Smart DRS Playbook

Including comprehensive results from most recent projects

Smart DRS

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23 U.S. Steel Košice Production Plant

Letter from the CSO

DRS for every country

sDRS stands for Smart DRS or Smart Deposit Return System, where "S" signifies "Smart". This approach brings smartness to the traditional DRS, which has been present for many years and has worked very well. However, technology has now reached a status that allows for a completely new approach to make the whole system much more efficient, fraud-resistant, and affordable. This is why it's smart – it's a logical step in DRS evolution that is happening right now.

The beginning of new era

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Future is Smart

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Vincze

Tomas Vincze, CSO

Challenges of DRS

GENERAL

How does it work?

Smart DRS is based on three smart ideas:

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Challenges of DRS

Beverage Producers	DRS Operators	Consumers	Retail

- Industry fee
- Production cost
- Clean material availability
- Tethered caps

- High investment in counting centers
- Fraud
- Unprecise data

- Uncompressed container
- Air storing and transporting
- Long queues

- High investment in RVMs
- Limited space for RVMs
- Fault ratio of RVMs
- Employees' overload
- Customer satisfaction

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High fees

Financing the DRS operation and Implementation

The biggest challenge of Deposit Return Scheme for Beverage Producers

Cost of RVMs purchase
- directly (capex)
- indirectly (through handling fee)

Cost of RVMs day-to-day operation
- maintenance
- quick-fixing
- cleaning
- SW licenses and more

Cost of fraud and
fraud prevention measures
Cost of counting centers
Cost of logistics
Cost of plastic bags

3 Pillars

AI powered recognition of the material handover

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Unique Identification Code	Smart Production Line	Smart Collection Point

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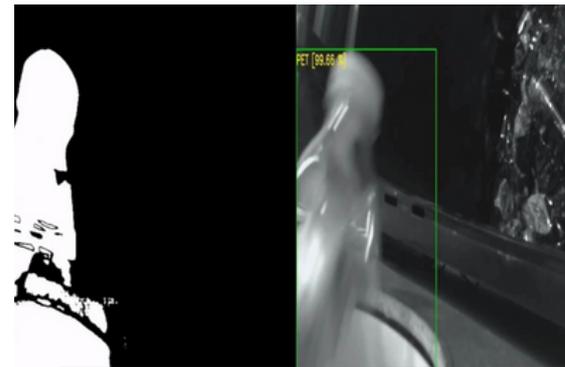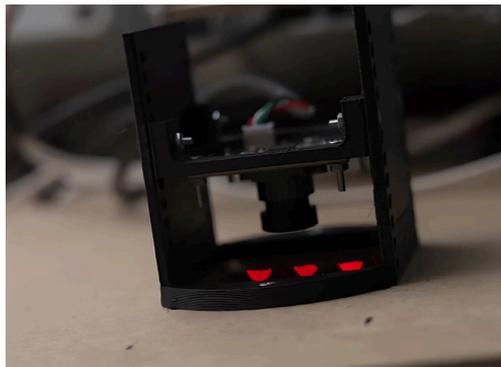
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Deployments

23k+ beverage containers returned at 2 of the largest beverage producers in CEE

First return system for Tetra Pak in the world as schools in Singapore recycle with Smart DRS

One of the largest employers in the CEEE region is using the Smart DRS within its closed plant environment 100K+ returns monthly

