

Waste, Reimagined:

Practical Guidance *for* Digitalizing Waste Management



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Executive Summary

Today, municipalities and waste management companies around the world are exploring the use of digital tools as a way to strengthen planning and governance, improve service reliability, reduce operating costs, and build circular-economy practices. These tools also enable measurement and accountability, by generating more reliable data. However, many do not have clear guidance on identifying the appropriate tools to address specific issues, costs and benefits, or the conditions needed for successful deployment.

This report aims to respond to such gaps. Through step-by-step guidance and real-world examples, the report helps align operational and digital staff, building knowledge and understanding on ways to unlock the benefits of digital technologies—benefits that can help make the case to leaders and decision makers to commit to investment.

The report identifies long-standing waste management challenges, such as poor data collection, disengaged households and businesses, inefficient use of waste infrastructure, and weak links across the waste value chain. And it shows how digital tools address these issues in a cost-effective and scalable way, to strengthen planning, governance, and service delivery.

THE COSTS OF INACTION ARE SIGNIFICANT:



\$361B

annually in global health and environmental impacts from uncollected waste and disposal through open dumping and burning.

Findings from the case studies reveal that digital waste solutions deliver the greatest impact when integrated with broader service delivery and governance reforms, regardless of whether a country is high-, middle-, or low-income. Across all income contexts, strong results were driven by improved system visibility; aligned incentives for households, businesses, and waste companies; and reduced uncertainty for planning and investment. Interoperability, clear data governance, phased implementation, and sustained citizen and customer engagement, along with the ability to demonstrate returns from pilots and phased investments, are all critical enablers, including in resource-constrained settings.



The report:



Highlights market-ready digital tools and assesses their maturity, performance, and cost-benefits.



Matches solutions to needs and guides implementation by providing a strategic and operational framework.



Demonstrates tangible benefits drawn from real-world examples and city case studies.

The report concludes with insights for municipalities and waste management companies on how to optimize their digitalization initiatives, including:



Enabling conditions matter as much as technology: Successful deployment depends on governance reform, stakeholder engagement, and strong data management. Institutional capacity, sound financial planning, and phased implementation are critical to avoid fragmentation and ensure interoperability.



Engagement of citizens and businesses drives system performance: Digital tools are most effective when paired with behavior change initiatives targeting both households and commercial waste generators. Information tools, incentives, and feedback mechanisms increase participation in source separation, improve compliance, and raise material quality, reducing contamination and costs across the system.



