# Waste Management Innovations in Practice

## A Case Study of Smart Solution Applications by Haurun Jäteauto Oy


Interreg Aurora
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# Introduction

This report provides an overview of how Haurun Jäteauto Oy has adopted and piloted digital applications to modernize and optimize its waste collection operations. The motivation for implementing smart technologies is briefly outlined in motivating change section, highlighting operational, environmental, and customer service-related drivers that make digitalization a logical and forward-looking choice.

**The report presents the key smart solutions currently in use**, including sensor-based monitoring systems, mobile collect-on-demand platforms, and route optimization software. It also outlines **planned pilots** involving smart locks and controlled-access waste points, aimed at expanding the service model to new customer segments and seasonal locations.

These digital tools have begun to reshape Hauru's business model. Instead of offering isolated collection services, the company can now provide comprehensive, subscription-based, fixed price solutions that cover all relevant services. In some cases, pricing has shifted from per-emptying to volume-based invoicing, enabling more transparent and efficient cost structures for Hauru and its customers.

In parallel with technical development, Hauru is also exploring customer perspectives. Together with Oulu Business School, the company will conduct a study on consumer behavior, focusing on needs, value creation, and perceptions of digital waste services in the Oulu region. The research targets local households and examines expectations related to collection scheduling, reporting, and optimization. This study will be completed in autumn 2025.

The report ends with an introduction of a strategic roadmap for testing and scaling up smart waste management innovations. This roadmap is based on the piloting efforts and smart system implementations carried out by Hauru, and is intended to guide further development and deployment of digital waste services.

**Business insight**

Traditional waste collection is reactive and resource-intensive – innovation offers efficient alternatives for streamlining operations.

# Introduction: Key Drivers

**What changes and trends are driving innovation in waste collection?**

- ✓ Rising operational costs – fuel, labor, and equipment costs require smarter efficiency.
- ✓ Environmental pressure – need to reduce emissions, overflows, and unnecessary trips.
- ✓ Urbanization & seasonal fluctuations – more users, more variation, harder to predict.
- ✓ Customer expectations – demand for on-demand, transparent and digital services.
- ✓ Regulatory demands – ESG and circular economy targets tightening across EU.


**Business insight**

Rising cost pressures, environmental regulations, and changing customer expectations are pushing the waste sector toward smarter, more adaptive service models.

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# Introduction: Motivating Change

**Hauru has made a strategic decision to focus on smart solutions, including those developed in collaboration with service providers as well as the testing of off-the-shelf alternatives. Key motivations and targets:**

- ✓ Optimize collection routes and schedules → Based on real-time fill levels and collect-on-demand orders rather than fixed schedules.
- ✓ Get more done with the same resources → optimized operations enable new customer acquisition without increasing staff.
- ✓ Improve service quality → Timely collections, fewer complaints, enhanced transparency.
- ✓ Reduce customer service workload → Users place orders via app, no need for phone/email support. → Fill-level data helps avoid overflows and urgent calls.
- ✓ Enable predictive maintenance → Plan servicing and avoid unexpected disruptions.
- ✓ Strengthen brand positioning → Profiling as a smart, sustainable service provider builds trust and visibility. → Early adoption of innovations signals leadership in the circular economy.

**Business insight**

Digital and data-driven models unlock operational efficiency, customer flexibility, while reducing cost and service workload.

# Hauru Smart – Overview

Hauru's waste collection fleet is equipped with a comprehensive system of digital waste management applications. At the core of this system is the Vingo ERP platform, which integrates route optimization, customer relationship management, invoicing, and reporting. The platform also supports electronic waste transfer documentation, ensuring full compliance and traceability.

Vingo is connected to smart waste containers via a cloud-based interface. These include both fill-level sensors and a collect-on-demand application, enabling real-time monitoring and automated service requests. An API integration between these systems and Vingo allows for automatic ticket generation without the need for manual intervention by route planners. When a container reaches a predefined fill level or a request is issued via the application, the system automatically adds the location to the driver's route, streamlining operations and improving responsiveness.

In addition, Hauru utilizes the Europress SMART software, which provides continuous monitoring of waste compactor fill levels and supports optimized logistics for compactor transport and emptying.


*Diagram showing data flows between sensors, apps, and backend systems enabling Hauru Smart services.*

**Business insight**

Significant cost and emission reductions from dynamic routing.

Enables new business models and opportunities.

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# Case: Oulun Golf & Fill-Level Sensors

**Business insight**
Digitalization supports operational agility and data-based decision-making for both the operator (e.g. service development) and customer (ESG reporting).

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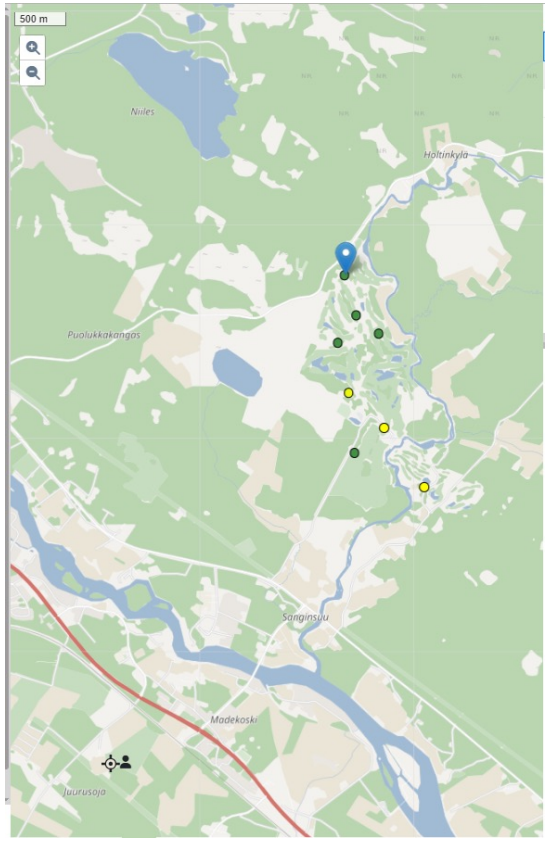
# Oulun Golf: Background

**Oulun Golf Club (OGK)** was founded in 1964. It's located in the Sanginjoki area, approximately 10 kilometers east of downtown Oulu. It is the largest golf club in Northern Finland, attracting around 70,000 players annually.

The club operates two courses: the 18-hole River Course and the 9-hole Forest Course. The courses are set in a scenic natural environment surrounded by riverside landscapes and forests.

Maintaining the courses and related services requires carefully planned and executed environmental and waste management practices to minimize the environmental impact and ensure the comfort and cleanliness of the area.