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Strengths

- **Significantly lower fees**

- **No national EANs**

- **Automated reporting**

- **Full traceability**

- **Ultimate fraud prevention**

- **Warehouse optimization**

- **Accepting crushed bottles**

- **Supporting Back-to-Retail model**

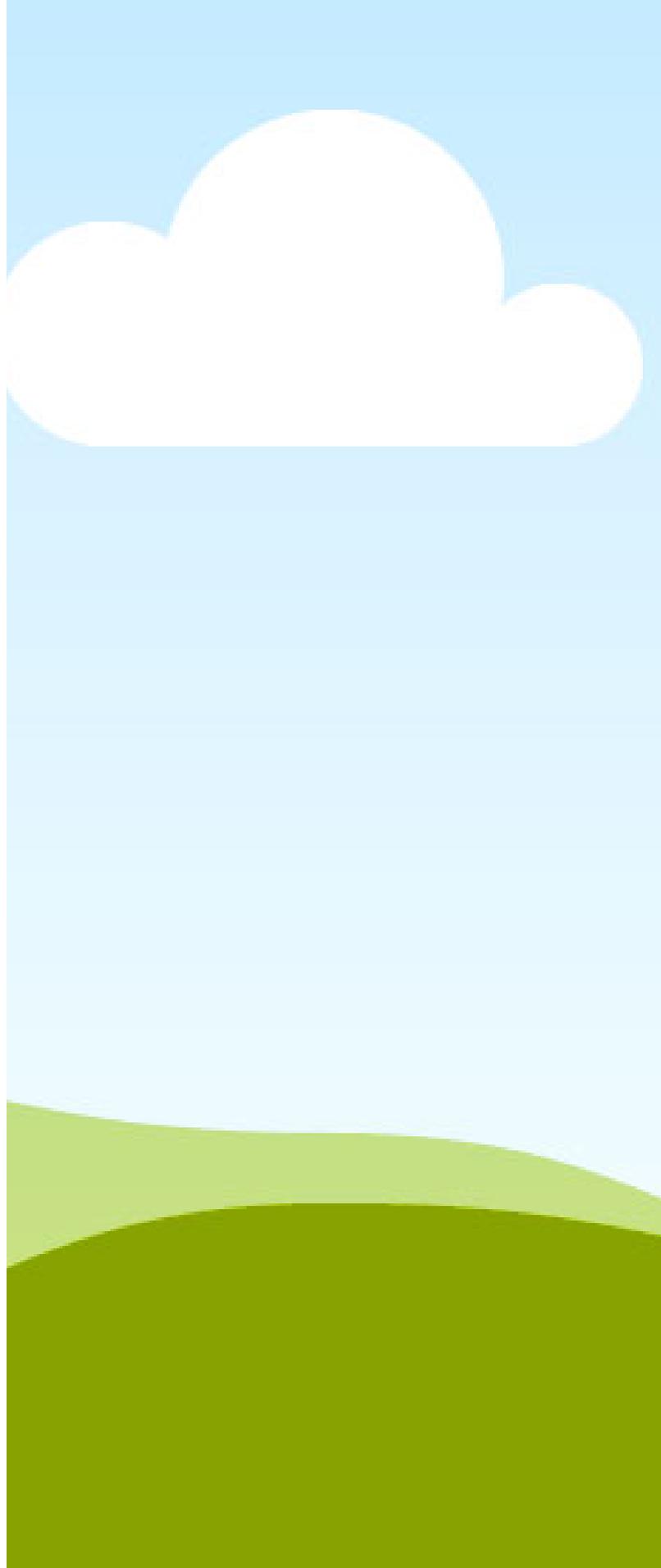- **Faster and more convenient returns**

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No national EANs

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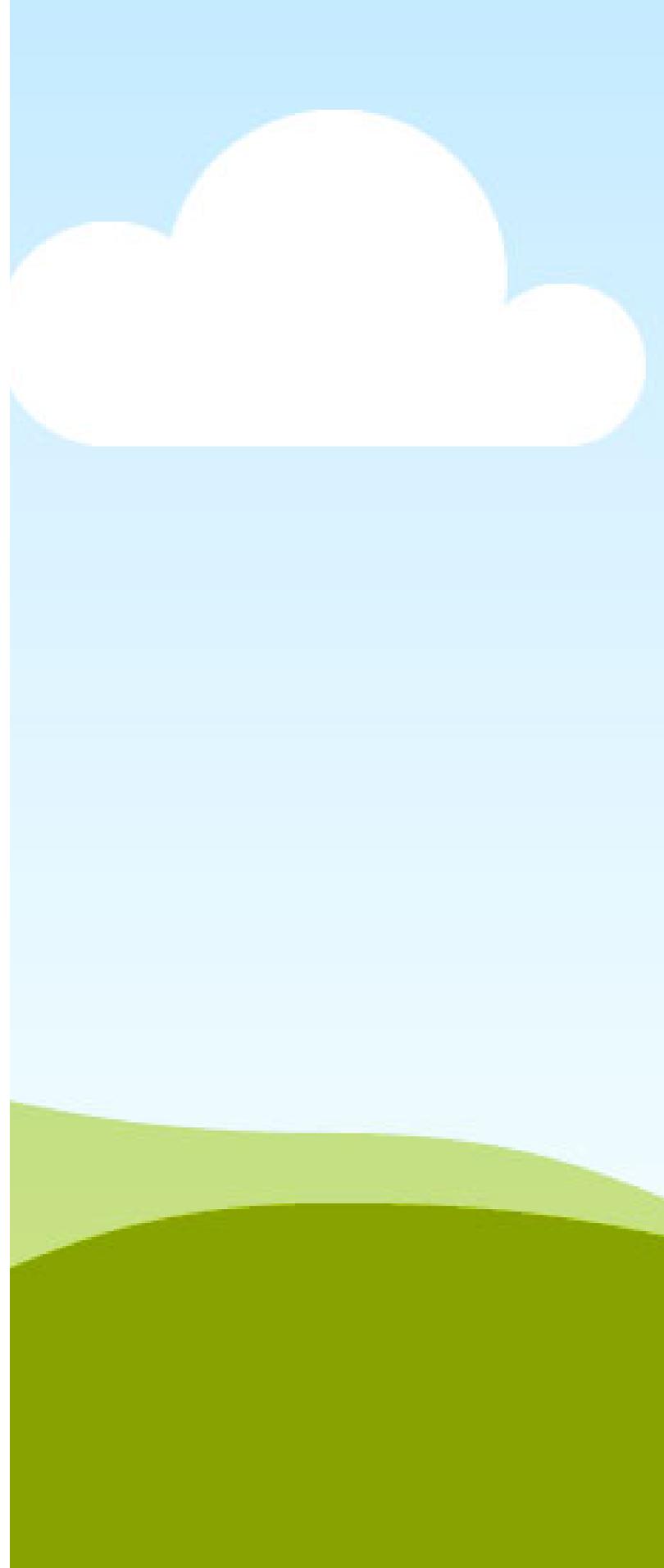
Automated reporting

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Full traceability

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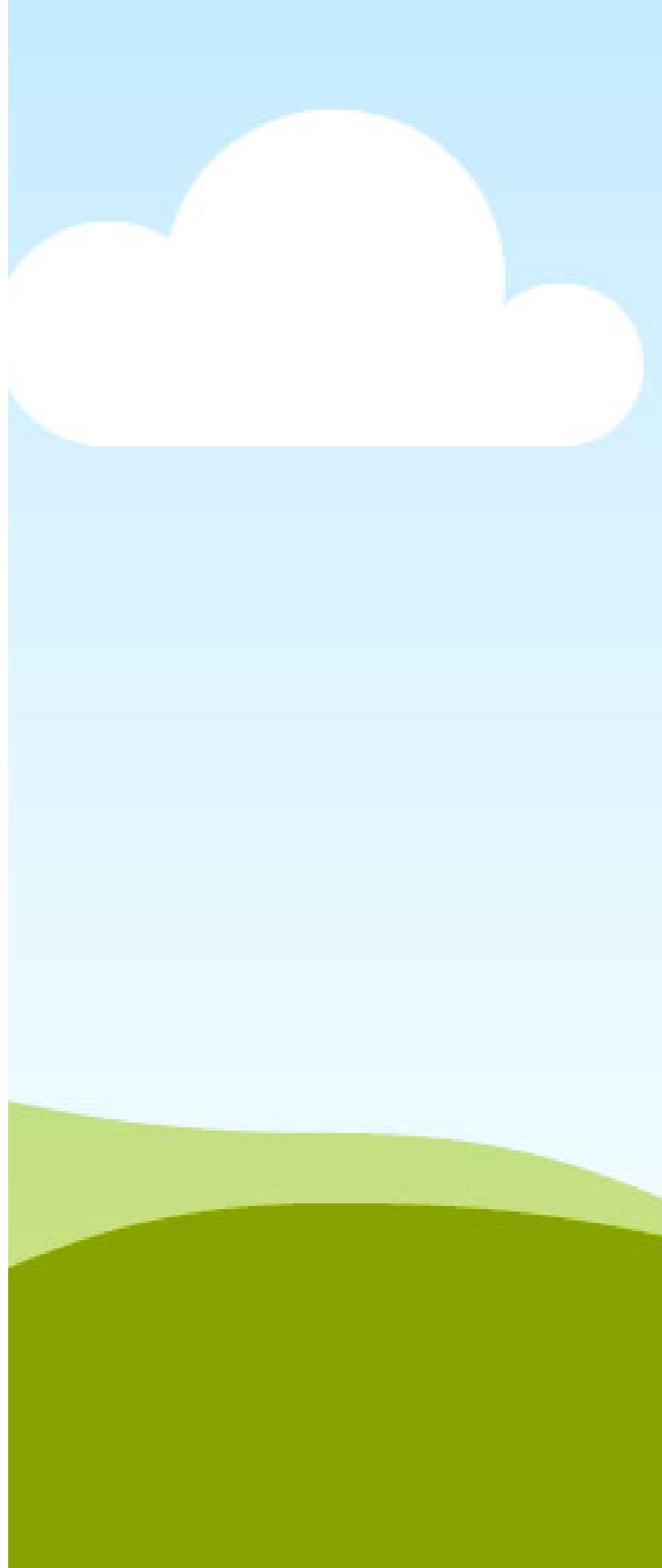
Ultimate fraud prevention

