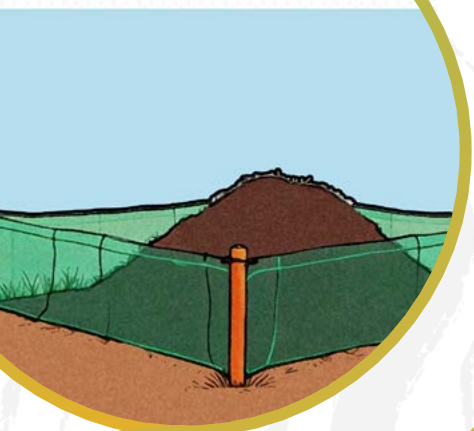

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CLOSING THE LOOP

CITY–FARMER PARTNERSHIP FOR WET WASTE COMPOSTING

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CLOSING THE LOOP: CITY–FARMER PARTNERSHIP FOR WET WASTE COMPOSTING

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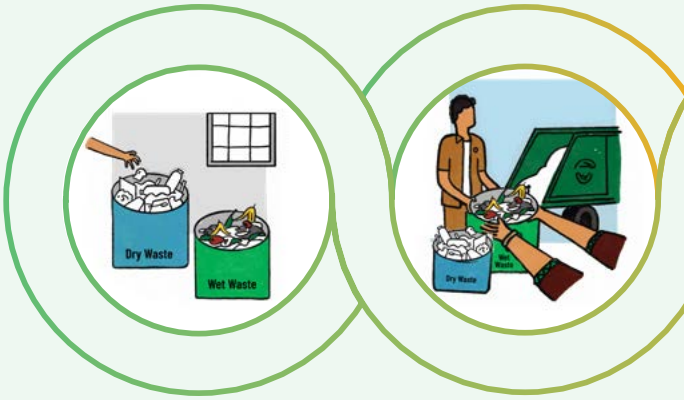

Dry Waste
Wet Waste

BACKGROUND

India's cities and towns are struggling with growing volumes of waste, even as farmers pay heavily for chemical fertilisers that could, in part, be replaced with greener nutrients recovered from that same urban waste.

This brief sets out a practical, low-cost model: city–farmer partnerships for wet waste composting—designed to help urban local bodies (ULBs) reduce landfill pressure, and secure affordable, locally produced compost for farmers. Under this model, ULBs deliver segregated wet waste directly to farmlands instead of sending it to landfills, and farmers compost the wet waste they receive for use in their own fields.

Building on IIHS' pioneering experience of designing and implementing these city–farmer partnerships in Karnataka, this brief explains why the approach is needed, presents field evidence demonstrating its effectiveness, outlines its key policy design and operational requirements, and proposes pathways for scaling it up.

The brief is intended for decision-makers and implementers interested in:

- Reducing waste going to landfills and improving overall waste processing rates
- Containing long-term infrastructure and landfill costs for ULBs
- Enabling farmers' access to reliable, low-cost compost that reduces chemical fertiliser use and strengthens soil health
- Advancing climate action goals by cutting methane emissions through a more circular flow of nutrients between cities and surrounding farms

THE CHALLENGE

India's current solid waste and agricultural nutrient systems are misaligned: cities are overwhelmed with wet waste that is mostly dumped rather than treated, while farmers depend on costly chemical fertilisers instead of drawing on the nutrient value of that waste (Kiran et al., 2025). This mismatch expands landfill footprints and greenhouse gas (GHG) emissions on one side, increases input costs and degrades soil and water health on the other, and manifests in five interlinked challenges.

Urban India produces far more wet waste than it can process. India generates about 62 million tonnes per annum (mtpa) of municipal solid waste (MSW) (CPCB, 2022–23). A very large share of this—upto 37 mtpa or 60 per cent—is organic material from homes, business establishments, and institutions (MoHUA, 2021). Of this, about 16 mtpa (about 44 per cent) is not treated and goes straight to landfills. Material that could be stabilised and turned into compost is instead left to rot in uncontrolled conditions, creating environmental and public health hazards rather than agronomic value.