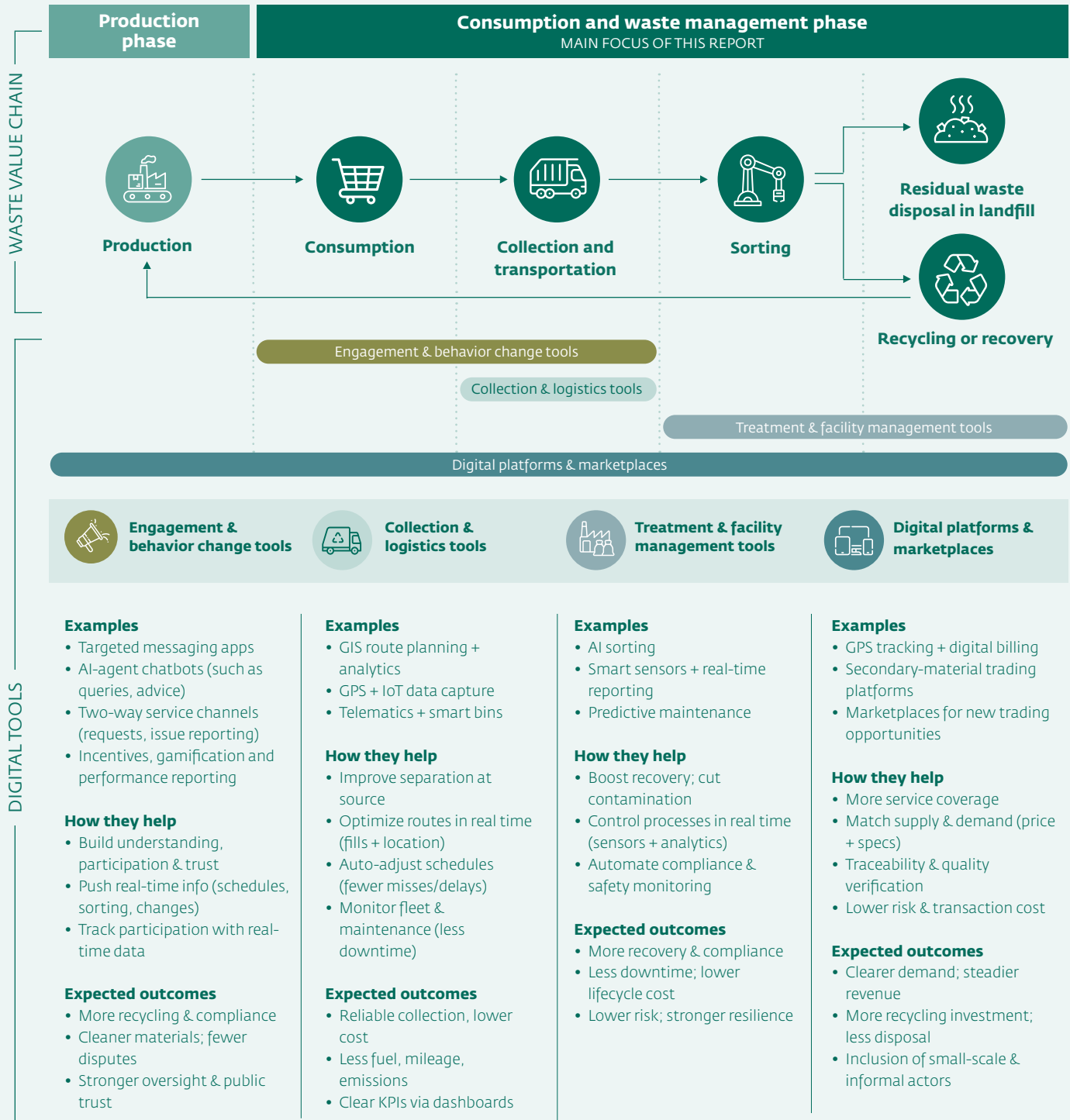
Digitalization enables circular waste systems: Digital solutions improve operational efficiency, reduce costs, and strengthen compliance, while supporting circular economy objectives such as higher material recovery and emissions reduction. They enable data-driven decision-making and greater transparency across the waste value chain.



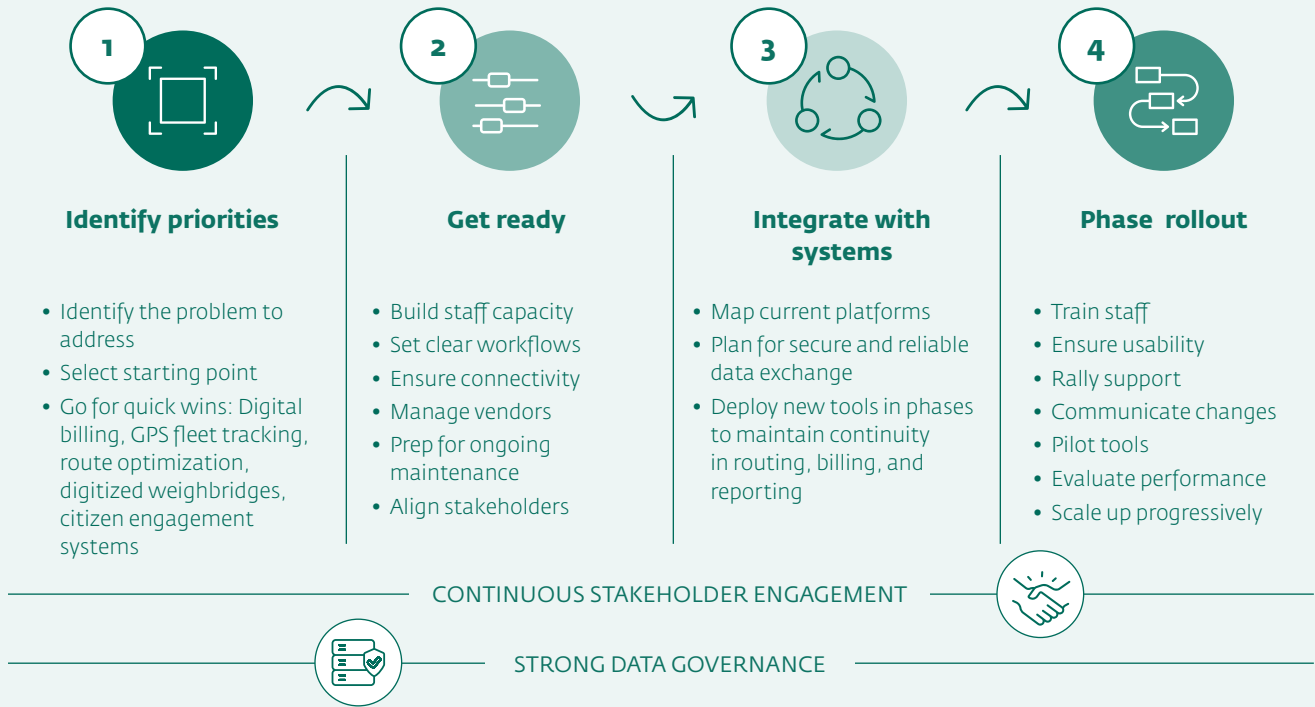
Digitalization consistently offers low-cost, high-impact operational returns: Compared with spending on physical infrastructure, digitalization represents a small share of cost while rapidly unlocking benefits in reduced fuel use, overtime, service failures, and overall cost.