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Warehouse optimization

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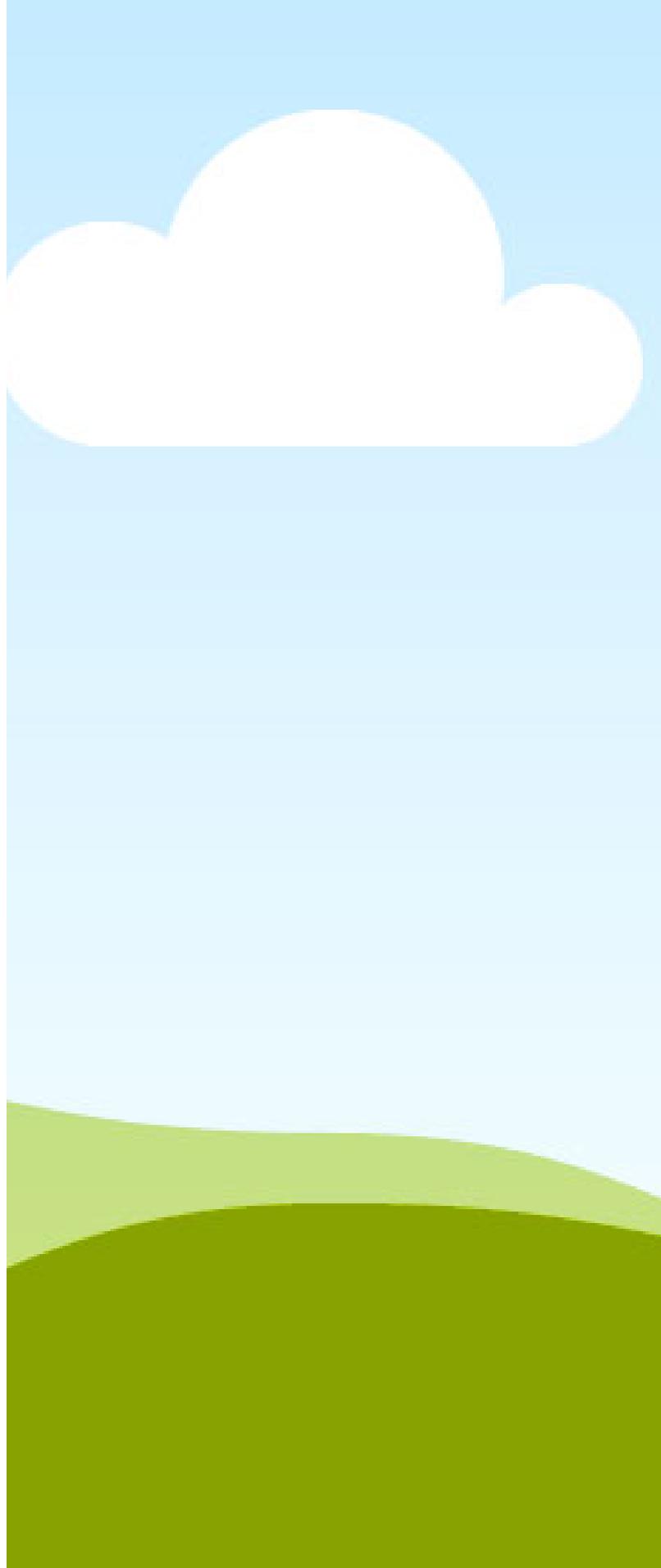
Accepting crushed bottles

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Supporting Back-to-Retail model