The toilets next to golf courses are not connected with local sewage system. The sludge is collected in 8 septic tanks located near the restrooms. Prior to summer 2022, the course maintenance staff manually checked the fill level of each tank on a regular basis to prevent overflows. This manual monitoring of the tanks took significant amount of working time each week.

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# Oulun Golf: Technical Issues

- Connectivity issues were observed with 4G sensors installed in septic tanks that have cast iron lids, which interfered with signal transmission. Additionally, the tanks are dispersed across golf course areas, some of which have limited NB-IoT network coverage.
- To address these challenges, in spring 2025 some sensors were replaced with 4G models equipped with external antennas, which can be mounted on top of iron lids to improve signal strength. In locations with poor NB-IoT connectivity, sensors with LoRawan communication were installed to ensure consistent data transmission and reliability.
- Currently, the API integration between the sensor cloud platform and the Vingo ERP system is still under development. As a result, ticket creation for septic tank servicing is handled manually. In the future, this process will be fully automated based on real-time fill level data.


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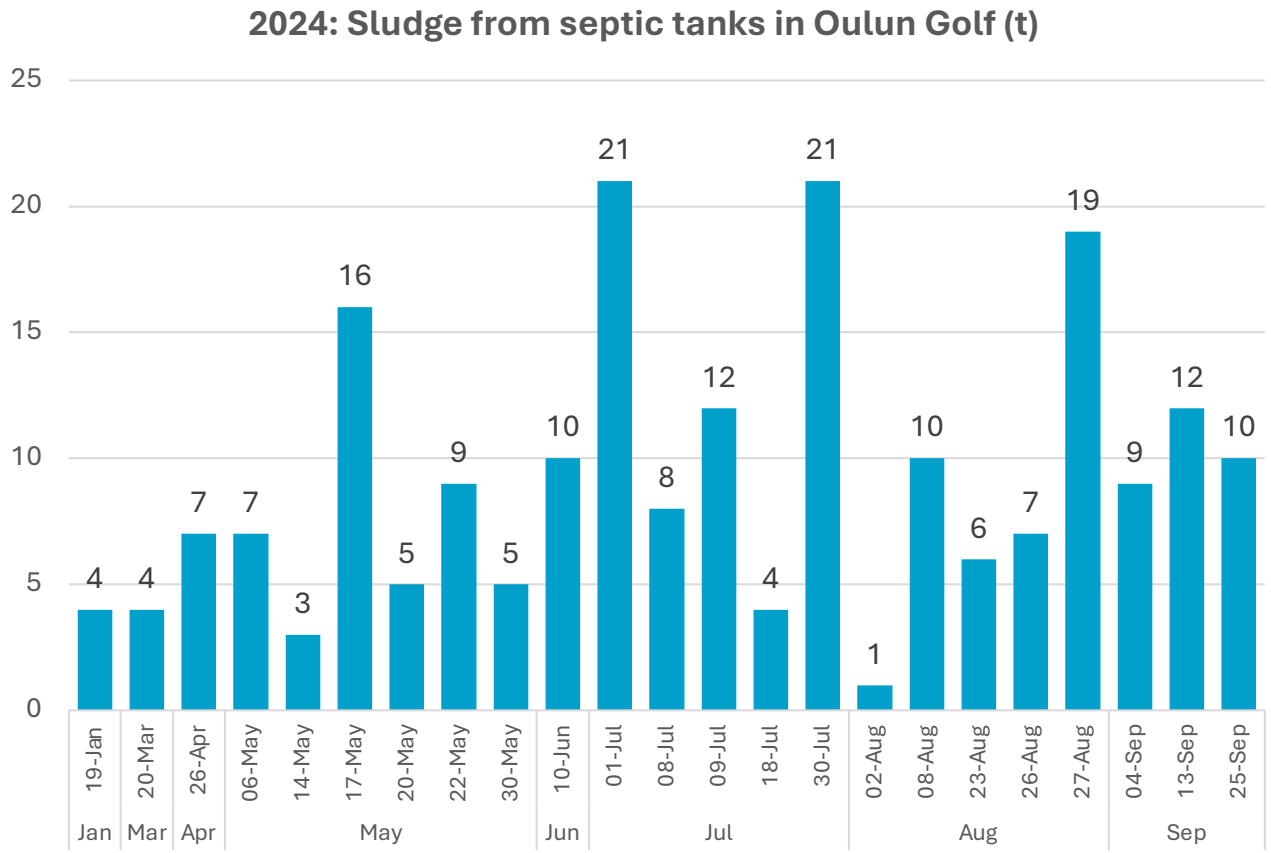
# Oulun Golf: Optimization




**Optimizing Septic Tank Collections Using Sensor Data**

With the help of sensor data, septic tank emptying operations can be optimized to ensure full truckloads. A total of 210 tonnes of sludge was collected across 29 emptying events in 2024. In some cases, the collections were planned to maximize the amount of sludge retrieved from the Oulun golf area, while at other times, the golf area served as an additional collection point complementing other routes.

Now that the technical issues have been resolved, Hauru is moving forward with the implementation of a full truckload invoicing model. This approach is expected to reduce the number of collection events while increasing the average volume per load.

**The next step** is to implement a similar API integration with the Vingo ERP system, as has already been successfully done for waste container management. This update enables the broader rollout of Smart services to customers with septic tanks.

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# Case: Ideapark – Smart Compactors

**Business insight**
Enables high-volume sites to reduce service frequency and need for emergency collections without sacrificing cleanliness.

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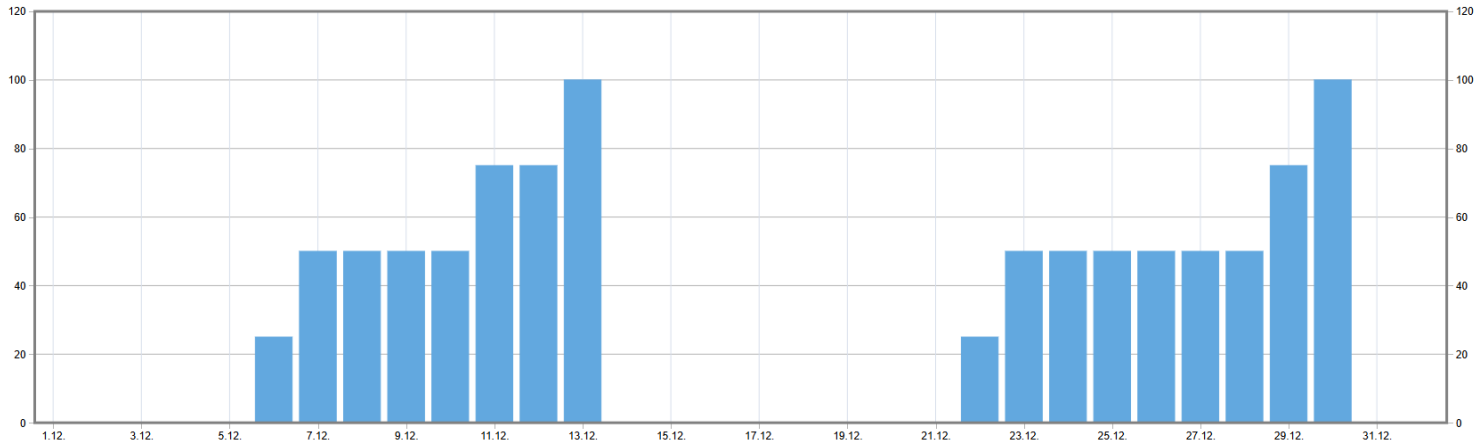
# Ideapark: Background

