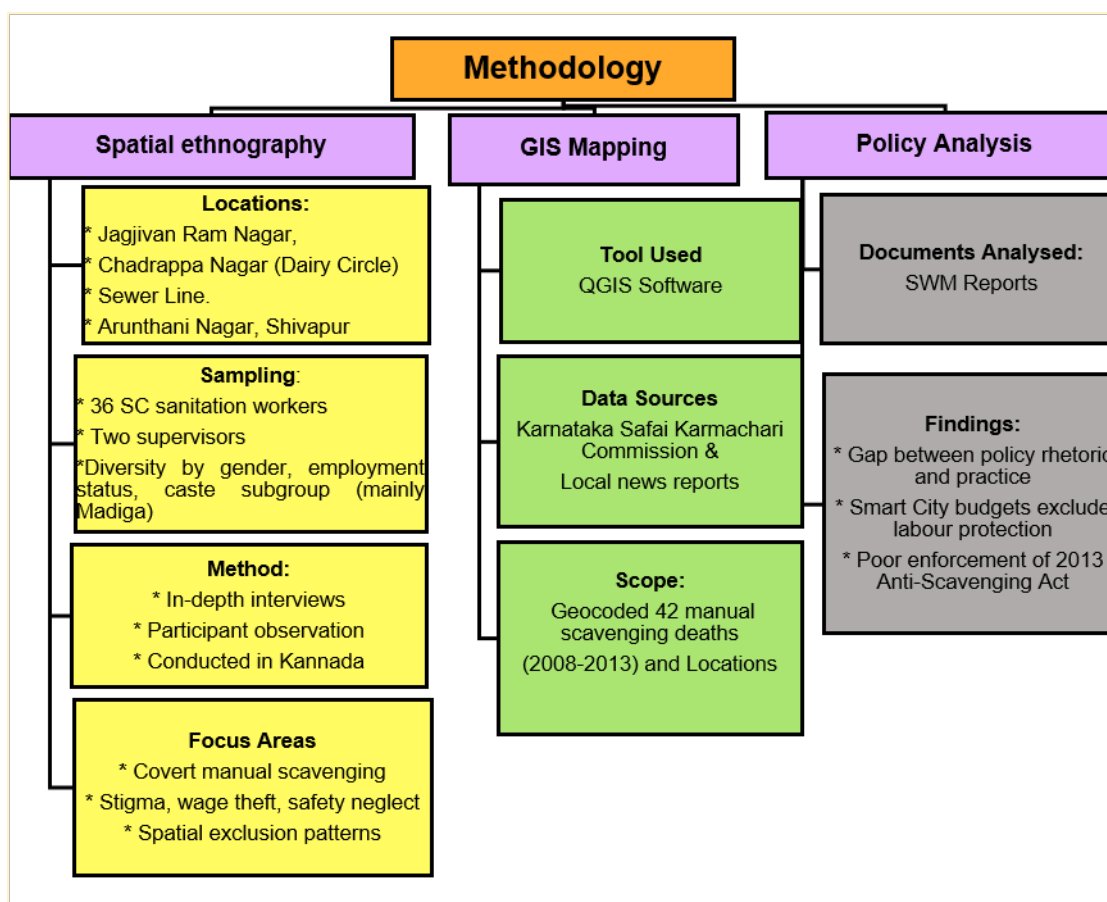
Source: Author's own work

The study engaged 36 sanitation workers and two supervisors through in-depth interviews and participant observation. As Table 1 shows, the sample was predominantly male (28 of 36) with meaningful representation of women workers (8 of 36), whose distinct occupational health burdens are discussed in Section 4; it was weighted toward contract rather than permanent employment status (22 of 36), reflecting the broader shift toward contractualization documented in Table 4; and predominantly, though not exclusively, from the Madiga caste subgroup (30 of 36), with 6 participants from other SC subgroups. This study conducted interviews with the help of one community leader (PKPS) (working as a contractual supervisor in BBMP and one of the participants of the study) in Kannada during lunch time (between 1-2 p.m.) and evening to document covert manual scavenging practices and workers lived experiences of stigma, wage practices, and safety conditions. Field notes captured spatial patterns of exclusion, from segregated housing to worksite rituals reinforcing caste hierarchies.

GIS mapping analyses the geography of sanitation-related deaths using QGIS software to complement ethnographic insights. The study geocoded 42 manual scavenging fatalities (2008-2023) records and local news reporting. Fatalities were mapped against BBMP contract zones and ward-level income data; 50% (21 of 42) occurred in high-income wards and a broader 68% (29 of 42) occurred in wards serviced by privatised sanitation contracts. A category that includes but is not limited to affluent wards (see Section 4, Figure 2).