Report highlights

Deploying the right digital tools throughout the waste management lifecycle leads to positive outcomes.



Implementation of the right digital tools is an ongoing process that requires attention to strong data governance, prioritized needs, baseline and improvement monitoring, system and resource capabilities, and stakeholder engagement.



Findings from case studies of cities around the world quantify the value of digitalizing waste management systems.¹

Demonstration projects in Chengdu and Suzhou, China showed how connected digital systems combining education, incentives, smart bins, and centralized sorting can improve sorting accuracy up to:

98%

An initiative in Cité el Habib, Tunisia showed that route analytics and telematics can reduce:

Collection time by up to: **57%** and fuel use by: **29-48%**

A pilot in Seoul, Republic of Korea showed that Internet of Things (IoT) smart bins can:

Reduce collection frequency by up to:	Help to lower costs by up to:
66%	83%

An initiative in Battambang, Cambodia showed that integrated digital platforms combining Global Positioning System (GPS) tracking and digital billing can boost service coverage by:

35-40%

Sorting facilities using optical sensors and artificial intelligence (AI) in Switzerland helped achieve recovery rates of up to:

95%

for household plastics, in the context of supportive waste management policy.

Solving Waste Problems with Digital Tools



Operational Efficiency & Cost Reduction



Up to **57%**
reduction in collection time.



29-48%
reduction in fuel consumption.



Improved Recovery & Material Purity



>90%
material purity achieved.



Enhanced Compliance & Revenue



Automated data capture:
Streamlines regulatory adherence.



Revenue protection:
Digitized billing reduces financial leakage.



Citizen Engagement & Service Quality



Service reliability:
Boosts participation, trust and responsiveness.



Mobile apps:
Drastically reduce response times.

Barcelona, Spain

- Complex waste collection system, overflowing street bins, collection challenges in dense urban districts.
- Integrated platforms for contract and quality management, RFID-enabled smart bins, underground pneumatic waste collection.
- Greater compliance, real-time monitoring, dynamic routing, and predictive analytics improved efficiency and service quality, while self-compacting bins cut emptying costs by 8x.