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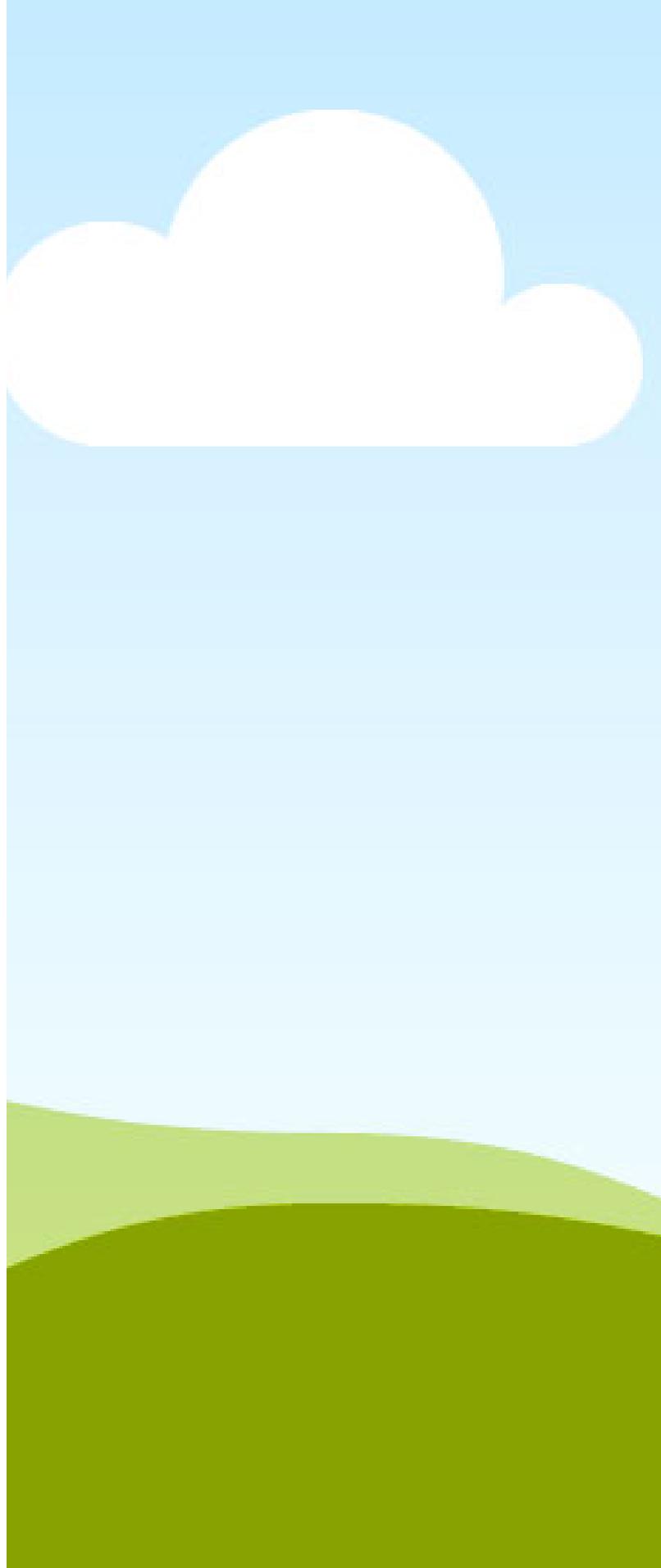
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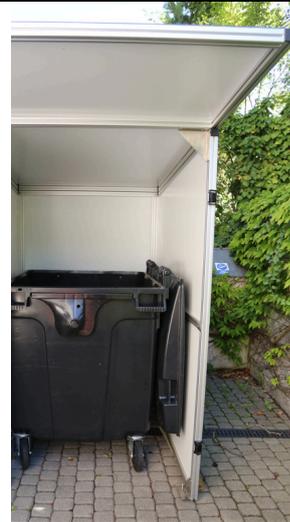
Evolution of how we return bottles and cans

Smart DRS

In Practice

Real-life deployment of the solution | Smart Production Line

In Practice

In Practice

drink
squeeze
scan
return
repeat

Process of return

SHOP FLOOR   BACK ROOM

Tablet

Code scanner

Voucher printer

Collection
smart gate

Smart Gate

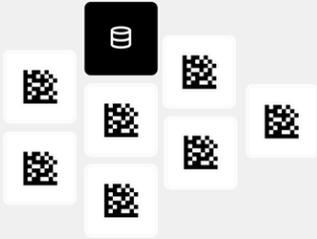Light Tunnel
(AI powered
handover
recognition)
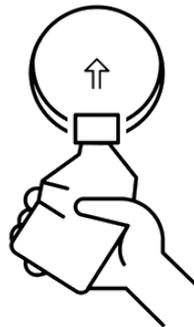
Collection bag,
Wheelie bin
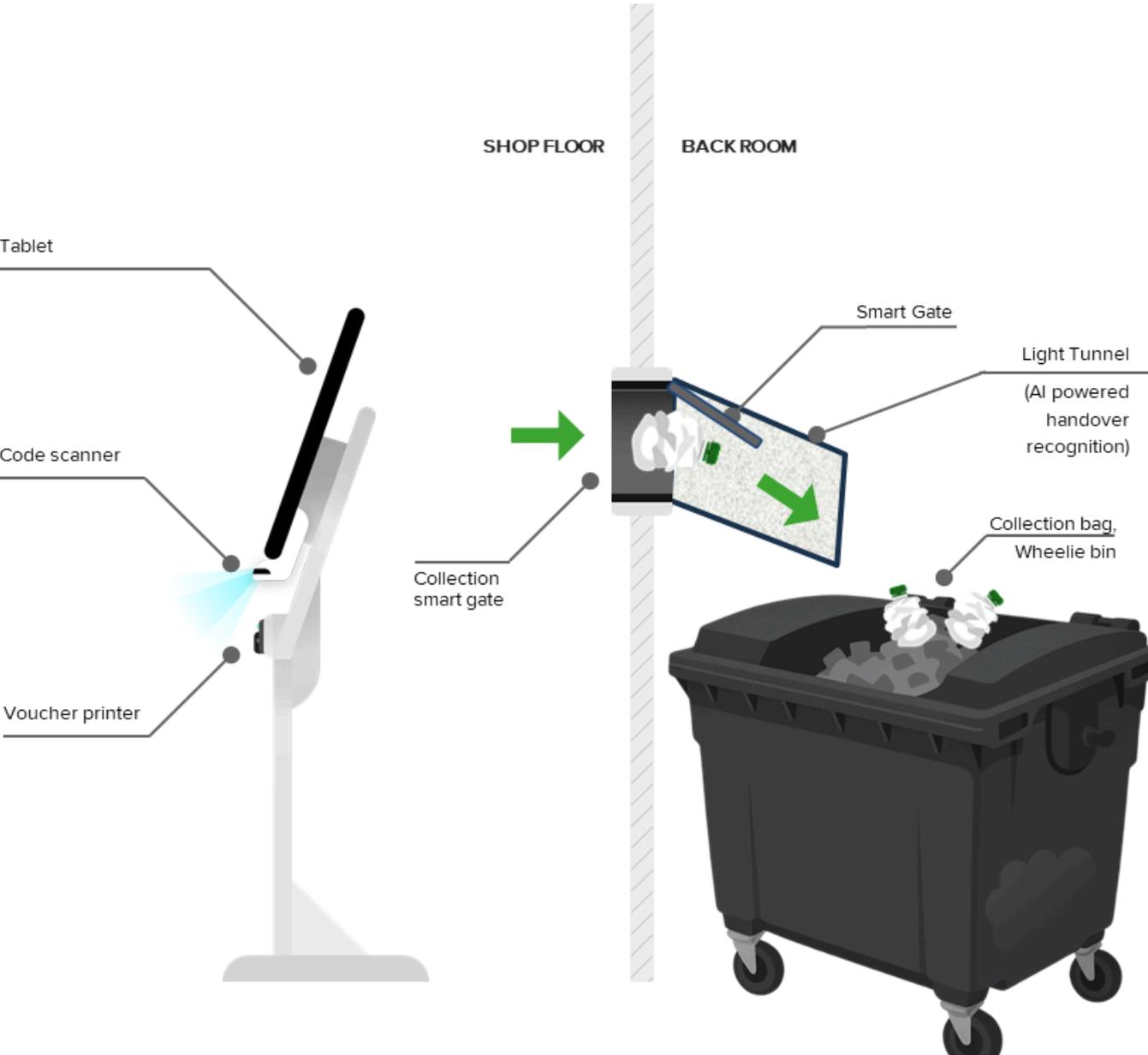
Production process

