

# Mechanisation in Sanitation Services: Opportunities and Barriers for Safe, Dignified, and Climate-Resilient WASH Systems

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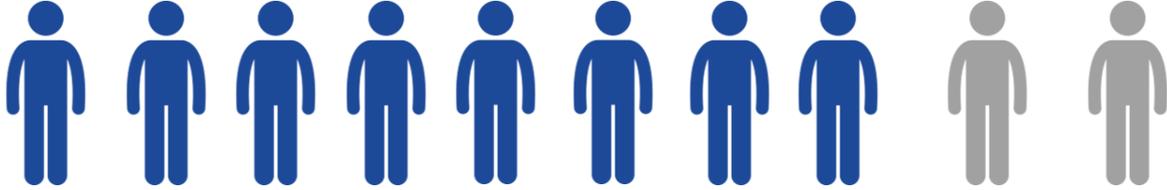
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# Death of Sanitation Workers in India from 2020-2025

162 Total Incidences

461 Workers involved



370 (80%)  
Died

91 (20%)  
Survived

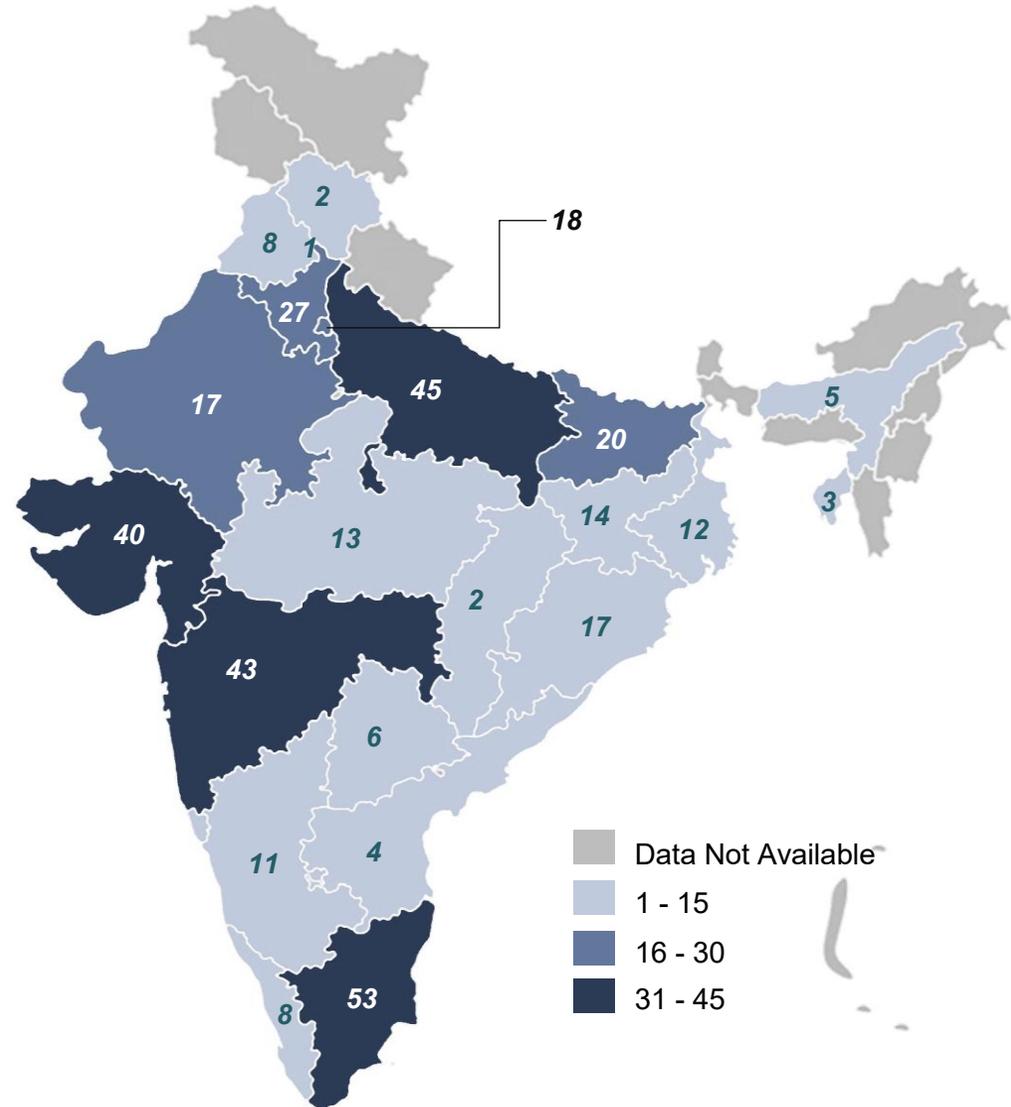
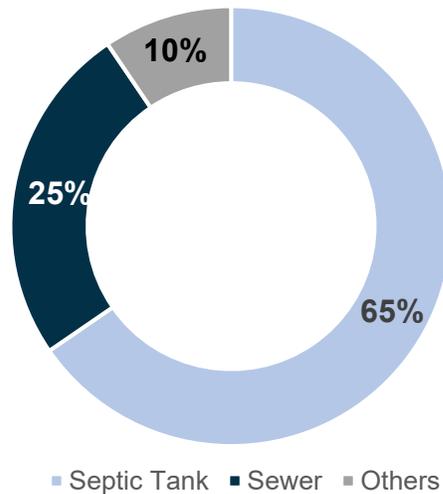