Landfills are carrying the burden of unprocessed wet waste. Unprocessed waste is disposed in landfills. An estimated 2,479 landfills containing over 1,000 tonnes of waste each now occupy large tracts of scarce urban land—over 15,000 acres countrywide (PIB, 2026). Decomposing wet waste in these landfills drives GHG emissions, contaminates surface and groundwater through leachate, and triggers recurring fire and odour episodes that harm nearby communities (MoHUA, 2021).

If the 16 mtpa wet waste estimated to be reaching landfills unprocessed were composted instead, it would generate 4 mtpa of compost—enough to meet the full annual fertiliser requirements of roughly 1.2 million farmers—and significantly lower the physical and environmental burden on landfills.

ULBs are constrained in processing wet waste. In most ULBs, a large share of solid waste management (SWM) budgets—often over 60 per cent—is spent on collection and transport, leaving little fiscal space for investing in processing facilities. Where centralised composting or bio-methanation plants exist, they face persistent market constraints, as chemical fertilisers remain cheaper and more readily available. In addition, weak segregation at source, limited technical capacity, fluctuating operating budgets, and uncertain compost demand result in stop–start functioning, and make it difficult for ULBs to sustain processing efforts over time.

Farmers face real barriers to using compost. Even when compost (priced at Rs 2,000–3,000 per tonne) is significantly cheaper than chemical fertiliser (priced at Rs 14,000–15,000 per tonne), farmers typically need 15–20 times more compost by weight per acre for equivalent nutrient application. This greatly increases transport costs, especially for farms distant from composting plants, and raises labour requirements for spreading the bulkier material. Moreover, compost is not always available in local markets at the right time or in predictable quantities. As a result, farmers continue to rely on bagged chemical fertilisers, which are lighter, easier to handle, and supported by well-established distribution networks and subsidy systems.

These supply- and demand-side constraints reinforce each other and prevent a circular solution from emerging. ULBs hesitate to invest in wet waste processing because they cannot count on stable compost demand, and farmers stick with chemical fertilisers because compost is logistically inconvenient and unreliable as a core input. The city–farmer partnership model aims to break this cycle by redesigning how wet waste moves from households to fields—turning a disposal problem into a local resource opportunity.

THE PROPOSED MODEL

IDEA IN BRIEF

The central idea is to establish city–farmer partnerships that systematically divert segregated municipal wet waste from landfills to nearby farms, where it is composted and applied to agricultural land as a soil nutrient.