Ideapark Oulu is a shopping centre opened in 2014, located around nine kilometres north of downtown Oulu. The centre is single-storey and has a total floor area of 23,550 square metres housing around 50 stores. In 2022, Ideapark attracted a record number of 4.2 million visitors.

The shopping centre has seven centralized waste collection areas, equipped with five 20 cubic meter compactors for cardboard and two for mixed waste. Before the implementation of Europress SMART compactors, Ideapark frequently faced situations where emergency waste collections had to be arranged due to full compactors. At the time, there was no way to monitor fill levels or anticipate when the next collection would be needed. These unplanned collections not only incurred considerable costs but also often coincided with weekends or bank holidays, further complicating logistics and disrupting the centre's internal waste management operations.

At the time being there's no API integration with the overall ERP system and ticketing is done manually.




*A screenshot of Europress' SMART dashboard. Cardboard compactor's chart: the fill level becomes visible once it exceeds 25%.*

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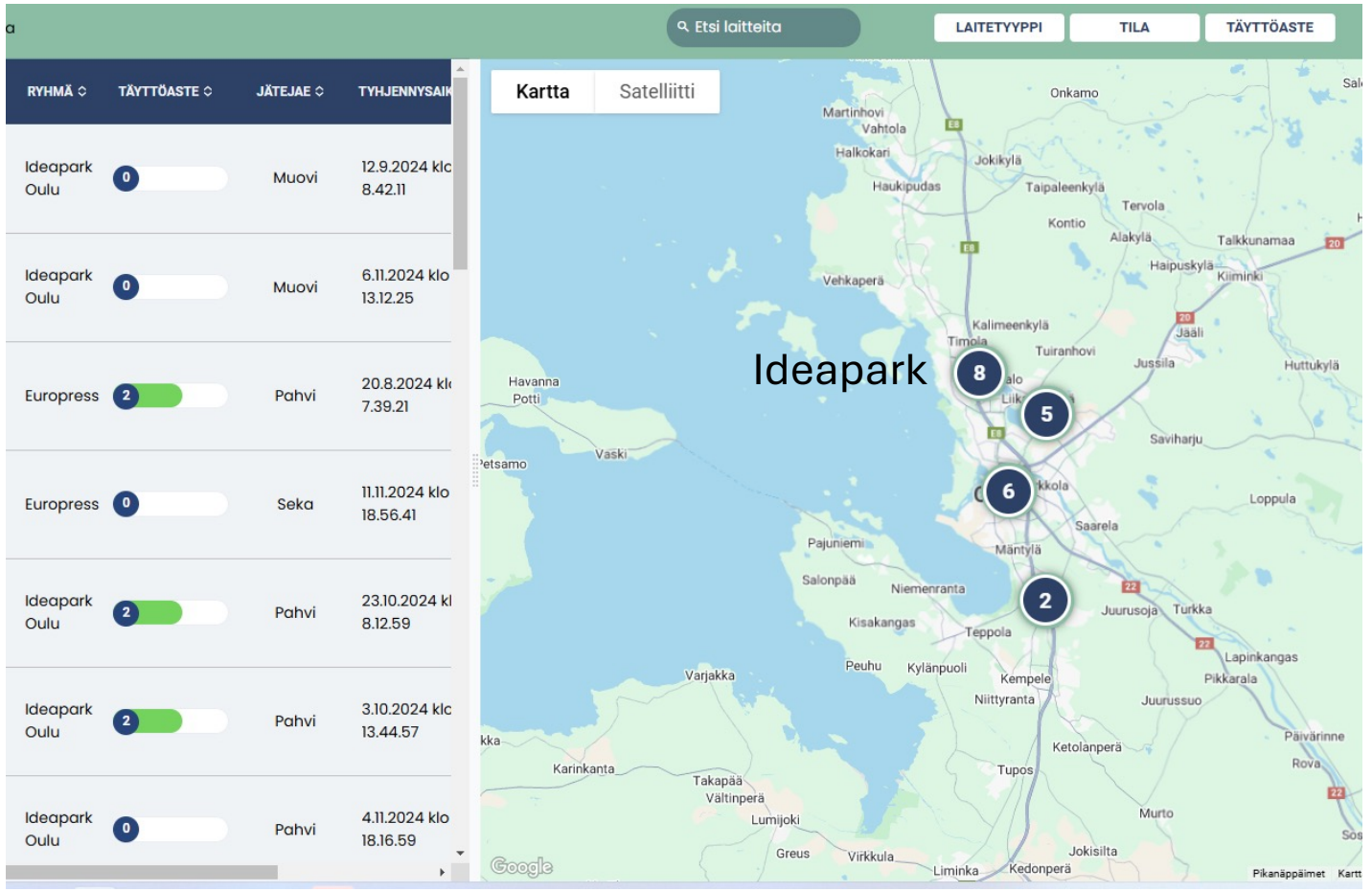
# Ideapark: Optimization

**Optimizing logistics with Smart waste compactors**

The Europress SMART system monitors the fill levels of compactors using a five-step scale.

Hauru can use this real-time data to optimize the logistics of hooklift container operations. For example, when delivering or collecting a roll-off container in the vicinity of Ideapark, the driver can, during the same trip, also pick up a waste compactor, provided its fill level is sufficiently high. This improves efficiency by combining transport tasks and reducing unnecessary trips.

In 2024, the cardboard compactors were emptied 53 times, yielding a total of 140 tonnes of cardboard waste with an average of 2.6 tonnes per load. The mixed waste compactors were emptied 36 times, producing 155 tonnes of mixed waste, averaging 4.3 tonnes per load.




*A screenshot of Europress' SMART dashboard.*

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# Hauru Smart app and User Experience



**Business insight**

Self-service interfaces reduce support load and create flexible service experiences.