2 workers died in each sewer incident



3 workers died in each Septic Tank incidents

Site of Death



Death of Sanitation Workers in India from 2020 Till date

\* Analysis based on media reports collated by UMC (as on 06/11/2025)

# The Sanitation Value Chain

## Containment/Emptying

## Transportation

## Treatment

### Job Role



Sewer Line Cleaners



Septic Tank Emptiers



Drain Cleaners



Septic Tank Emptiers



Drain Cleaners



O&M of Sewage Treatment Plant/FSTP

### Number of Workers

~170,000

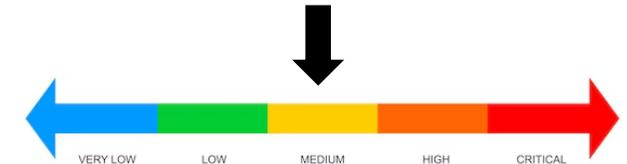
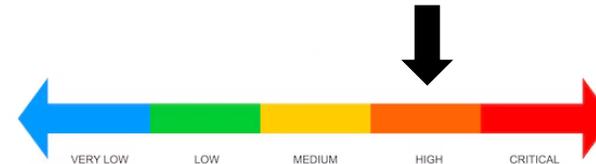
~130,000

~12,000

### Level of Hazard



### Level of Vulnerability



\* Statistics based on study conducted by Dalberg (2017) and UMC

# Reasons for fatality

1. **Toxic exposure to gases like hydrogen sulfide and methane causes instant asphyxiation and death.**
2. **Direct contact with faecal matter leads to serious infections and diseases.**
3. **No protective gear leaves workers vulnerable to illness and collapse.**
4. **Poor training and upkeep cause frequent injuries and equipment failures.**

**Mechanisation replaces such dangerous manual tasks with safe, machine-led operations.** This eliminates human entry, reducing exposure to waste and gases, and ensuring sanitation work is safe, dignified, and efficient.



# Financial challenges

## Cost

**₹23,074 crore**

*Estimated national mechanisation budget requirement by 2031 to serve an estimated population of 169 crores*

**₹6 crore**

*Comprehensive mechanised sewer cleaning equipment for city-wide implementation.*

## Why is this a problem?

**High upfront capital costs**

*Beyond routine ULB budgets*

**Smaller ULBs most affected**

*Limited fiscal capacity*

**Persistent underinvestment**

*Continued reliance on manual practices*

**Worker collectives excluded**

*Limited access to formal credit*

## Financial Gaps

### What exists

- *Swachhta Udyami Yojana (SUY)*
- *Formal credit mechanisms*

### What is needed

- *Scale & coverage*
- *Awareness & uptake*
- *Tailored financing products*

**Without dedicated, accessible financing, mechanisation remains financially out of reach—particularly for small cities and sanitation worker collectives.**

*(as per a study conducted by UMC)*

# Governance and technical challenges

## Technology–Context Mismatch

- *Standardised equipment is designed for ideal conditions, not complex urban realities.*
- *Narrow lanes, dense settlements, variable sewers, and inaccessible septic tanks limit machine reach.*
- *Lack of modular or adaptable designs results in partial mechanisation and continued manual work*

## Data, Mapping and Planning Deficits

- *Incomplete mapping of sewers and septic tanks constrains informed deployment.*
  - *Limited use of geospatial data leads to reactive, ad-hoc operations.*
  - *Weak data integration reduces efficiency and equipment utilisation.*

**Mechanisation is constrained**

**Climate Change impacts WASH  
infrastructure maintenance**

## Operational Capacity & Incentive Gaps

- *Gaps in technical training in advanced equipment restricts safe and effective equipment use.*
- *Informal employment structures offer few incentives to mechanise.*

## Fragmented Governance & Accountability

- *Multiple agencies share sanitation functions with unclear ownership.*
- *Mechanisation mandates are unevenly interpreted and enforced.*
  - *Worker safety receives limited institutional priority.*

# What challenges do ULBs face in ensuring mechanization?



# Pathways for operationalizing 100% mechanisation

1

## Evidence-Based Planning & Asset Right-Sizing

City-level needs assessments to determine the appropriate type, quantity, and mix of ULB-owned and privately contracted mechanised equipment, aligned with operational demand.

2

## PPP-Led Service Delivery & Workforce Transition

Private deployment and maintenance with workers trained as machine operators—safer jobs, faster response.

3

## Safety Systems for High-Risk Operations (ERSUs)

Controlled manual entry with full PPE, real-time oversight, and verified safe disposal.

4

## Predictive & Preventive Operations through Technology

IoT monitoring and preventive maintenance to reduce emergencies and optimise mechanisation.