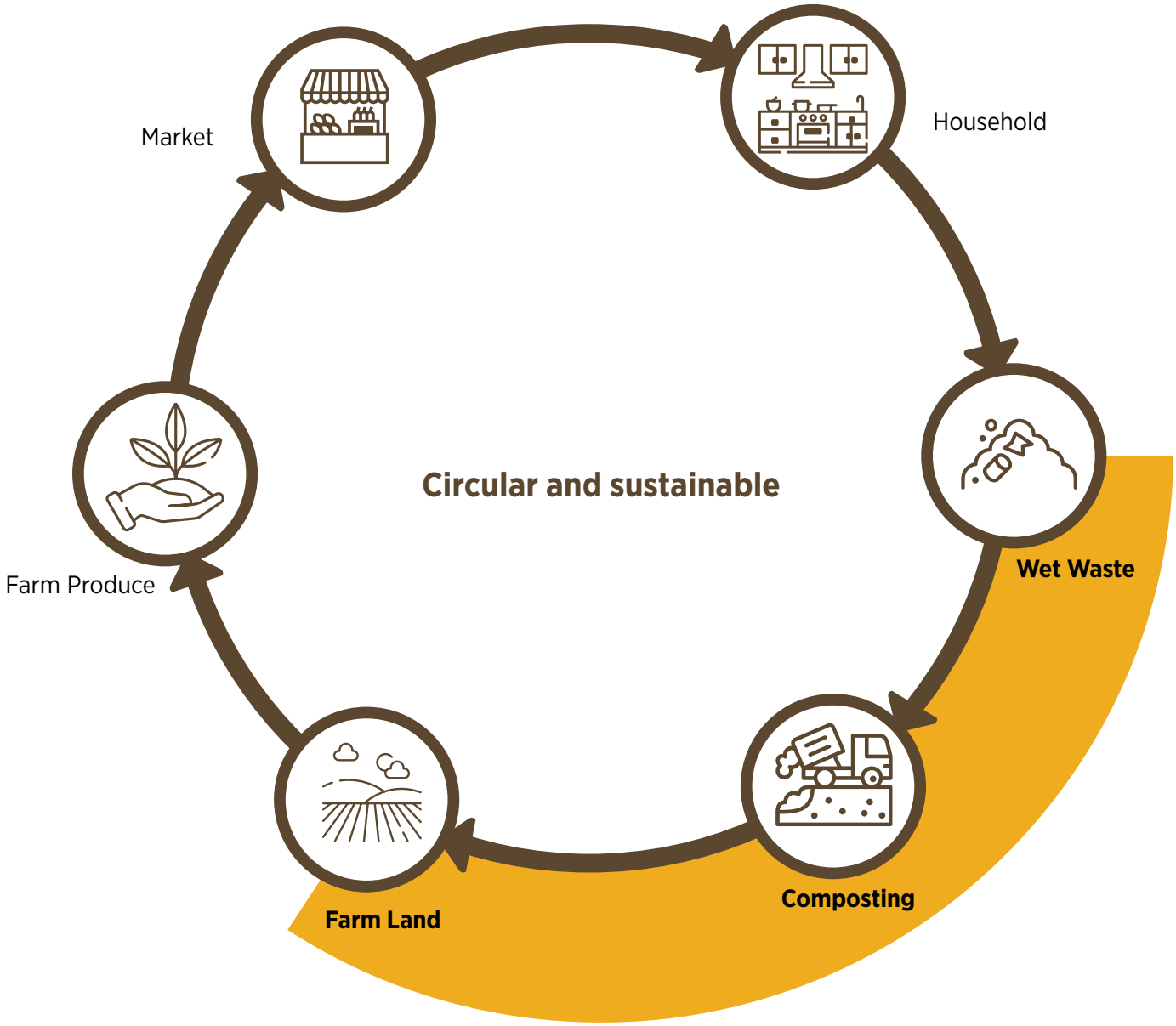
Key elements

- ULBs mobilise urban residents to segregate waste at source and, by adapting existing collection vehicles and routes, deliver segregated wet waste to volunteering peri-urban farmers, typically within a 10 km radius of the city/ town.

- A simple planning ratio of one partner farmer per 1,000 residents helps match urban wet waste generation with on-farm composting capacity and land available for compost application.

- Participating farmers compost wet waste on-site using low-cost, pit-based methods and apply the resulting compost on their own fields, partially replacing chemical fertilisers.

City-farmer partnership model



The city–farmer partnership model operationalises a powerful circular model. Made available to farmers, this compost enhances soil health. Healthier soils produce safer, more resilient crops that supply the city—completing a regenerative loop. By converting waste into value, this circular model lowers dependence on chemical fertilisers, and strengthens local rural–urban sustainability.

Benefits

Economic

- 30 per cent lower landfill operation and maintenance costs for ULBs and local governments
- Longer life for existing landfill sites, deferring the need for expensive new land acquisition and costly infrastructure expansion
- Reduced agriculture input costs by 20 per cent, through access to a low-cost alternative to chemical fertilisers that enhances long-term soil productivity

Environmental

- Lower methane emissions from decomposing wet waste (1 tonne ≈ 1.4 metric tonnes of carbon dioxide equivalent ($MtCO_2e$)), and reduced overall GHG output from landfills
- Decreased risks of groundwater and soil contamination from leachate and unmanaged landfills
- Improved agro-ecosystem health through nutrient recycling, and enhanced soil organic matter and structure