Step 1
Production and Packaging

Get ID batch

Cap and lid producers electronically obtain large batches of random unique IDs from the **ID Authority**, settled and managed by **Producers** (Sensoneo can provide an on-premise system for ID management).

Step 2
Production and Packaging

Laser the UIDs

Cap and lid producers produce the caps and lids with unique IDs in batches per **beverage producer order.**

Step 3
Production and Packaging

Fill the drink and close

Beverage producers produce the beverages **as usual** with the use of pre-printed caps and lids.

Step 4
Production and Packaging

Read the UIDs

An array of high-speed cameras reads the container's **unique code** during multipacking.

Step 5
Production and Packaging

Multipacking

Every multi-package gets an **internal producer logistics code,** which links the batch of unique IDs in the packaging with it in the internal system (Sensoneo can provide an on-premise system for ID management)

Step 6
Production and Packaging

Palletizing

Every pallet gets an internal producer logistics code, which links the batch of multi-package codes with it in the internal system (Sensoneo can provide an on-premise system for ID management).

Packaging & Logistics

Step 1
Logistics

Transport order

The pallet or multipack is requested to be unloaded from the warehouse based on a **sales order** from the central warehouse for the **specific country.**

Step 2
Logistics

Loading and transport

The warehouse worker scans the pallet code and unloads the pallet onto the truck.

Step 3
Logistics

Goods receiving

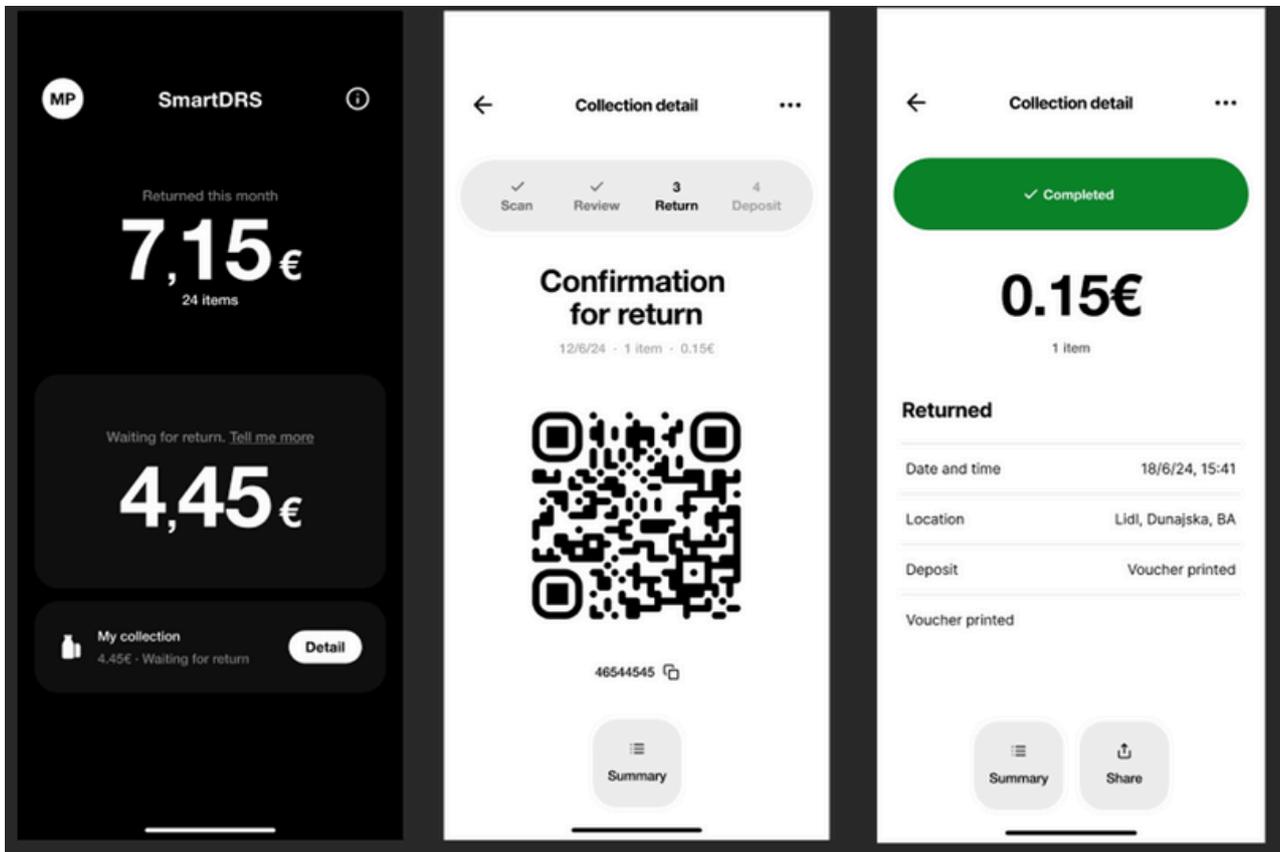The pallet code is scanned.