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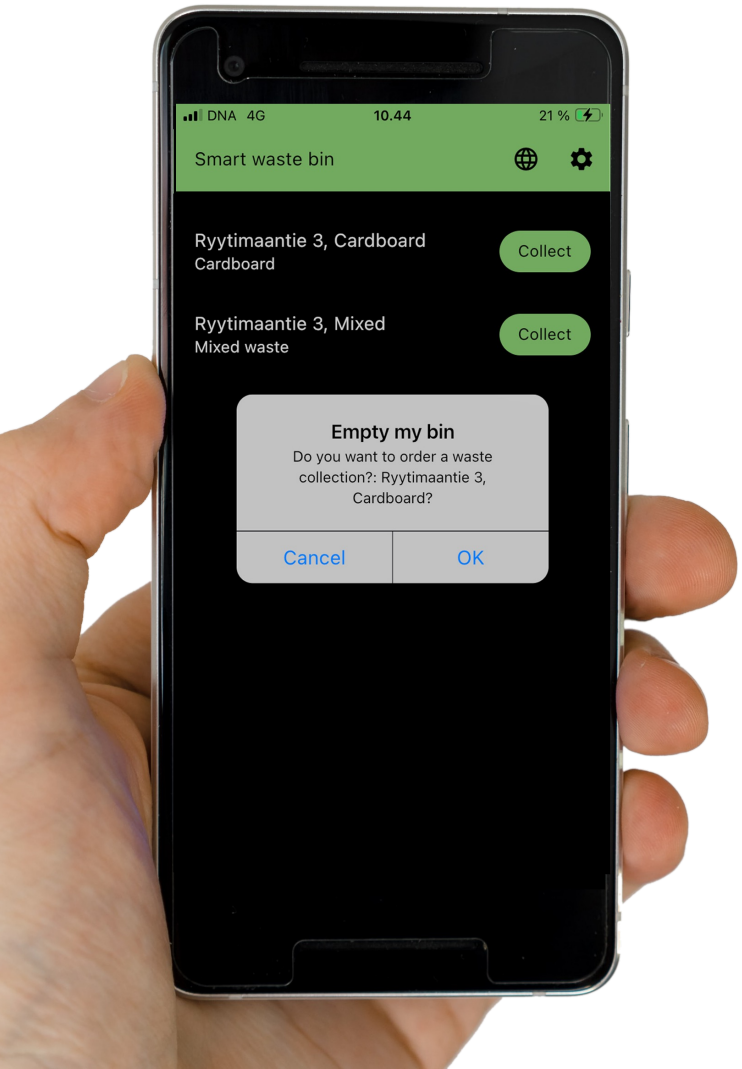
# Collect-On-Demand Service




Fill-level sensors are an excellent solution for monitoring waste levels in large residential complexes, housing cooperatives, and high-volume containers. However, for detached house residents, this technology is often unnecessarily costly. To address this, Hauru together with Wastebook introduced the Smart Waste Bin application in 2022, featuring a collect-on-demand ordering function tailored specifically for private households.

The app eliminates the need for service suspensions during holidays and enables residents to request emptying only when needed, rather than following a fixed collection schedule. This gives users greater flexibility and control over their waste management and costs. The solutions also allows customers to monitor their waste accumulation.

As of 2025, the application has nearly 1,000 users in the Oulu region. When a collection request is submitted via the app, it is sent to a cloud-based system, from which Vingo retrieves the requests once per day. The system then automatically assigns the collection to the next suitable route, ensuring a seamless and efficient user experience without manual planning reducing the burden of customer service.


*Driver interface screenshot from the Vingo system showing which collection points along the route have already been emptied.*

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# Positive User Experience

**Survey participants appreciated following aspects:**

| On-demand | Price | Ease of use |
|---|---|---|
| 60 % | 20 % | 78 % |

**Participant Insights**

48 % of Hauru Smart app users answered the survey

61 % were aged 33-48 years

80 % considered the development of smart waste management very important

**84 %**

Would highly recommend the service

The reception of the application has been highly positive. According to a customer satisfaction survey conducted in 2022, four out of five respondents considered the digitalization of waste management important and stated they would highly likely recommend the service to others.

Detached house residents are not the only user group. The Smart Waste Bin application is also used to place other types of waste collection orders. For instance, some rental housing companies use the app to arrange garden roll-off container emptying and to order the collection of non-standard waste types such as couches or furniture.