Social

- Better public health outcomes from reduced exposure to overflowing landfills, polluted water, smoke, and pests
- Cleaner and more liveable urban environments through better organic waste management
- Safer and sustainably grown food enabled by reduced chemical dependence and healthier soils

Institutional

- Improved compliance with segregation and processing mandates for ULBs and local governments
- Greater shared responsibility and collaboration between ULBs, farmers, and urban residents for managing organic waste as a resource
- Enhanced citizen engagement and awareness around segregation, composting, and circular waste practices

EVIDENCE: THE CHIKKABALLAPURA CASE

What has been done

IIHS has been implementing the city-farmer partnership model in Chikkaballapura, Karnataka, since March 2024, in partnership with the Chikkaballapura City Municipal Council (CCMC) and with CSR support from Godrej Properties Limited (GPL).

During this period, IIHS has supported the CCMC in:

Designing and implementing intensive Information, Education, and Communication (IEC) and Behaviour Change Communication (BCC) campaigns to promote waste segregation at source

Supporting farmers with composting pits to promote sustainable and organic agricultural practices

Identifying and training volunteer farmers to handle composting operations

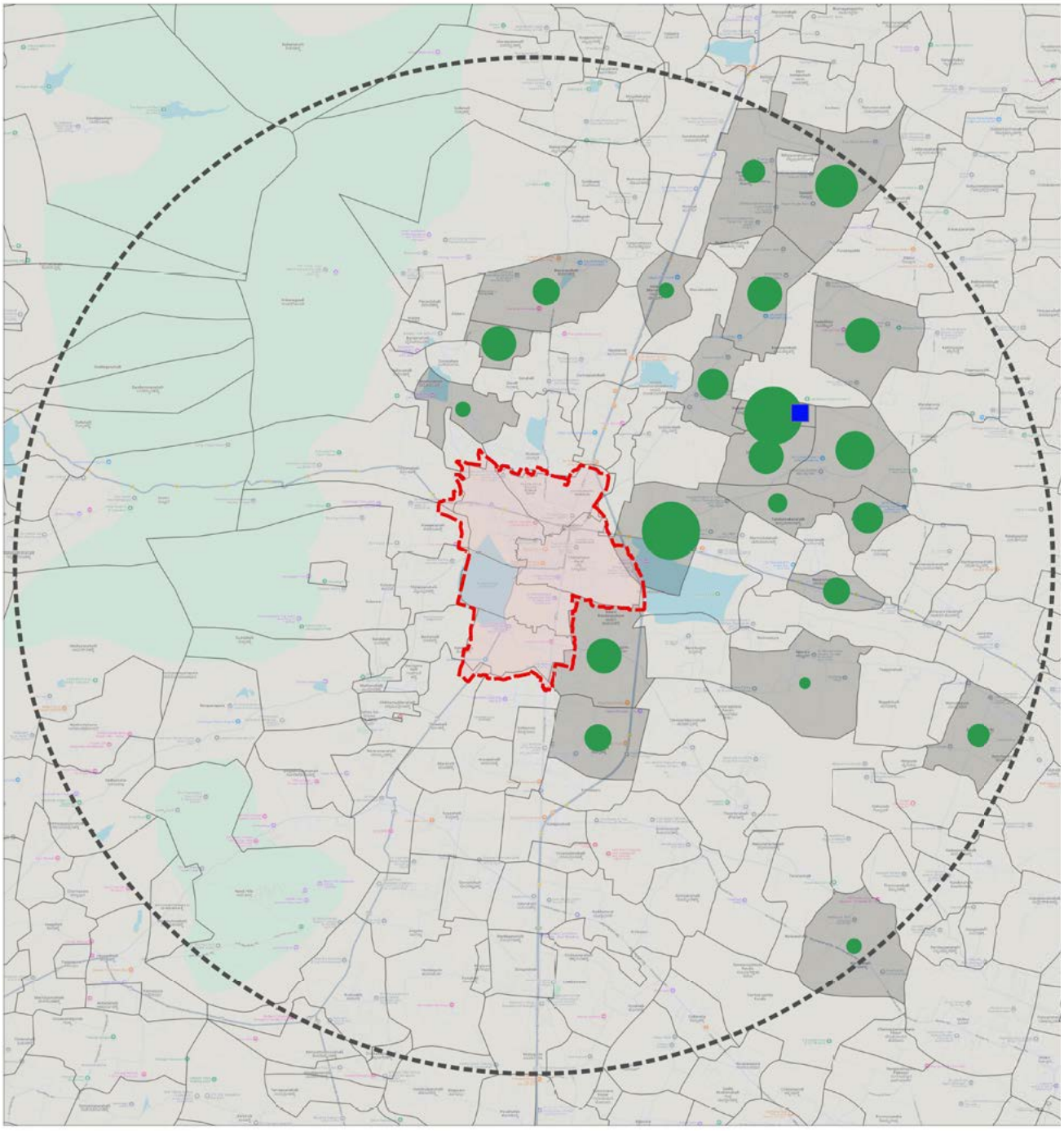
Tracking soil health improvements through regular sample testing.