Producer IT adoption

Step 4
Logistics

UIDs activation

Country Assignment and Volume Placement Report. If the products were shipped to the retailer, the UIDs will be activated and assigned to the country of the retailer, and an automatic Volume Placement Report will be sent to the local DRS operator.

Consumer App with instant payment

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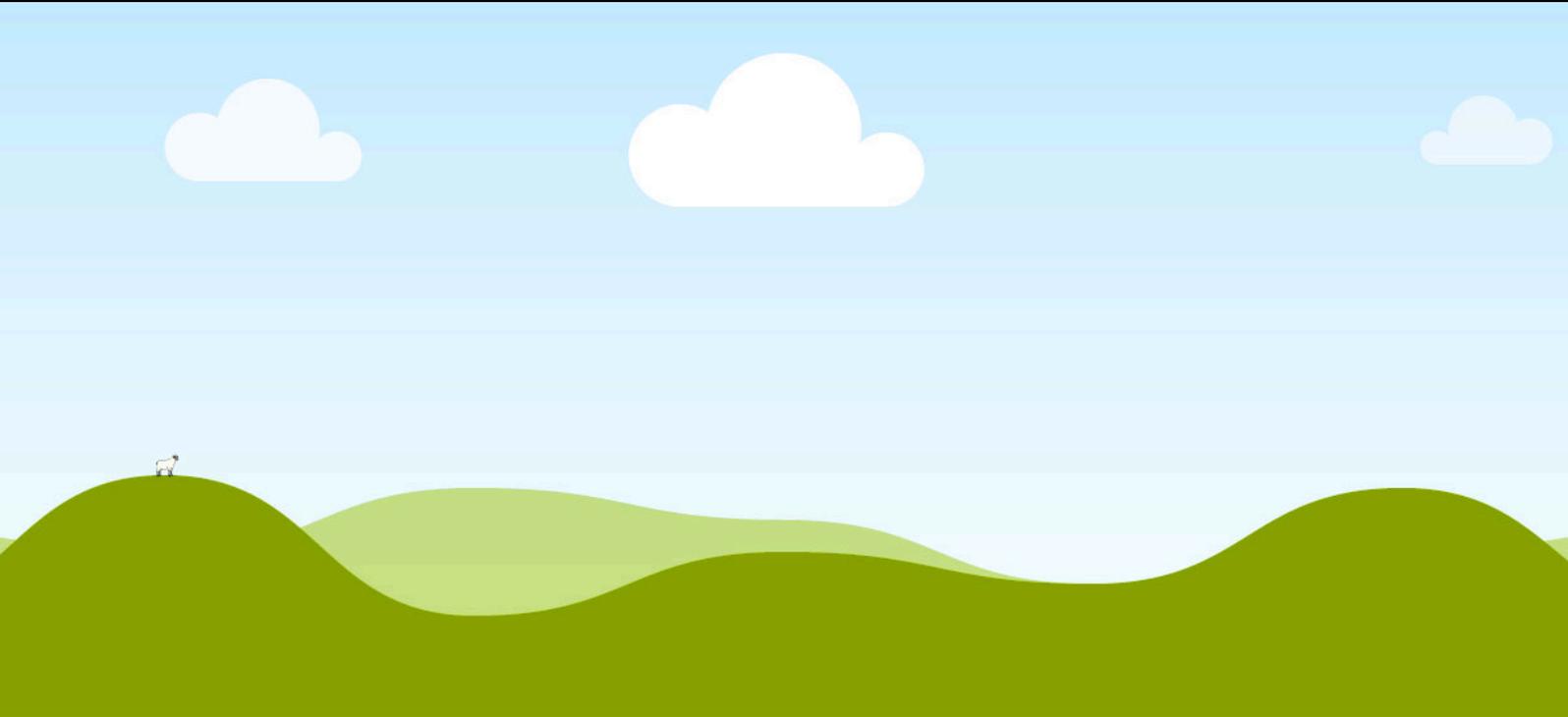
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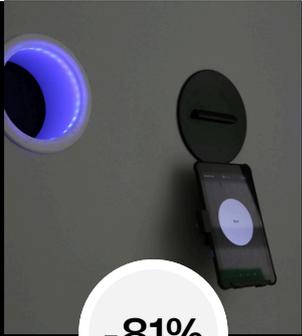
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Results

-81%

Purchase or lease costs
Compared to RVMs

-41%

Operational costs
Compared to RVMs

-50%

Time of the return process
Compared to RVMs
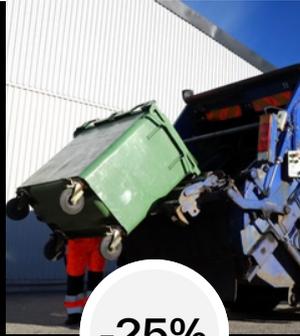
-25%

Staff workload
Compared to RVMs

-39%

Lower costs for
Industry Fee
Compared to
traditional DRS

-48%

Lower costs for
Handling Fee
sDRS compared to
traditional DRS

-26%

Lower costs for
Logistics
sDRS compared to
traditional DRS

-100%

Lower costs for
Counting Centers
sDRS compared to
traditional DRS

-100%

Lower costs for
Plastic Bags
sDRS compared to
traditional DRS

-100%

Lower costs for
National EAN
sDRS compared to
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-100%

Lower costs for
Fraud
sDRS compared to
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FAQs

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What are the biggest benefits?

Key benefits include up to 2× faster returns, 51% lower investment costs compared to traditional DRS, and 100% fraud elimination.

Benefits for stakeholders:

- Producers: Lower industry fees, no national EANs, automated reporting, full traceability.
- DRS Operators: Fraud-proof system, no counting centers, lower handling costs, more accurate data.
- Retailers: Minimal setup, less staff effort, more shop floor space.
- Consumers: Crushed containers accepted, no storage or transport of air, no false rejections, faster and easier returns.

FAQs

GENERAL

Why 2D codes instead of existing barcodes or QR codes?