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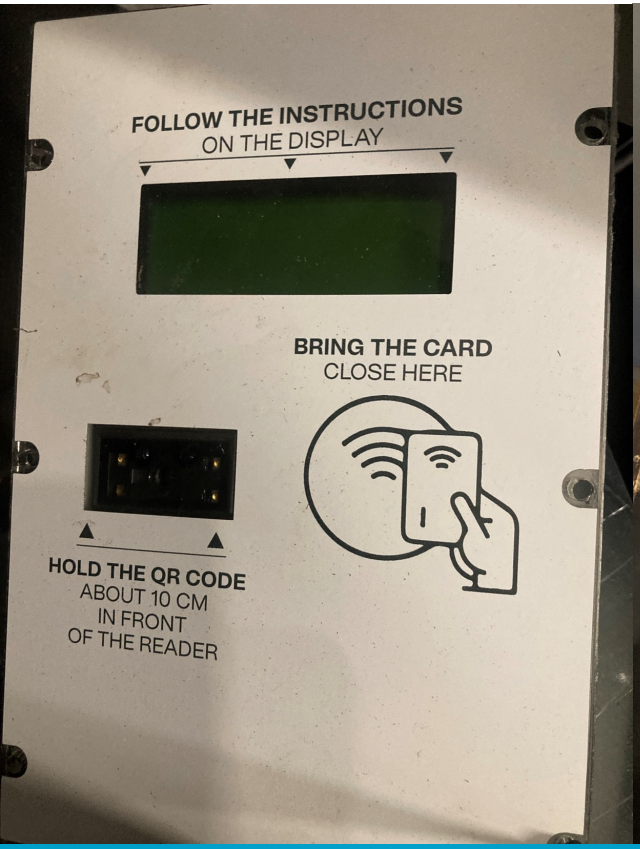
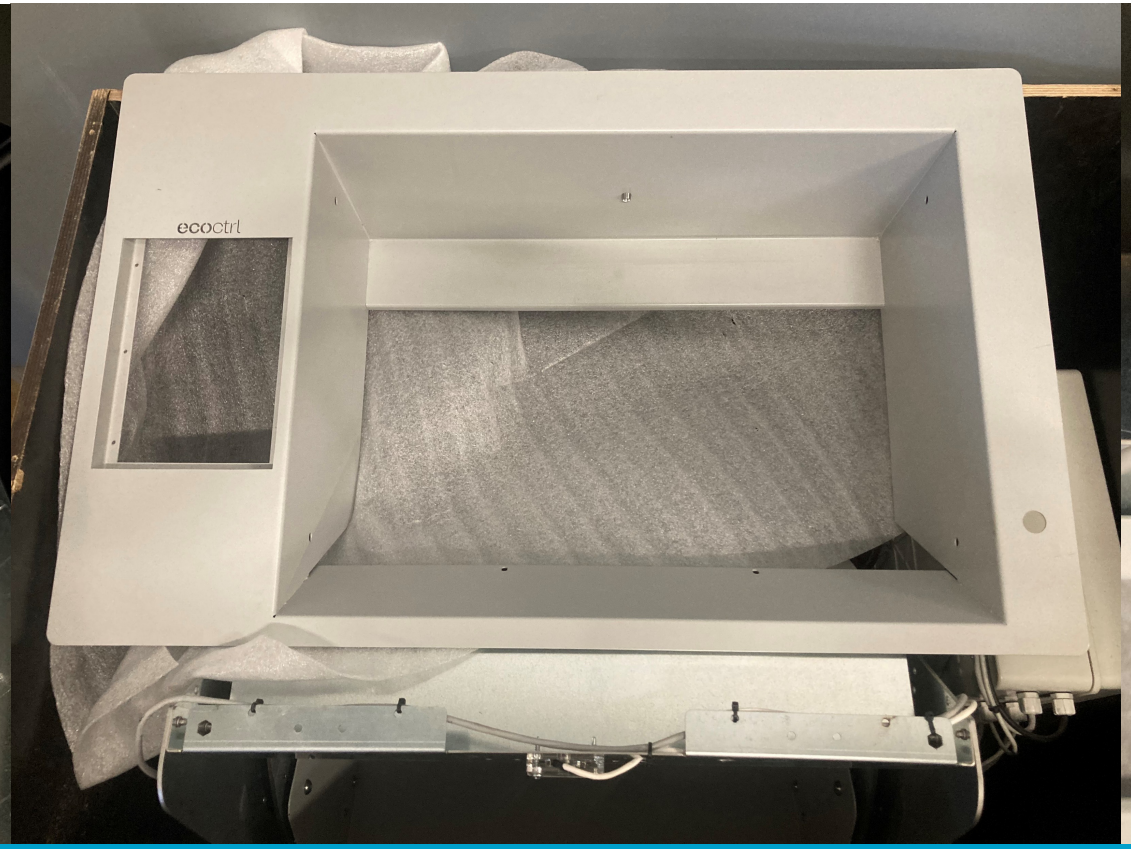
# Pilot Plan: Smart Hatch




**Business insight**

Monetization of waste points + better control = scalable for marina, festival, or resort use. Possible WM solution for cottages and holiday homes.

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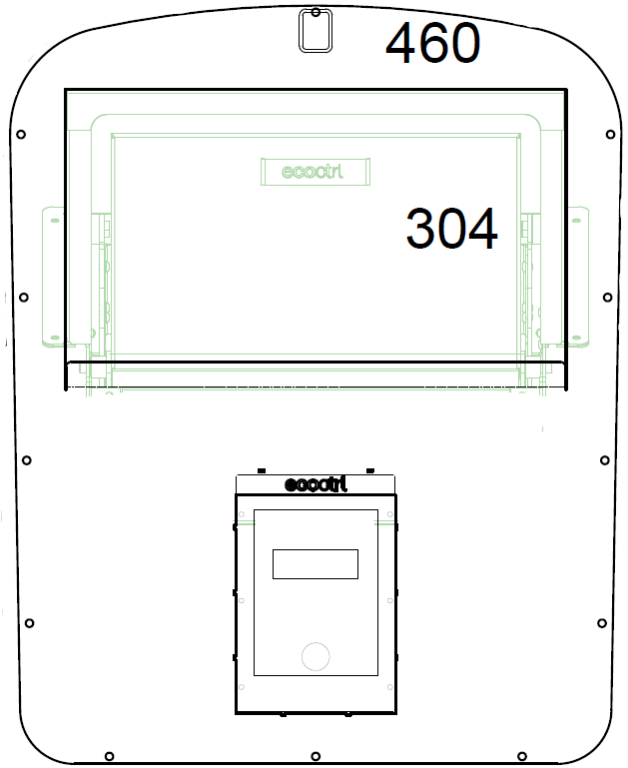
# Pilot Plan: Smart Hatch

**Smart Hatch**
The hatch is a retrofit solution that can be installed on waste containers or directly on waste shelter walls. It enables controlled access and usage monitoring without physical keys.
User identification is handled via a QR code through the Waper mobile app. Access rights can be assigned to predefined user groups or access can be purchased on demand.
All usage data is stored in the cloud service and can be integrated with logistics or billing systems via API, enabling smart, PAYT-based waste management adaptable to various environments and user needs.
The Hatch is a product of an Italian company Ecoctrl specialized in smart waste collection.

**1. Pilot Objective**
The pilot aims to test a smart waste access and tracking system using Smart Hatch, enabling user group–based access control, data-driven collection optimization and a Pay-As-You-Throw (PAYT) model. The goal is to enhance service efficiency, reduce misuse and create scalable digital tools for waste management in seasonal and decentralized areas.




*Technical drawing of a hatch installation compatible with side-mounted containers, such as bell-shaped units.*

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# Pilot Plan: Smart Hatch

## 2. Target Use Cases & Pilot Locations

Target user groups:

boaters, summer cottage owners, seasonal visitors

Proposed pilot locations:

- Harbour or marina waste stations
- Seasonal waste points in cottage areas

Installation surface: directly on waste container or fixed to the wall of a waste shelter

Access method: QR code via Waper mobile app.


*An example of the hatch  mounted on top of a metallic container.*

## 3. Pilot Scope & Duration

- Pilot duration: 3–4 months of operational testing
- Fractions supported: up to 5 waste streams per unit
- System components:
  - Smart hatch with QR-based access
  - Cloud-based usage tracking and access rights system
  - Waper mobile app interface for users
- User types: pre-authorized customers and one-time users (purchase-based access)

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# Pilot Plan: Smart Hatch

## 4. Implementation Phases

### Phase 1: Stakeholder Engagement

- Partner onboarding: Haurun Jäteauto Oy, municipality, Wastebook, local user groups
- Communication materials and onboarding guide for pilot participants

### Phase 2: Installation & Configuration

- Site selection and technical inspection
- Mounting Smart Hatch to shelters or containers
- System configuration for access groups
  (e.g. cottage owners vs. visitors)

### Phase 3: Operation & Data Collection

- Pilot users access the station via QR code (Waper app)
- Data collected: usage frequency, user group, fraction type
- Cloud dashboard for operator visibility and logistics optimization