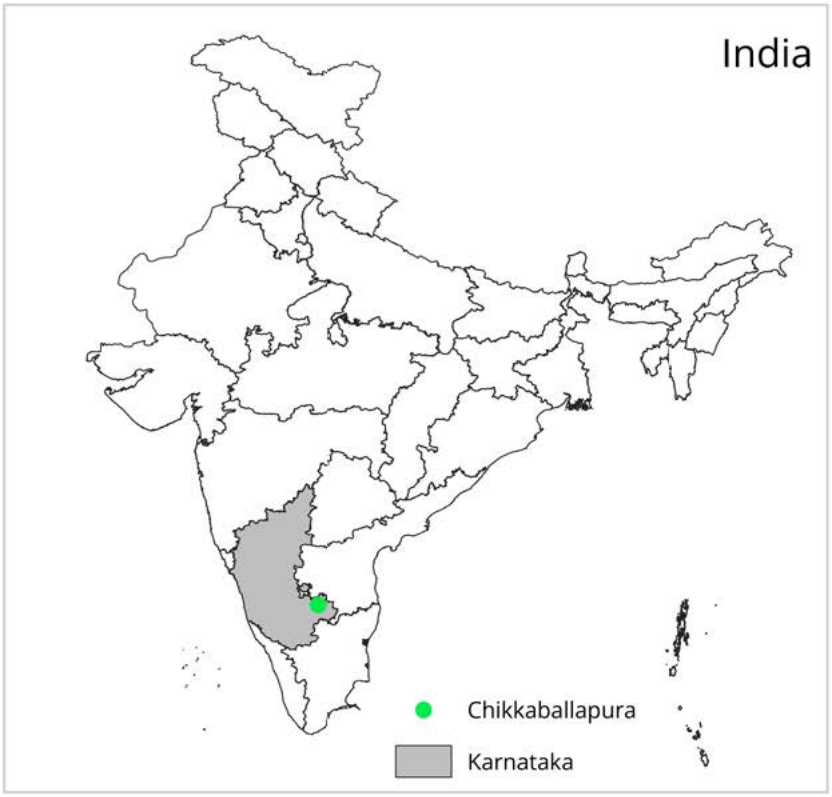
Planning, operationalising, and monitoring wet waste delivery to farmlands

Supporting farmers with technical guidance, composting equipment, and input such as bio-culture

Supporting farmers with additives, turning, and demonstration of composting operations

City–farmer partnership map: locations of villages engaged in the project





Legend

- SWM Site
- Villages fed with Segregated Wet Waste
- Buffer 10KM
- Chikkaballapura city