Critical policy analysis examined municipal documents (the Solid Waste Management Report) to assess the relationship between policy rhetoric and ground realities, focusing on how modernisation discourse in Smart City budgets treats labour protection, and on the enforcement record of the 2013 Prohibition of Employment as Manual Scavengers Act. The study did not interview municipal officials, relying instead on worker testimony and policy texts. We treat this as a methodological limitation rather than an oversight, since it means the analysis reflects worker and policy-document perspectives without a matched institutional account, and we return to this in the limitations discussion below.

Figure 1: Methodology Framework



Source: Author's own work

Ethical rigour was maintained through participant anonymity, member-checking of findings with workers, and enabling trust-building while necessitating emotional labour when confronting shared trauma. Limitations include underreported manual scavenging and lack of municipal perspectives, which future research could address through participatory policy dialogues. This triangulation of spatial, narrative, and policy data provides a multidimensional critique of Bangalore's sanitation apartheid, aligning with Ambedkarite calls for evidence-based emancipatory action.

4 Findings

This study reveals stark disparities in the lived experiences of sanitation workers in Bangalore, shaped by caste, contractual hierarchies, and spatial marginalisation. Pourakarmikara (*Safai Karmachari*) and manual scavengers occupy structurally different positions; however, both are embedded in a system of layered exploitation. Among them, manual scavengers, primarily tasked with cleaning sewers and septic tanks, face the gravest risks, including frequent deaths from asphyxiation, toxic gas exposure, and infrastructural accidents. Workers are aware of these fatalities but report a lack of accessible data, reflecting institutional apathy. After enacting the 'Manual Scavengers and Rehabilitation Act, 2013', workers are afraid to confess or take anybody's name as a manual scavenger. The Safai Karmachari Kavalu Samiti (SKKS) state convener claims that there are 50,000 informal sanitation workers in Bengaluru, noting they are

termed ‘informal’ precisely because no government or organisation holds systematic data on them (Padmavinod, 2023).

There is also a discrepancy between the information released by the central and state government figures. According to the central government, Karnataka has 2972 manual scavengers (Government of India, Ministry of Social Justice & Empowerment, 2024). While Karnataka has identified 7,493 manual scavengers, Bengaluru has the highest number, BBMP identified 1,625 manual scavengers (Karnataka State Safai Karmachari Commission, 2023; Padmavinod, 2023). On the other hand, on January 31, 2024, Chief Minister Siddaramaiah said there should be no manual scavengers in the state. He also warned that strict legal action will be taken if anyone practices manual scavenging (Government of Karnataka, 2024). This contradiction between central and state data on manual scavengers data documentation constitutes a governance of invisibility, reflecting administrative practices that obscure caste-labour regimes integral to the urban economy. However, participants reveal, "*Most people who work as safai karmachari also work as manual scavengers*". Although the Supreme Court has mandated compensation at death (February 2023) of ₹30 lakh and ₹20 lakh for grievous injuries (Onmanorama, 2023). Manual scavenger Dileep Kumar (24 years) died in 2023. The family of Dileep Kumar is fighting for ₹30 lakh in court for compensation at the time of fieldwork (fieldwork, 2025).

The research highlights how privatisation intensifies inequities. Permanent municipal employees report earning, for example, ₹100 per operation for tasks for which contract workers receive as little as ₹30 (fieldwork data, 2025), widening the economic divide. Data shows that permanent sanitation workers earn approximately ₹35,000 per month, while temporary and contract labourers earn ₹17,000 or less (fieldwork data, 2025; see Table 2). These amounts of wages are not merely economic but are structured by caste: nearly 90% of Sanitation workers in Karnataka are SC, especially from the Madiga community (fieldwork data, 2025, corroborated by Karnataka State Safai Karmachari Commission, 2023). The contractual nature of employment systematically denies long-term benefits. There is no provision for a pension, only a one-time ‘Bhavishya Nidhi’ (Future Fund) payment, often insufficient and inconsistently disbursed. However, contractors, by contrast, are almost exclusively drawn from the dominant castes (fieldwork data, 2025).