2D codes offer higher data density, allowing up to 10^24 combinations, enabling unique codes for over 300 planets producing as many beverage containers as produced worldwide today. They also feature superior self-correction algorithms, ensuring readability even if the code is partially damaged. 2D codes are read faster than QR codes and provide ultimate fraud prevention through traceability throughout the container lifecycle. Additionally, they allow offline prefabrication of caps and lids.

How can the system detect if a different object or just a cap is thrown in without the bottle?

An HD camera with infrared reading, powered by AI, is placed in the backroom of the Smart Collection Point. It monitors the bottle handover, as well as analyzes, and collects data about the fullness of collection bags or bins.

Are all color types of caps and aluminum cans supported?

Currently, eight cap colors are fully supported, which scanners can read without issues. Smart DRS is continuously innovating, experimenting with lighting and wave interactions to enhance compatibility.

Is there still a need for a tethered cap with sDRS?

No. The cap itself is the key to deposit redemption in Smart DRS, maximizing consumer motivation to return bottles with caps.

What about compacting the beverage containers? Isn't the collection point filling up too quickly without a compacting system?

Consumers are well used to compacting bottles, and Smart DRS encourages this behavior. Statistical data shows that consumer-initiated compaction matches the volume handled by the most used compacting RVMs. Compactors for standalone collection points are currently under development, designed to be lean and efficient, with a bin capacity of approximately 360 liters. For larger collection points, a solution is being developed as well, but the containers in 1100 liters bins can be easily managed by waste collection vehicles with compaction capabilities.

How does sDRS address contamination?

Contamination is a critical issue that Smart DRS actively combats. Traditional RVMs allow any item to be placed inside, leading to contamination. Smart DRS employs Smart Gates that only open for eligible codes and AI cameras that recognize unusual objects. Retail employees receive immediate notifications with images to verify and address any issues, significantly reducing contamination compared to traditional RVMs.

FAQs

GENERAL

How is HoReCa handled?

Entities from the HoReCa sector can be easily registered and integrated with retailers, as in the traditional model. However, the key difference and benefit is that, with financially affordable collection points, hotels or restaurants can set up their own Smart Collection Points, making the return process fast and convenient for consumers.

Is sDRS compatible with curbside collection?

Yes, curbside and door-to-door collection is supported. Some countries prefer to maintain this model, when bottles and cans are placed in bags on the street. Containers cannot be compressed, as they must be sent to the counting center; otherwise, the deposit cannot be redeemed. Smart DRS also supports this system, but its disadvantage is that containers cannot be compressed and counting centers are required. You can combine this model with back-to-retail collection points or continue with curbside collection. This is a win-win situation for everyone, as waste collectors will still have enough business opportunities.

CANS

Does the system also support cans?

Yes, Smart DRS fully supports the return of aluminum cans.

Where is the UCID placed on the can?

The UCID can be placed either on the tab of the can or next to it, on the lid surface.

GLASS

What about glass?

Glass containers remain compatible with existing crate-based collection process, requiring only light integration with the central DRS system.

How is UCID placed on single use glass bottles?

As the caps are removed in the stream of single-use glass beverages, the only possible way to ensure that each bottle has its own unique identification code is to place it on the label.

FAQs

REFILLABLES

What about refillables?

Refillables follow the same process as one-way containers, with caps removed during cleaning and inspection.

DIFFERENCE TO TRADITIONAL DRS

What is the main competitive advantage compared to traditional DRS with RVMs?

- Price: SCPs use standard, market-available components, costing from hundreds to low thousands of euros per unit, compared to RVMs, which range from €10k to €100k.

- Space: SCPs require approximately 1-2.5m², while RVMs need 2-10m².

- Fraud Resistance: sDRS is 100% fraud-resistant with unique Data Matrix codes, unlike RVMs and EANs, which are vulnerable to fraud.

- Contamination: Smart Gates and AI visual inspections minimize contamination compared to traditional RVMs.

- Container Compression: sDRS allows container compression, eliminating the need for counting centers.

- Bags/Bins: SCPs use significantly less bag volume and are compatible with standard waste bins, enhancing ease of handling.

- Service and Maintenance: SCPs consist of proven, simple components that can be easily serviced remotely, unlike complex RVMs requiring specialized maintenance.

- Cap Production: Allows pre-production of caps and lids offline, enhancing flexibility.

What are the full costs of Smart DRS compared to Traditional DRS?

Calculations based on real data from a country with an implemented DRS show that the overall savings of Smart DRS compared to the traditional model exceed 50%. This makes the entire system approximately half as expensive.

Is the aim of sDRS to replace traditional RVMs with new Smart Collection Points?

Yes. Traditional RVMs are becoming obsolete due to advancements in technology. Smart DRS serves as the new engine of the system, making RVMs unnecessary. While RVMs have served their purpose, Smart DRS offers a more efficient and modern solution.

FAQs

DIFFERENCE TO DIGITAL DRS

Why and how is it different from digital DRS?

Digital DRS has failed in multiple pilots due to:

- Contamination: Digital DRS allowed non-eligible items to be placed in collection bags, whereas Smart DRS prevents contamination through Smart Gates and AI inspections.

- Fraud Resistance: Digital DRS was vulnerable to code duplication and fraud. Smart DRS uses unique Data Matrix codes with no predictable series, ensuring zero fraud.

- Unique IDs and International EAN: Digital DRS struggled with unique ID placement and did not solve the international EAN problem. Smart DRS places unique IDs on the top of containers, ensuring easy readability by the scanners.

- Consumer Friendliness: Digital DRS relied on mobile phones, excluding elderly and children. Smart DRS allows returns without the need for mobile devices, making it accessible to all consumers.

- Counting Centers: Digital DRS required costly counting centers. Smart DRS eliminates the need for counting centers by enabling container compression.

- Container Compression: Unlike Digital DRS, Smart DRS supports container compression increasing the efficiency of the whole system.

FAQs

BEVERAGE PRODUCERS

How does the system work for the beverage producers?