No. of Pits in each Village

- 1 - 2
- 2 - 4
- 4 - 6
- 6 - 10
- 10 and above

0 1 2 km

Source(s): IIHS-2026; BharatMaps.
Map by: Lokesh BS, IIHS-GSL

Changes achieved

1 **Diverted 5,000 tonnes of wet waste from landfill, and reduced GHG emissions by 7,200 MtCO2e**

5,000 tonnes of wet waste have been diverted to farmers for composting, resulting in GHG emission reductions of about 7,200 $MtCO_2e$ during the first 24 months of the project. This progress was achieved as the share of daily MSW generation diverted from landfill increased from about 5 per cent (around 1 tonne per day, tpd) in March 2024 to nearly 50 per cent (around 13 tpd) by March 2026. By its scheduled completion in March 2027, the initiative is expected to divert at least 10,000 tonnes of wet waste to farmers, and reduce GHG emissions by about 14,500 $MtCO_2e$.

2 **1,500 tonnes of compost enabled the reduction of chemical fertiliser use by 100 tonnes**

1,500 tonnes of compost have been produced and chemical fertiliser use has been reduced by about 100 tonnes through the diversion of about 5,000 tonnes of wet waste to over 220 volunteer farmers between March 2024 and March 2026. By March 2027, the project is expected to divert at least 10,000 tonnes of wet waste to farmers, produce around 3,000 tonnes of compost, and reduce chemical fertiliser use by about 200 tonnes.

3 **Saving farmers an estimated ₹14,000 each in input costs from avoided chemical fertiliser use**

Saving volunteer farmers an estimated Rs. 14,000 each, annually, in input costs from avoided chemical fertiliser use, the city–farmer partnership model has operated at a cost of about Rs. 550–600 per tonne. With wet waste transport routes designed to keep costs comparable to landfill transfers, the initiative enables MSW processing worth about Rs. 1,000 per tonne.

4 **Waste segregation at source improved from 20 per cent(about 5.6 tpd) to about 50 per cent (14 tpd) within 4 months**

Waste segregation levels increased from about 20 per cent, (around 5.6 tpd) to about 50 per cent (around 14 tpd)—as a proportion of the daily average MSW generation of 28 tpd—within four months of the project's start, and have remained steady since. This improvement has led to significant diversion of MSW from landfill, and a notable reduction in garbage vulnerable points, which have decreased from 120 to 80.

5 **Soil health indicators improving steadily.**

As part of the quality assurance process, over 50 samples have been tested for pollutants, contamination risk, and soil health improvement. The results indicate no significant risk associated with the pit composting of wet waste.

Potential impact

The Chikkaballapura experience demonstrates that the city–farmer partnership model can simultaneously achieve landfill diversion, farmer benefits, and cost savings.

By routing segregated wet waste to farms, enabling on-farm composting with basic infrastructure and technical guidance, and coupling these efforts with sustained community mobilisation through sharp IEC efforts, Chikkaballapura has lifted segregation rates, reduced landfill inflows, and established a clear, trusted-end use for wet waste—lowering both municipal processing costs and farmers' input expenses.

Scaled across Indian cities and towns, the model could divert millions of tonnes of wet waste from landfills each year, generate large volumes of nutrient-rich compost, displace significant quantities of chemical fertilisers, and cut methane reductions as a major climate co-benefit.

In a city of about 100,000 residents generating 35–40 tpd of MSW, roughly 21–24 tpd will be wet waste suitable for this model and can be directed to about 100 farmers. At segregation levels of around 60 per cent, the city–farmer partnership could annually divert about 4,500 tonnes of wet waste from landfills, reduce GHG emissions by roughly 6,500 MtCO2e, enable production of around 1,350 tonnes of compost, and avoid about 100 tonnes of chemical fertiliser use, translating into annual input cost savings of roughly Rs 14,000 for each participating farmer.

Organic household waste

Collection & transportation by ULBs

Wet waste supplied directly to farmers

Composting pits

Compost application in farms

OPERATIONAL MODEL

The operational model creates a circular link between urban waste generation and agricultural resource needs, by directing segregated wet waste from a city to peri-urban farms within a roughly 10 km radius, using a subset of existing vehicles. The goal is to reduce landfill loads, enhance soil health, and lower input costs for farmers.