### Phase 4: Evaluation

- Evaluation of any malfunctions, usability issues, or performance degradation in cold conditions
- End-user feedback survey
- Operational observations: maintenance needs, misuse rate, logistics efficiency


*An example of the hatch mounted on the side of a bell-shaped container*

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# Pilot Plan: Smart Hatch

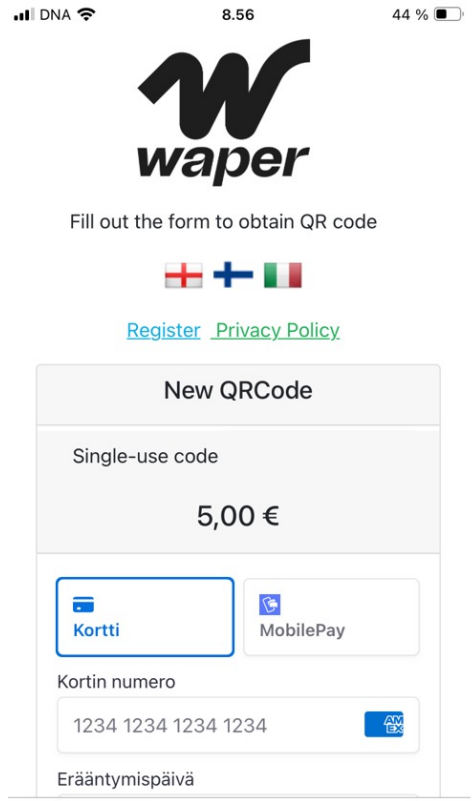
## 5. Success Metrics & Business Model Opportunities

### Key Success Metrics

- Number of registered/paying users
- Usage frequency per waste stream
- Reduction in unauthorized waste usage
- Logistic savings and route efficiency
- Positive end-user feedback

### Business Model Opportunities

- PAYT-based invoicing for occasional users
- Scalable seasonal concept for municipalities
- Differentiated pricing by user group (e.g. residents vs. visitors)
- Platform integration into wider municipal digital services




*A screenshot of how the browser interface for purchasing access to the Smart Hatch would look like.*

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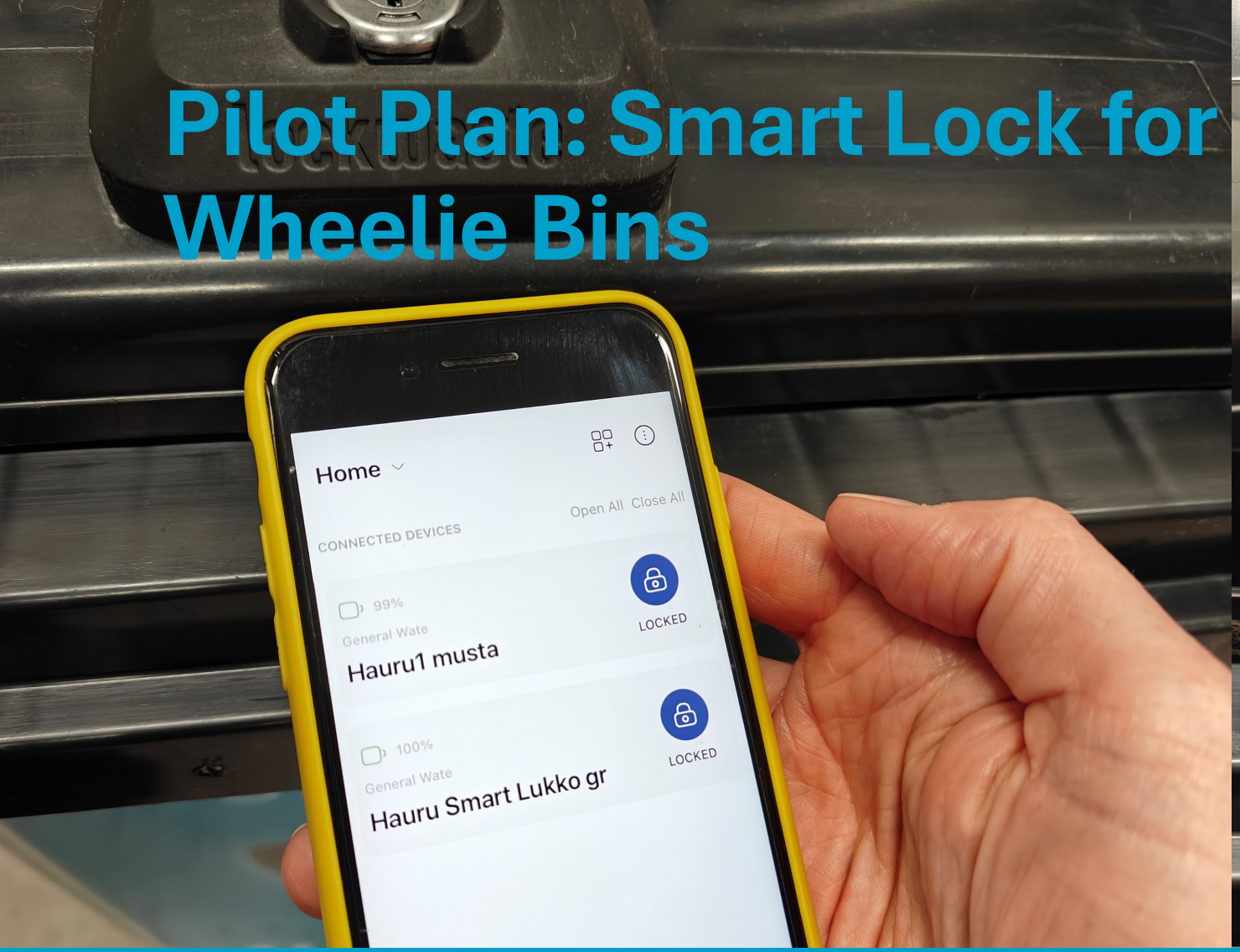
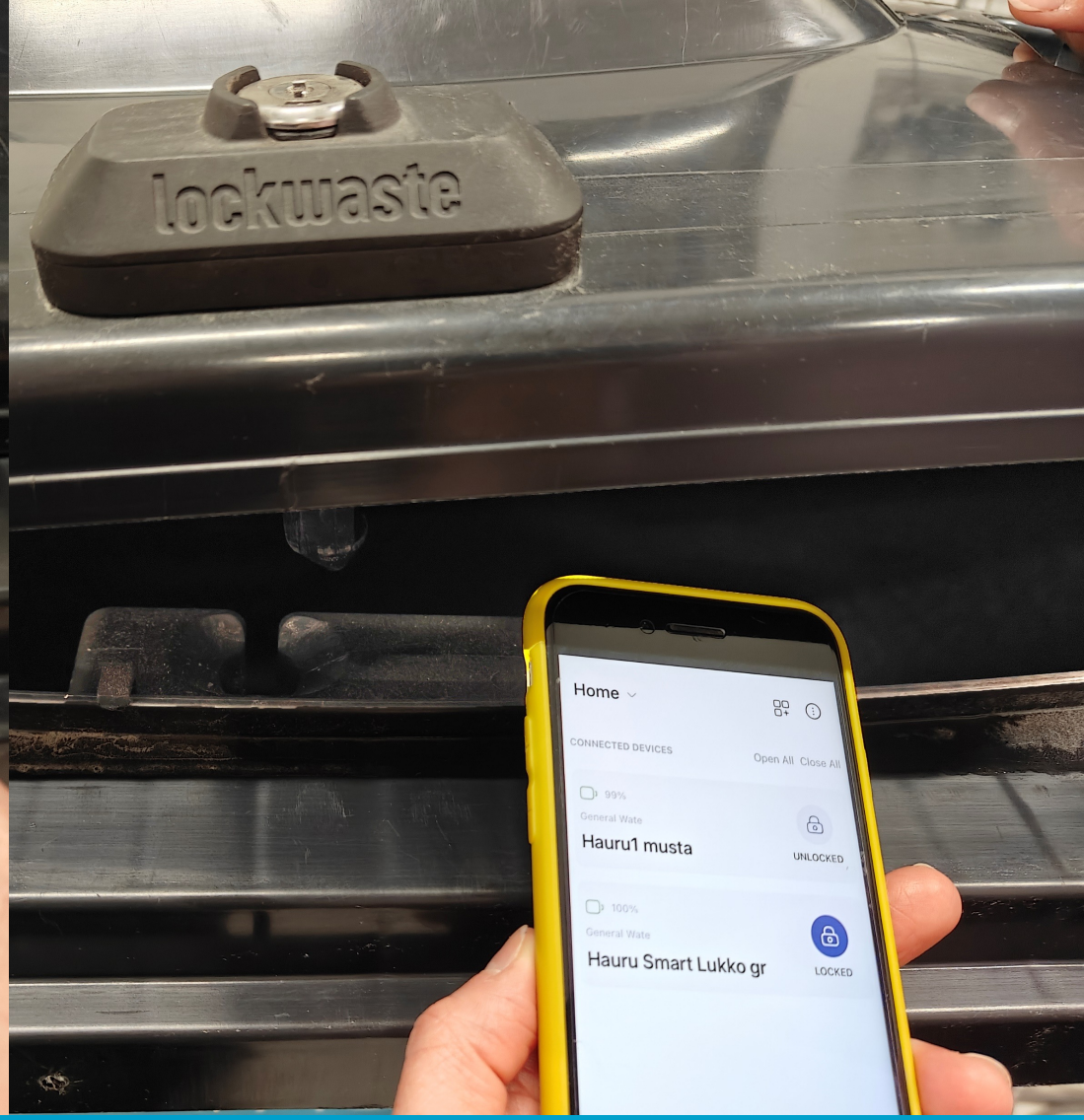
# Pilot Plan: Smart Lock for Wheelie Bins