Table 2: Wage Disparities in Sanitation Workers

Employment Category	Avg. Monthly Earnings	Safety Provisions	Caste Composition
Permanent Staff	₹35,000	Basic gear (moderate quality)	90% SC (Madiga)
Contract Workers	₹17,000	Basic gear (moderate quality)	90% SC (Madiga)
Manual Scavengers	Data NA	Data NA	Data NA

Source: fieldwork data, 2025

Safety gear and health insurance are symbolic of contract workers. Most workers reported working without gloves, boots, or respiratory masks, particularly in privatised zones managed by the BWSSB (Bangalore Water Supply and Sewerage Board). These absences are most visible in high-risk zones such as the KR Market, where workers face toxic fumes and rotten garbage. Participants also point out that biometric attendance systems pressure workers to arrive on time, leading to exhaustion, injury, and in some cases, fatalities. In Bangalore city, women workers are especially vulnerable: a lack of access to safe public toilets forces them to withhold water intake, leading to chronic urinary and reproductive health issues. Women workers also discuss the health card, which enables them to use government hospitals. However, they complain that this card is not used because the timing of the government hospital and the procedure is time-consuming. If they use this facility, they must compromise their one-day salary.

Intergenerational consequences are significant. Workers report that their children often leave school early due to financial hardship or stigma and that alcohol use among male workers is a common coping response that further destabilises family life (fieldwork data, 2025). Section 4.1 below presents these and other themes in the worker's own words.

4.1 Thematic Findings: Worker Testimony

Table 3 below organises representative worker testimony by theme, linking each to the analytical claim it supports.

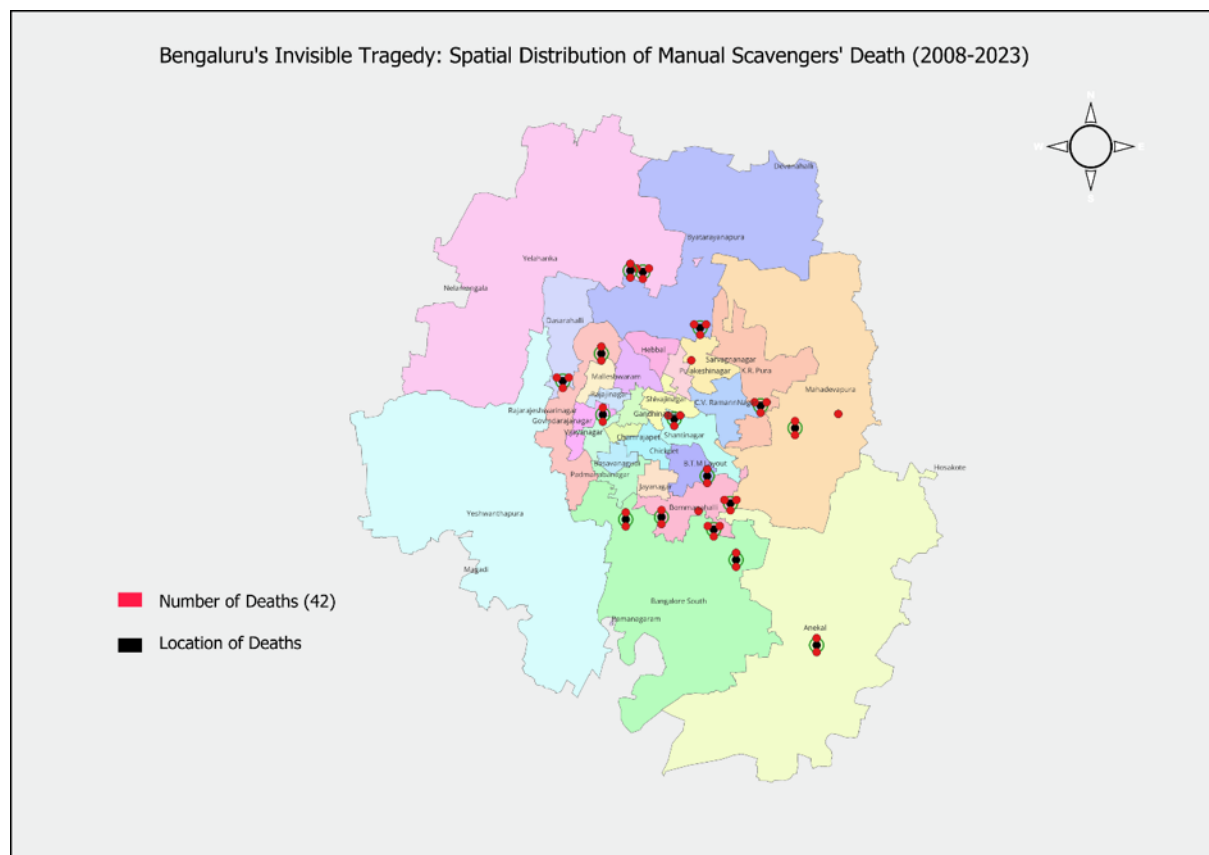
Theme	Representative testimony	Analytical claim supported
Embodied stigma	<i>"After work, our bodies are stinking, no soap can wash the smell."</i>	Manual scavenging produces corporeal, not only social, stigma that persists beyond the workday (Section 2, embodied stigma framework)
Institutional negligence	<i>"We call them informal sanitation workers, since no government or organisation has data on them".</i>	Governance of invisibility as a structural, not incidental, feature of the sanitation system
Wage theft	<i>"If permanent municipal employees are paid up to ₹100 per operation, whereas contract workers receive as little as ₹30 for the same work".</i>	Contractualisation compounds caste-based wage discrimination.
Intergenerational harm	<i>"The sanitation worker not only swims in the sewer but also drinks dirty water"</i>	Occupational trauma extends into family life via alcohol dependence and disrupted care
Family and mortality	<i>"These people die before death comes; their whole families suffer because of their deaths."</i>	Sanitation labour produces a form of slow, cumulative harm rather than only acute fatal risk.