5

## Institutionalised SOPs & Circular Resource Recovery

Scheduled desludging, standard SOPs, and safe reuse of sludge and septage.

**CLIMATE CHANGE IMPACTS**

# City-level needs assessment

Cities possess sanitation machines, but these are often inadequate or mismatched to the actual needs.

## Cities lack clarity on:

1. Type of machine and equipment required
2. Number of machines required
3. How to maintain and operate them
4. Challenges in appropriating machines with road width
5. Model of operation
6. Safety equipment's and their use for SEP
7. Type of Sanitation System – UGS or OSS

**Without first assessing this need, cities cannot make informed decisions** on procurement or outsourcing, leading to gaps in safety, efficiency, and service delivery.



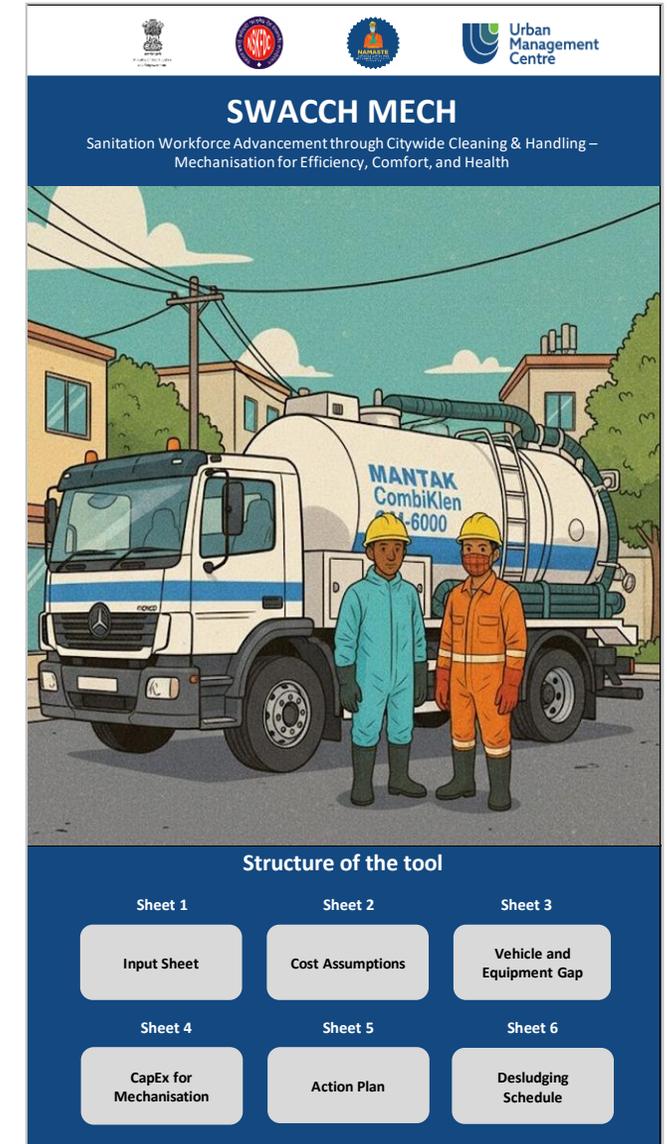
# Conducting city-level needs assessment through Swacch Mech

## About Swacch Mech:

**SWACHH-MECH** (*Sanitation Workforce Advancement through Citywide Cleaning & Handling – Mechanisation for Efficiency, Comfort, and Health*) is a proposed simple to use excel-based city-wide action planning tool for assisting cities to create their action plans for transitioning to complete mechanization of sanitation works (sewer line operations and maintenance & septic tank desludging).

## How does it work?

1. Cities input data on their city profile to understand the population, households and sanitation network to be managed. Along with that, cities input data on their existing machine and equipment inventory.
2. The tool generates the number of additional vehicles, equipment and safety gears required based on the city profile to address the demand for mechanization required.
3. Based on the gap assessment, the tool generates the total cost of procurement along with strategies on how to procure them.



# Components of the Swacch Mech Tool

## Step 1:

### Input Sheet

- City name, demographics, area and property distribution
- Total length and layout of the sewer network
- Existing vehicle and equipment inventory (jetting machines, rodding units, combined jetting-suction machines)

## Step 2:

### Cost Assumptions

- Cost estimates based on rates from the GeM Portal and the state-specific market.

## Step 3:

### Vehicle and Equipment Gap

- Required fleet size by vehicle type (jetting, rodding, etc.)
- Compares current vehicle holdings (from city/ULB inventory) with required fleet
- Highlights shortages or surpluses in each vehicle category
- Suggests specific procurement or reallocation needs for complete coverage

## Step 4:

### CapEx Calculation for Mechanisation

- Capital Expenditure Required by the ULB

## Step 5:

### Action Plan

- Funding and procurement strategies along with O&M

## Assumptions

### Desludging Schedule

- Recommended cleaning frequencies for primary and secondary sewers (e.g., monthly, quarterly, as needed)
- Vehicle deployment rates (e.g., vehicles per km of network)

# Thank You

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