**Business insight**

Smart locks enable secured waste collection in areas previously exposed to misuse and open new revenue streams improving service transparency.

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# Pilot Plan: Smart Lock for Wheelie Bins


## Smart lock

LockWaste is a smart lock for wheelie bins that prevents unauthorized or accidental opening. The container can be opened via an app, a beacon, or automatically when its position changes to an upside-down orientation corresponding to emptying. The lock is weatherproof and easy to install on standard wheelie bins.

## 1. Pilot Objective

To test the operational, user, and business value of smart lock system in controlled waste collection scenarios. The aim is to prevent unauthorized use of waste containers and to enable pay-per-access or subscription-based waste services in seasonal, remote, or shared environments. In addition, the system will be technically tested in Finland's arctic conditions to evaluate its performance and durability in harsh climate conditions.

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# Pilot Plan: Smart Lock for Wheelie Bins

## 2. Target Use Cases & Pilot Locations

| Use Case | Description | Benefits |
|---|---|---|
| **Detached housing areas** | Shared containers in residential neighborhoods | Limits access, enables cost-sharing between neighbors |
| **Seasonal users / summer cottages** | Individual or shared containers for cottage owners | Supports pay-as-you-use model, reduces collection frequency |
| **Public roadside containers** | Waste bins on public roads or shared access points | Prevents misuse by passersby, improves cleanliness |

## 3. Pilot Scope & Duration

- **Pilot period:** 3–6 months
- **Number of smart locks:** 10–15 units
- **Container types:** 240L / 660L wheeled bins, including “Kimppa” shared bins
- **User groups:**
  - Residents of 3–4 detached house neighborhoods
  - Cottage associations (with 3–10 participating households)
  - Roadside collection points (1–2 publicly visible bins)

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# Pilot Plan: Smart Lock for Wheelie Bins

## 4. Implementation Phases

### Phase 1: Planning & Stakeholder Engagement

- Selection of pilot area and confirmation of participant groups
- Mapping logistics route and current collection volumes
- Defining service model (e.g. subscription, prepaid access)

### Phase 2: Installation & Configuration

- Installation of smart locks on designated containers
- Mobile app access to registered users

### Phase 3: Operation & Data Collection

- Usage monitoring
- Tracking the number of accesses
- Feedback via digital forms or app

### Phase 4: Evaluation

- Assessment of operational impact
- Evaluation of any malfunctions, usability issues, or performance degradation in cold conditions
- User satisfaction analysis and willingness to pay
- Evaluation of the potential to offer full-service packages (e.g. annual access + pickups)

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# Pilot Plan: Smart Lock for Wheelie Bins

## 5. Success metrics

| Category | Metric |
|---|---|
| **Operational** | Reduced unauthorized waste |
| **Customer** | Ease of use (app-based unlocking) |
| | Reported satisfaction and perceived fairness |
| **Financial** | Feasibility of access-based pricing |
| | Potential to bundle into seasonal service packages |

## 6. Business Model Opportunities

- Annual access fee for registered users (includes basic pickup quota)
- Prepaid usage credits (pay-as-you-go model)
- Bundled service: Lock + container + pick-ups with Smart service via Smart Waste Bin app
- Differentiation in tenders or municipal partnerships as a secure and digital service model