Source: field work data, 2025

Note: Thematic findings linking worker testimony to analytical claims

The spatial dimensions of this pattern emerge clearly through GIS analysis. Of the 42 geocoded manual scavenging deaths recorded between 2008 and 2023, 50% (21 of 42) occurred in high-income wards, and a broader 68% (29 of 42) occurred in wards serviced by privatised sanitation contracts. This category includes but extends beyond affluent areas (see Figure 2). This pattern of privatisation predicts fatality location to be more proximate to wealth, as the primary structural risk driver. These fatalities occur disproportionately near luxury apartments and technology parks.

Figure 2: GIS Mapping of Manual Scavenging Deaths in Bangalore (2008-2023)



Source: Karnataka State Safai Karmachari Commission (2023). Manual scavenging fatalities data, Bengaluru (2008-2023) [Data set]. Mapping and analysis by the author (s) using QGIS

Figure 2: GIS Mapping of Manual Scavenging Deaths in Bangalore (2008-2023). Black markers indicate the location of each fatal incident; red markers, overlaid on each location, indicate the number of workers who died there. Most locations show a red marker for one fatality; a small number show multiple overlapping red markers where several workers died in the same incident. Notably, HSR Layout, Somasundara Palya, where three men died in a single January 2018 incident (see Section 1 and Section 3). Across all locations, the map represents the full set of 42 recorded fatalities. Data source: Karnataka Safai Karmachari Commission, 2023

Institutional neglect is particularly glaring in budgetary allocations. While ₹17.3 crore was spent on sensor-enabled garbage bins for the Smart City project, zero funds were allocated to mechanise sewer cleaning or provide proper safety equipment (Kumar, 2018). This ₹17.3 crore represents just over 1% of BSCL's total ₹1,700 crore Smart City budget (Kumar, 2018). A

modest absolute sum, but one whose significance lies in the zero allocated to sewer mechanisation specifically, not in its scale relative to the total budget. We note this proportion to avoid overstating the ₹17.3 crore figure in isolation; the more precise claim, and the one this paper rests on, is the categorical absence of any sewer-mechanisation line item, set against continued investment in GPS-tracked vehicle monitoring (350 units) and landfill CCTV.

This fiscal prioritisation reflects what workers describe as municipal negligence, a description this paper treats as directly evidenced. Where a specific, verifiable budget line (₹ 0 for sewer mechanisation) is the basis for the claim, as distinct from broader claims about municipal intent discussed elsewhere in this paper as implementation gaps rather than negligence per se. The intergenerational impact is severe: workers report near-universal alcohol dependence linked to occupational trauma within their households (fieldwork data, 2025), consistent with the pattern discussed in Table 3 above.

This gap between announced technology and ground-level reality is not confined to budget lines; it extends to specific, named initiatives. BBMP has publicly announced plans to adopt Bandicoot robotic technology for drain cleaning in Bengaluru, following a widely publicised rollout in Chennai (The Hindu, 2025). BWSSB has separately moved to pilot robotic cleaning services through short-term tenders (Ramesh, 2025). Yet none of the 36 workers or two supervisors interviewed for this study were aware that such technology existed or had been announced for use in their own city, let alone had encountered it at a worksite (fieldwork data, 2025). We read this disjuncture as direct evidence of the governance-of-invisibility pattern identified earlier in this section: technological investment can be announced, reported, and publicly credited to municipal authorities without reaching, or even being communicated to, the workers whose safety it is nominally intended to protect. This is precisely the failure mode the ‘technological co-design’ component of Ambedkarite praxis (Section 2) is designed to prevent, since co-design premised on SC-worker participation and cooperative ownership would make such a disjuncture structurally difficult to sustain.