Role of ULBs

- Strengthen segregation at source through sustained IEC. Identify and enrol farmers within an approximate 10 km radius of the city, aiming for a planning ratio of one farmer per 1,000 residents.
- Plan and operate dedicated wet waste collection and delivery routes using existing vehicles, transporting segregated wet waste directly to volunteering farmers' fields instead of landfill sites.
- Support on-farm composting by facilitating construction of compost pits, supplying bio-culture and basic tools, appointing farmer coordinators to manage field-level engagement, and maintain simple records and quality checks of composting operations.

Role of farmers

- Provide space (20 square meters) on their farms for compost pits, and prepare biomass base layers to receive segregated wet waste.
- Carry out the composting process, including applying bio-culture, maintaining adequate moisture, adding supplementary inputs such as cow dung and urine, turning the waste periodically, and recovering finished compost from the pits.
- Use the compost on their own fields to improve soil organic matter and structure, thereby reducing dependence on chemical fertilisers and enhancing long-term soil productivity.

Required resources

- City wise dedicated farmers' coordinator to coordinate waste supply, oversee composting operations, and quality control.
- City-level community mobiliser to ensure that only segregated wet waste is supplied to farmers.
- Budget for formation of composting pits (5x4x1 m) and turning of waste heaps.

SCALING UP

POLICY AND INSTITUTIONAL ACTIONS FOR SCALE UP

For state governments

- Issue state-wide guidelines on city–farmer partnerships, including norms on distance (for example, up to 10 km), farmer–population ratios (for example, one farmer per 1,000 residents), and minimum service and monitoring standards.
- Constitute a state-level technical committee to support ULBs with model bye-laws, standard operating procedures, training materials, and peer-learning platforms anchored in cases such as Chikkaballapura and Doddaballapura.
- Direct ULBs to include city–farmer partnerships in their SWM plans and integrate these efforts with state climate action, agriculture, and rural development strategies and targets.
- Align behaviour change and IEC funds under Swachh Bharat Mission and related schemes to focus on segregation at source, farmer participation, and citizen acceptance of farm-linked wet waste management.

For urban local bodies

- Amend SWM bye-laws to mandate wet–dry segregation at source, authorise delivery of segregated wet waste to registered farmers within a defined radius, and specify ULB support for on-farm composting (pits, bio-culture, technical guidance).
- Earmark a small share of current processing and transport expenditure towards promoting decentralised, farm-based composting.
- Appoint farmer coordinators to manage farmer enrolment, route planning, compost quality checks, and basic data reporting (tonnes diverted, compost produced, acres covered).
- Institutionalise monthly review and experience-sharing forums involving farmers, ward representatives, and SWM staff to troubleshoot operational issues and refine routing, pit design, and support measures.

Estimating farmer mobilisation requirement for city–farmer partnership

Key assumptions

MSW collected = 0.35 kg/capita/day

Wet waste percentage = 60% = 0.6

Segregation efficiency = 50% = 0.5

Wet waste available per capita per day = 0.35 × 0.6 × 0.5 = 0.105 kg/capita/day

Total wet waste available for diversion

$$\text{Total wet waste (tonnes per annum)} = \left(\frac{\text{Population} \times 0.105}{1{,}000}\right) \times 365$$

Estimation of number of farmers required to be mobilised

$$\text{No. of farmers required to be mobilised} = \frac{\text{Total wet waste (tonnes per annum)}}{40}$$

Where: 40 = annual wet waste handling capacity per farmer = 2 batches × 20 tonnes/batch

Example:

City population = 50,000

$$\text{Total wet waste (tonnes per annum)} = \left(\frac{50{,}000 \times 0.105}{1000}\right) \times 365 = 1{,}916$$

$$\text{No. of farmers required to be mobilised} = \frac{1916}{40} = 47.9 \approx 48$$

Note: a city with a population of 50,000 will need 48–50 farmers

ILLUSTRATIVE ACTION ROADMAP FOR KARNATAKA

The Chikkaballapura experience provides a strong foundation for a state-wide rollout in Karnataka.