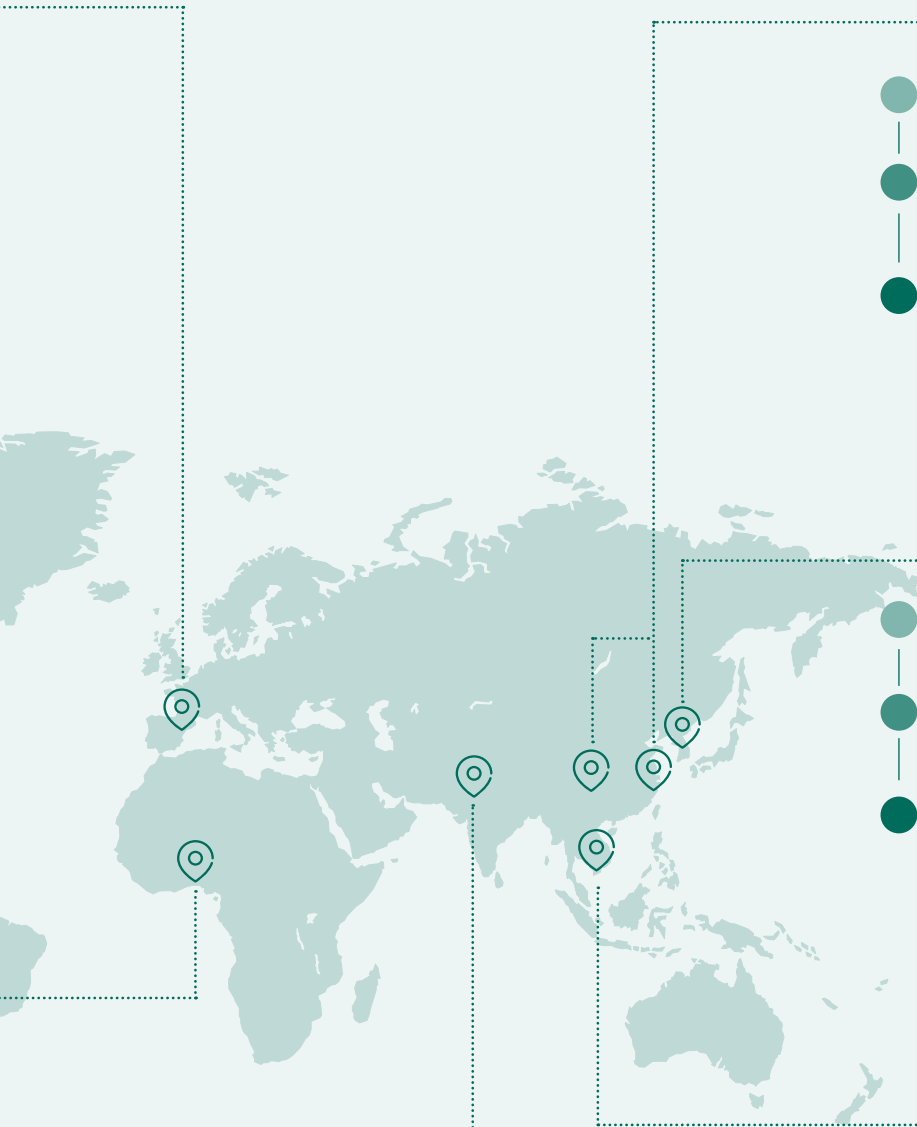
San Francisco, USA

- Smart bins: 80% decrease in overflowing bins; 66% drop in street cleaning service requests.

Cotonou, Benin

- Missed collections and limited visibility of fleet operations.
- GPS-enabled tracking of waste collection vehicles. (Costs: About \$465 to install per vehicle; \$23 month per unit.)
- Fewer missed pickups, improved route compliance, and fuel savings, alongside a ~9% increase in waste collection (430k t to 470k t) and ~500 fewer landfill trips, while real-time monitoring reduced fuel theft and extra payment demands.

● Problem ● Solution ● Outcome



Lahore, Pakistan

IoT sensors and fleet analytics: Fleet management and optimization reduced fuel use by 29%, lowered maintenance costs by 18%, and improved route efficiency by 32%.

Chengdu & Suzhou, China

- Irregular, low-volume, poor quality household recycling.
- QR-tracked AI recycling machines with digital marketplaces, IoT logistics.
- Higher household participation and recycler supply, achieving 98% sorting accuracy with 5,778 t of plastics diverted, while food waste separation rose from 5% to 40%.

Seoul, Republic of Korea

- Overflowing bins, inefficient fixed routes, low food recycling.
- RFID food-waste charging/ Pay-As-You-Throw (PAYT).
- Cleaner streets and more reliable collections, with food-waste recycling rising from ~2% to ~98%, alongside smart bins reducing collection costs by 83% and frequency by 66%, while total food waste fell by 10% as residents responded to weight-based digital fees.

Battambang, Cambodia

- Low payment compliance, limited waste service coverage.
- Digital billing with mobile payments for households, GPS tracking of collection vehicles.
- Higher fee collection through digital billing and expanded service coverage, increasing from approximately 40% to 75–80%.