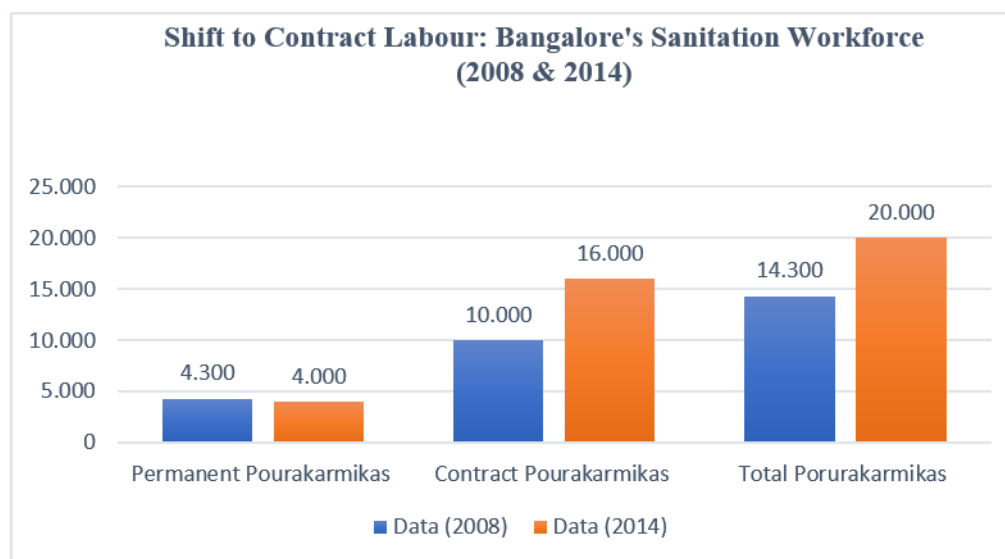
Table 4: BBMP’s Waste Management Structure

Aspect	Data (2008)	Data (2014)
Outsourced Activities	70%	80%
Permanent Pourakarmikas	4,300	4,000
Contract Pourakarmikas	10,000	16,000
GPS=Enabled Vehicles	350	NA
Biomedical Waste in Municipal Solid Waste	2%	NA
Total Porurakarmikas	14,300	20,000

Source: Solid waste management report 2008 & 2014

Table 4 and figure 3 describe the institutional structure of waste management in Bangalore under the BBMP, revealing structural inequities perpetuating caste-based exploitation. With 70% of work being outsourced, a rigid contractual hierarchy emerges: only 4,300 permanent workers receive stable employment compared to 10,000 indeterminate contract workers, mainly SC workers who handle 2% of the unprocessed biomedical waste without protective equipment (BBMP, 2008). Simultaneously, BBMP 2014 report shows 20,000 Pournakarmika under BBMP, and 80% of work being outsourced. This occupational segregation increases health risks while the BBMP prioritises technical monitoring (350 GPS-enabled vehicles) over workers' safety (BBMP, 2008).

Figure 3: Shift to Contract Labour - a comparison of permanent vs. contract sanitation workers



Source: Solid Waste Management Report 2008 & 2014

Further, Table 5 reveals the BBMP's contradictory investment priorities: allocating significant resources for vehicle monitoring systems (GPS/CCTV). The high investment in garbage truck tracking enables contractor monitoring but neglects worker safety, reducing human labour to a monitored input in municipal performance metrics. The high investment in monitoring infrastructure alongside zero investment in sewer mechanisation helps explain why contractors continue to deploy workers to septic tanks manually rather than adopting available suction technology, a pattern this paper reads as a specific instance of the broader mechanisation gap discussed in Section 2 (see the Bandicoot comparator). This dichotomy is emblematic of how the smart city administration prioritises the aesthetics of sanitation's performance over the lives of those who maintain it. (Truelove & O'Reilly, 2020; Malik, 2023).