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# Hauru Smart Ecosystem Summary

| Category | Name / Product | Function | Integration / Data Flow | Use Case or Pilot Context |
|---|---|---|---|---|
| **ERP & Core System** | **Vingo** | Route optimization, CRM, invoicing, reporting | API interfaces with sensors & apps | Backbone of logistics and collect-on-demand workflows |
| **Monitoring Platform** | **Europress SMART** | Real-time monitoring of compactor fill levels | No direct API with Vingo (manual ticketing) | Used at Ideapark for cardboard and mixed waste |
| **Fill-level sensor 1** | **Jaete 4G Fill-Level Sensor** | Fill level monitoring of septic tanks (basic version) | Signal issues with cast iron lids | Oulun Golf (initial deployment in every tank) |
| **Fill-level sensor 2** | **Aistin 4G Sensor with External Antenna** | Improved signal transmission through metal lids | Better reliability in challenging placements | Oulun Golf (installed spring 2025 in some tanks) |
| **Fill-level sensor 3** | **Aistin LoRa Fill-Level Sensor** | Sensor uses LoRaWAN network | Reliable in weak 4G/NB-IoT areas | Oulun Golf (low-coverage areas) |
| **Mobile App** | **Hauru Smart App** | Collect-on-demand orders, service feedback | Connects to Vingo cloud once/day | 1,000+ users in Oulu (detached houses, housing companies) |
| **Mobile App** | **Waper App** | QR code-based access control | Connected to Ecoisola cloud system | Used with Smart Hatch and Smart Lock pilots |
| **Pilot Product** | **Smart Hatch** | Controlled access lid for containers or shelters | Integrated with Waper, connected to Ecoisola cloud system | Planned pilot in marinas, cottage villages or public drop-off pts |
| **Pilot Product (bundle with existing app)** | **Smart Lock** | Smart lock system for wheelie bins, possibility to bundle with Smart Waste Bin Smart pick-ups | App/beacon-based unlocking and locking, automated trigger | Planned pilot in residential or seasonal shared bin settings |

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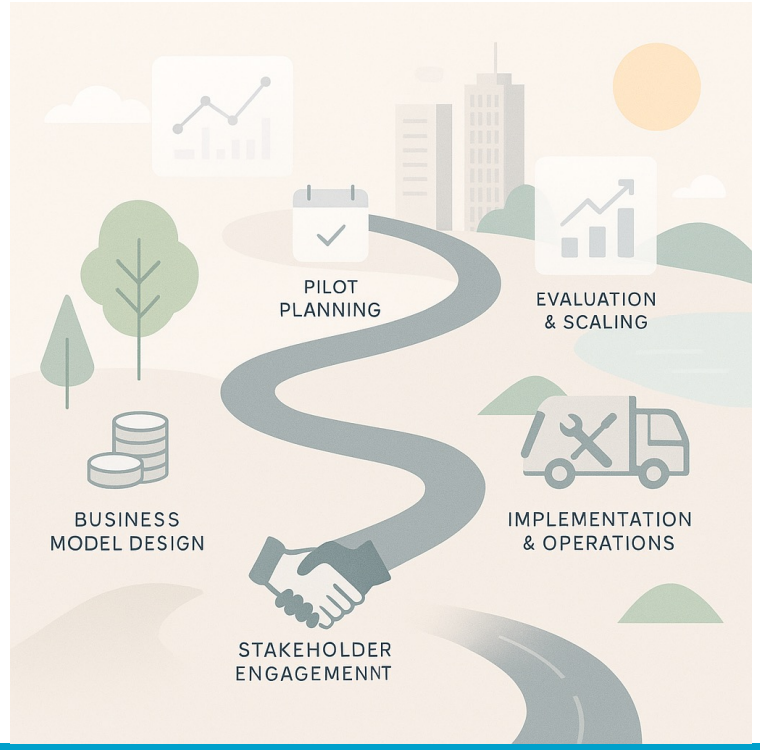
# From Pilots to Impact: Roadmap for Smart Waste Innovation




Based on its own piloting experiences, Haurun Jäteauto Oy has compiled a strategic roadmap for testing and scaling smart waste innovations.

This roadmap outlines a phased approach to implementing new digital solutions from identifying needs and launching pilots to full-scale deployment, and long-term service development.

This structured model helps guide future innovation projects. The roadmap reflects both lessons learned and the company's ambition to be in the forefront of waste management's digitalization and lead sustainable transformation in the waste sector.

**Business insight**
A concrete, tested roadmap for delivering measurable ESG value through innovation.

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# Roadmap: From Pilots to Scalable Impact

**Goal**
Identify high-impact areas for smart solutions in waste management.

**Phase 1: Insight & Ideation**

- Map operational pain points
  (e.g. overflow, low fill rates, missed pickups).
- Identify ESG goals
  (e.g. reduce emissions).
- Benchmark smart technologies
  (sensors, mobile apps, lock systems).
- Define potential pilot cases: seasonal, remote, or unpredictable waste flows.

**ESG Value**
Aligns innovation with environmental goals from the outset.

# Roadmap: From Pilots to Scalable Impact

**Goal**
Prove the technical and operational viability in real-world conditions.

**Phase 2: Pilot & Validate**

- Deploy pilots (e.g. Oulun Golf, Ideapark, SWB users).
- Collect data: fill levels, usage frequency, customer feedback.
- Assess reduction in fuel use, trip frequency, service complaints.
- Refine technology setup
  (API integrations, UI/UX, maintenance alerts).

**ESG Value**
Demonstrates measurable E (Environmental) gains ($CO_2$ reduction, waste prevention).

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# Roadmap: From Pilots to Scalable Impact

**Goal**
Move from pilot to portfolio-wide implementation.

**Phase 3: Scale & Optimize**

- Identify scalable site types: marinas, summer housing areas, industrial parks.
- Expand integration with logistics systems (e.g., route optimization).
- Enable PAYT (Pay-As-You-Throw) and demand-based billing models.
- Leverage automation to reduce manual error and labor intensity.

**ESG Value**
Enables systematic emission reduction through smarter routing.

# Roadmap: From Pilots to Scalable Impact

**Goal**
Embed ESG monitoring and transparency into operations.

**Phase 4: Monitor & Report**

- Implement dashboards for waste volume, fill-level efficiency, and route data.
- Track customer satisfaction (e.g., Net Promoter Score).
- Produce ESG-aligned reports (e.g., GHG reduction, digital service accessibility).
- Use data in sustainability reporting (e.g., CSRD, GRI).

**ESG Value**
Strong G (Governance) foundation via data-driven reporting and transparency.

# Roadmap: From Pilots to Scalable Impact

**Goal**
Position as a national leader in smart circular waste logistics.

**Phase 5: Innovate & Lead**

- Develop new services (e.g., subscription-based smart access, predictive maintenance).
- Partner with municipalities and companies on regional ESG goals.
- Influence regulatory and sectoral standards through pilot results.
- Publish case studies and best practices.

**ESG Value**
Drives systemic ESG transformation across the sector.
Demonstrates leadership and innovation aligned with EU climate and digital goals.

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