(0–6 months) Set the state framework

- Issue a Government Order notifying city–farmer partnerships for wet waste composting as an approved SWM strategy under state policy, referencing Chikkaballapura as a model.
- Hold a consultation with select ULBs to get their feedback, and assess their needs for operationalising the model.
- Develop and circulate model documents: standard SWM bye-law clauses, MoU templates between ULBs and farmer groups, technical guidelines on pit design and compost quality, and simple monitoring formats.
- Establish a state-level coordination cell (within Urban Development or Directorate of Municipal Administration) or designate personnel to provide training, handholding, and periodic review.

(6–18 months) Launch demonstrations in the first cohort of cities

- Identify 10–15 ULBs (including at least one in each region) with suitable peri-urban farming belts and manageable waste volumes (for example, 25,000–1,00,000 population).
- Support each ULB to notify bye-law amendments, map potential partner farmers within a 10 km radius, plan routes to divert at least 30–40 per cent of wet waste to farms, and build and operationalise pits for an initial cohort of farmers (using the one farmer per 1,000 residents norm).
- Provide state-coordinated training for SWM staff and farmers, drawing on the Chikkaballapura training materials and formats. Require quarterly reporting on tonnes of wet waste diverted, compost produced, fertiliser displaced, and landfill-bound waste reduced, using common state formats.

(18–48 months) Scale across small and medium ULBs

- Based on pilot results, refine operational guidelines (for example, eligibility criteria for farmers, minimum volumes per route, quality standards for compost) and publish a Karnataka 'city–farmer partnership playbook'.

- Expand the programme to all ULBs below 300,000 population, with differentiated targets—for example, diverting at least 35 per cent of wet waste to farmers within three years, rising to 40–45 per cent over five years.

- Introduce performance-linked grants: higher state support for ULBs that meet diversion, compost production and segregation targets, verified through periodic audits. Facilitate district-level clusters where one technical partner supports multiple ULBs and shares farmer and route management lessons.

(Beyond 4 years) Consolidate, integrate, and innovate

- Integrate city–farmer partnership indicators into state climate action and agriculture plans (for example, tonnes of compost applied, hectares under compost, methane avoided), and report them in state climate and Sustainable Development Goals (SDG) dashboards.

- Encourage value-added initiatives such as farmer producer organisations handling compost collectively, or local branding of produce grown using city compost, where feasible.

- Use data from ULBs to progressively optimise planning norms (for example, adjusting farmer–population ratios, route lengths, and pit capacities) and update standards every 3–5 years.

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Pushkara has over 16 years of experience in municipal and sustainable waste management. He has worked in over 80 urban centres across 12 states, including overseeing one of India's largest composting facilities and co-conceptualising and executing a pioneering city–farmer partnership programme for circular waste management in small towns.

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Consultant, IIHS Practice

Kiran D A has supported more than 25 urban local bodies in Karnataka on legacy waste remediation, C&D waste management, material recovery, and integrated waste management systems. He has research interests in waste-to-energy technologies and environmental pollution.

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Kavita has over two decades of experience in urban sanitation, infrastructure development, and service delivery. Over the past decade, she has led two large urban sanitation initiatives, the Tamil Nadu Urban Sanitation Support Programme and the Citywide Inclusive Sanitation initiative in Tiruchirappalli—strengthening inclusive, decentralised service delivery across over 600 towns, benefiting over 20 million people.

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Manish has over three decades of experience in policy and finance design, institutional strengthening, programme management, and ecosystem mobilisation to realise high impact infrastructure and service delivery systems at scale. Working with central and state governments, finance commissions, international agencies and Indian industry, he has driven early power and water reforms, reformed institutional arrangements, created new infrastructure financing tracks, and delivered large, impactful programmes.

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