Table 5: Technology vs. Labour Investment

Municipal priority	Investment	Worker Impact
Vehicle Tracking (GPS/CCTV)	High	Surveillance only
Sewer Mechanisation	Non	Manual Scavenging Persists

Source: BBMP, 2008

Despite these challenges, grassroots resistance offers pathways for change. Pourakarmika Parivartan Sangha has demonstrated the capacity to organise workers, conduct rights education, patrol worksites, and file complaints against unlawful practices. Their record is significant evidence under the operationalisation set out in Section 2 of the evidence-based advocacy component of Ambedkarite praxis. It is already occurring independent of this paper's own proposals. Their work points toward specific systemic interventions that convert contractual positions to permanent roles with equal pay, redirecting Smart City funds toward worker cooperatives, and establishing health clinics in SC colonies. These findings indicate that Bangalore's celebrated urban development currently depends on unresolved implementation gaps in caste-based labour protection, and that addressing this requires structural rather than incremental reform.

5 Discussion

Data, design, and healing must come together to address the deep inequalities in Bangalore's sanitation sector. Spatial mapping shows that the majority of manual-scavenging fatalities occur in wards that rely on outsourced contracts. At the same time, interviews reveal stark wage disparities and persistent psychosocial stigma among SC workers. Read together through the Ambedkarite-structural frame set out in Section 2. These findings support the paper's central claim: sanitation injustice in Bangalore is produced through specific, identifiable institutional mechanisms, contractual structure, budget allocation, and enforcement gaps rather than through diffuse social prejudice alone. This distinction matters practically because it points towards institutional rather than only interpersonal sites of intervention.

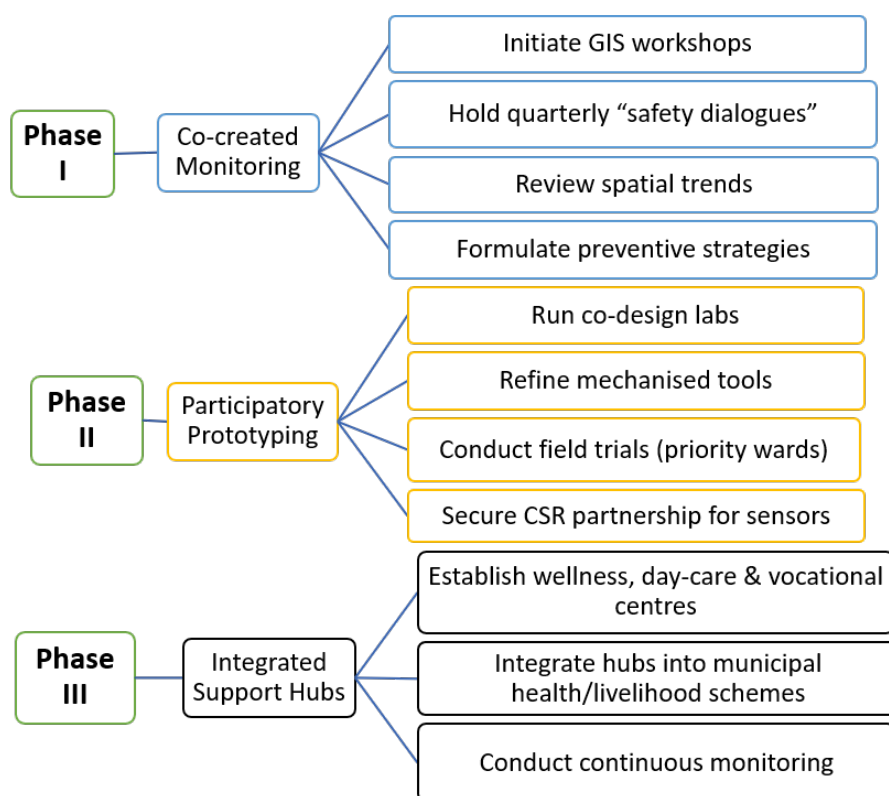
Evidence-based advocacy transforms GIS insight from static reports into dynamic planning tools. Rather than positioning data as adversarial, social workers can partner with BBMP field officers, SC unions, and civil society to host mapping workshops in infected colonies. In this collaborative session, community paralegals and municipal engineers jointly interpret incident clusters, prioritise resource distribution such as protective gear and targeted health outreach, and refine contract guidelines to reflect life lived realities. By embedding SC leadership in data generation and strategy forums, this approach ensures that exceptional evidence guides, including policy refinements, hold public accountability and strengthen stakeholders' trust.

Technological co-design extends the Smart City ethos to frontline sanitation workers through participatory innovations. Given BBMP's May 2025 announcement that it will deploy Genrobotics Bandicoot for drain cleaning in Bengaluru (The Hindu, 2025). The ownership-transfer standard in Section 2 cannot mean transferring the robot's underlying intellectual property to an SC cooperative; that will remain with the commercial vendor. What remains open is the service and operations contract: whether Genrobotics existing model of training former manual scavengers as certified operators feeds individual wage employment under a private subcontractor or a registered SC worker cooperative that holds the O&M tender directly and captures its revenue collectively. We propose the latter because as Section 4 reports, none of this study's 38 participants knew of the announcement at the time of fieldwork. It indicates the operations tender was still open to influence, not yet default-awarded. Beyond this specific case, design teams could still yield complementary tools (Portable suction units, ergonomic implements, and lease-to-own gas monitors) with genuine SC-cooperative IP co-ownership. Since these do not need to depend on a single vendor's proprietary platform. Pilots co-monitored by BBMP, SC unions, and gender-balanced worker committees would generate feedback and could integrate into standard procurement channels over time.

Radical rehabilitation addressed embodied trauma and the economic precarity of caste-bound sanitation works. Municipality-supported Wellness centres aligned with Karnataka’s Ayushman Bhagya Arogya Karnataka (AB-ArK) health framework can offer trauma-informed counselling, occupational illness screening, and legal aid for compensation support. Municipally-funded daycare centres in SC colonies must be prioritised alongside wellness hubs. These centres would alleviate care burdens, enabling women’s workforce participation without wage loss; break intergenerational stigma through early childhood education in safe, dignity-affirming spaces; and integrate daycare centres with health schemes to provide nutritional support and health monitoring for children. Vocational labs, co-developed with BBMP’s skill development cell, guide workers into adjacent livelihoods such as compost cooperatives, waste-to-product enterprises, and digital literacy hubs. This is not welfare but reparative infrastructure, consistent with Ambedkar’s vision of self-respecting, freely chosen forms of work, while recognising that its integration with existing schemes would need to be negotiated with municipal partners rather than assumed.

To operationalise these, we propose a concise three-phase road map:

Figure 4: Phased Governance Framework for Community-Led Sanitation Safety and Empowerment



Source: Author’s own work

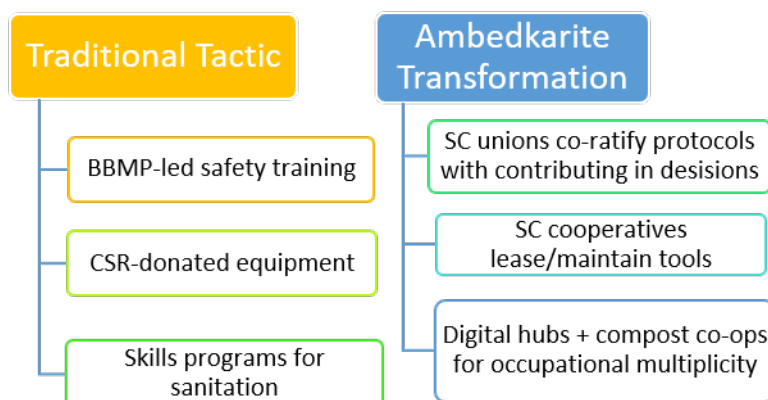
Phase I - Co-created Monitoring: Initiate GIS workshops and quarterly “safety dialogues” among BBMP staff, SC union leaders, and social work practitioners. These forums review spatial trends and collaboratively formulate preventive strategies. To ensure community agency translates into material power, phase one grants SC unions binding consultation rights on all safety decisions derived from the dialogues. Since consultation without binding weight would fall short of the evidence-based advocacy indicator specified in Section 2.

Phase II - Participatory Prototyping: Co-design labs with refining mechanised tools and conducting field trials in priority wards through structured pilot agreements, ensuring feedback loops and joint learning across municipal and community actors. Prioritise low-cost prototypes (e.g., ergonomic tools) and CSR partnerships for the sensor technology prioritisation in this phase. It is informed by the mechanisation literature discussed in Section 2.

Phase III - Integrated Support Hubs: Wellness, daycare and vocational centres within municipal health and livelihood schemes, with advisory councils composed of SC representatives and public health experts, supported by continuous monitoring for adaptive scaling.

The limitations of conventional municipal-led approaches to sanitation workers' safety and livelihood become starkly evident compared to transformative community-centred alternatives. As summarised in Figure 5, traditional strategies rely on top-down BBMP-administered safety trainings, CSR-dependent equipment donations, and separate skilling programmes that maintain institutional hierarchies. In contrast, the transformative model radically reconfigures power dynamics: SC associations gain formal co-ratification rights on safety protocols, while community cooperatives assume ownership of equipment leasing and maintenance. Crucially, this paradigm goes beyond occupational safety to foster economic agencies through digital hubs and compost cooperatives.

Figure 5: Contrasting Approaches to Sanitation Empowerment



Source: Author's own work

Comparative precedent affirmed the feasibility of this collaborative model. In Pune, the PMC-SWaCH partnership has fundamentally changed sanitation work from an informal, undignified, and less efficient system to a formalised, organised, and more sustainable one, benefiting the city's environment and the livelihoods of waste pickers (Pune Municipal Corporation, 2014). Pune's federated waste-picker initiatives show that inclusive sanitation governance can scale under supportive municipal frameworks. Short-term study visits and knowledge exchange can help Bangalore, like structured secondments of BBMP engineers to Pune's workers-owned sanitation cooperative (SWaCH)³. Build technical capacity while fostering solidarity.

³ Pune's municipality, through its partnership with the SWaCH cooperative, has developed a successful model for waste management that integrates informal waste pickers into the formal system. This model, known as the

Anticipating hurdles, such as municipal procurement norms, ensuring long-term maintenance, and IP frameworks, are addressed through this roadmap, which embeds contingency measures. Template-based co-ownership agreements, while phased procurement clauses allow pilot devices to enter service before full contract updates (early-stage pilot tenders). Joint maintenance teams, combining BBMP technicians with cooperative members, ensure sustainable operation and build technical capacity at the community level. We note, again that these are proposed mechanisms requiring negotiation and validation with the relevant municipal and community actors and not existing arrangements.

Ultimately, achieving sanitation justice demands continuous participatory evaluation and policy integration. Regular impact reviews, transparent data dashboards accessible to all stakeholders, and an inclusive policy forum will sustain momentum and accountability. Bangalore can advance a sanitation model rooted in shared dignity, resilience, and structural equity by weaving together Ambedkarite practices and collaborative governance. Bangalore can be a forge sanitation system where no life is expendable, and every worker's dignity guides the city's pursuit of innovative features.

6 Conclusion

This study documents the systemic challenges in Bangalore's sanitation sector, where SC workers, particularly from the Madiga community, continue to face occupational hazards, wage disparities and limited social protections despite the new progressive legislation. Through spatial analysis, worker testimony and policy review, three key areas emerged for collaborative improvement.

First, contractual inequalities need institutional attention. The disparity between a permanent ₹35,000 per month and a contractual worker's ₹17,000 per month requires a review to ensure a fair compensation model. Second, occupational safety systems need to be implemented, particularly in high-risk areas identified through GIS mapping with high mortality rates. Third, health and social safety gaps from absent protective equipment and limited access to trauma care require coordinated responses.

Grassroots initiatives like Pourakarmika Parivartan Sangha demonstrate community drive and pathways for change through rights awareness and collective advocacy. The efforts highlight opportunities for partnerships between workers, municipal organisations, and social work professionals to enhance safety protocols for low-cost mechanisation pilots in priority wards. At the same time, strengthening the implementation of existing laws, for example, the Manual Scavenging Prohibition Act 2013, and integrating welfare services with Karnataka's health infrastructure (AB-Ark).

For urban governance, align Smart City gender-responsive infrastructure, mechanisation to reduce toxic exposure, trauma-informed health clinics, and colony-based daycare centres to unlock economic agency. Redirecting resources towards sewer-cleaning sanitation technologies and protective equipment will advance shared operational efficiency and human dignity goals. Social work can facilitate this transition by documenting best practices from cities

SWaCH model, is a worker-owned cooperative that provides door-to-door waste collection services and earns revenue through user fees and the sale of recyclable material (Pune Municipal Corporation, 2014).

like Pune, supporting skills training for mechanised sanitation rules, and promoting inclusive dialogue through municipal community forums.

We close by restating this study's principal limitations: the sample of 36 workers and two supervisors is analytically rich but not statistically representative of Bangalore's broader sanitation workforce, and the roadmap proposed in Section 5 depends on validation by SC unions and workers.

Bengaluru's journey towards truly inclusive Urban Development depends on reconciling technological ambitions with social equity. By placing worker safety at the heart of policy planning and respecting constitutional commitments to equality, the city can pioneer a sanitation model that serves all residents with dignity.

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