The system integrates seamlessly into the beverage production and packaging process:

1. Get ID batch – Cap and lid producers request and receive large batches of unique IDs from the ID Authority, managed by the producers.
2. Laser the UIDs – The caps and lids are marked with unique IDs, prepared in batches per beverage producer order.
3. Fill the drink and close – Beverage producers continue production as usual, using pre-printed, uniquely coded caps and lids.
4. Read the UIDs – High-speed cameras scan and record each container's unique code during multipacking.
5. Multipacking – Each multipack receives an internal logistics code, linked to the batch of unique IDs and stored in the internal system.
6. Palletizing – Each pallet also receives its own logistics code, tying it to the associated multipack batch and managed in the internal system.

This Option A of production ensures full traceability and efficient ID management throughout the production chain.

However, steps 4 and 5 are optional, and beverage producers have two additional options:

Option B: Without using multipack stickers and multipack UCID and with automated batch traceability. This is a good alternative for large beverage producers that prefer not to have agnostic production per batch/country.

Option C: Without using scanners, multipack stickers, and multipack UCID relying on manual batch traceability. This is a suitable option for microproducers with very small beverage production volumes.

How do beverage producers need to adapt their production lines?

With our Smart Production Line solution, there are no physical changes to the production line. The system integrates seamlessly with existing lines without requiring vendor assistance. It is non-invasive, does not block production, and operates as a lean, independent system.

What are the main benefits for the beverage producers?

Producers will pay lower industry fees, and production costs will decrease because production based on national markets will no longer be necessary. Clean material returned to them will be easily available, and there will be no more need for tethered caps.

FAQs

What about the investment costs for beverage producers?

Smart DRS significantly lowers the industry fee. Producers will pay a lower industry fee, mitigating the barrier of higher pricing thanks to the usage of international EAN.

What is the price for UCID on cap / lid?

The savings achieved by sDRS significantly exceed the costs of creating the data matrix on caps. The incremental cost of creating a cap with a data matrix per piece is €0.00105. At 100 million productions per year, the costs amount to €105,208 compared to estimated savings of €2,715,375.

How does the international EAN work and what are the benefits?

The key advantage is that beverage producers can produce a single container approved for multiple national markets, eliminating the need to produce separately for each country. Currently, large beverage producers often rely on international EANs but face double industry fees when importing the same product across borders. Smart DRS assigns a unique code to each multipack, linking it to a specific national market. This removes the need for country-specific production and delivers significant cost and operational benefits.

What about microproducers with just thousands of containers per year?

Microproducers are fully compatible with Smart DRS. They purchase UCIDs before placing products on the market and receive stickers to affix to their products. Unlike traditional EANs, which are vulnerable to fraud, Smart DRS ensures precise tracking and control. Producers purchase IDs upfront, improving cash flow and ensuring accurate traceability.

Alternatively, they can buy lids or caps from cap producers with pre-lasered UIDs, since this will become a standard product due to adoption by big producers.

FAQs

RETAILERS

What are the main benefits for the retailers?

Retailers benefit from several key advantages with Smart DRS:

- Smart DRS enables back-to-retail collection using simple, affordable, and efficient AI-powered collection points.

- Smart Collection Points eliminate the need for expensive, unreliable, service-intensive, and space-consuming RVMs.

- Lower purchase and operating costs compared to RVMs.

- Decreasing staff time on cleaning and maintenance, no heavy mechanical parts to service.

- Compatible with standard waste trucks with compactors, streamlining logistics.

- Reduction of the need to handle heavy plastic bags, thanks to standard wheelie bins for quick exchanges.

Is it possible to express the benefits for the retailers in numbers?

Smart DRS delivers significant savings and efficiency improvements compared to traditional DRS. Retailers can reduce purchase or lease costs by up to 81%, and cut operational costs by approximately 41%. The return process itself is up to 50% faster, while staff workload is reduced by around 25%, thanks to simplified handling and maintenance.

What about the investment costs for the retailers?

Nowadays, the entities responsible for the CAPEX costs of the RVMs vary from country to country and may also include retailers.

Typical RVMs start at approximately €10,000 for basic models and can go up to €100,000 for bulk machines. In contrast, Smart DRS requires no initial CAPEX. Managers of the collection points pay only a moderate monthly fee, representing a significant shift in the system.

How exactly does the collection point look?

The Smart Collection Point (SCP) is very lean, using existing, well-tested components like tablets and enterprise-grade scanners. The only proprietary component is the Smart Gate, which prevents contamination and manages the sorting of containers. The AI technology recognizes throwed items and determines deposit eligibility. The software running on the collection point integrates all functionalities.

FAQs

What exactly does the SCP include?

- Tablet and Scanner: Handle user interaction and communication with DRS servers, cameras, and printers.
- Voucher Printer: Prints vouchers with deposit values.
- Smart Gate: Opens only for approved bottles, preventing contamination.
- On-Premise AI System: Controls the handover of the beverage container, notifies about contamination, and manages local bag stock. It consists of an HD camera with infrared reading and a microcomputer analyzing the data.

DRS OPERATORS

What are the main benefits for the DRS Operators?

With sDRS, all forms of fraud are effectively eliminated, reducing financial losses. The need for costly and complex counting centers is completely removed.

Plastic bags at collection points become a thing of the past, replaced by standard waste bins that are easier to handle, more hygienic, and fully compatible with existing waste logistics. Handling fees are significantly reduced, as the collection points are not only cheaper to install but also much more cost-effective to operate over time.

Operators also gain access to the most precise, real-time data they've ever had empowering better decision-making, reporting, and system optimization.

Is it possible to express the benefits for the retailers in numbers?

The benefits of our sDRS solution for deposit return system (DRS) operators are clear and measurable. Compared to traditional DRS, operators can achieve:

- 39% lower industry fees
- 48% lower handling fees
- 26% lower logistics costs
- 100% savings on counting center costs, plastic bags, national EAN fees, and fraud-related costs

These figures highlight significant cost reductions across the entire system, making sDRS a more efficient and economically sustainable alternative to traditional models.

Could sDRS work on a nationwide level in parallel with traditional DRS and RVMs?

Yes, sDRS can coexist with traditional DRS. However, we believe that once stakeholders experience the benefits of sDRS, the transition from traditional RVMs will be swift as smart containers will become the norm. The only reason to retain RVMs might be for glass bottle collection.

FAQs

How would the transition from DRS to sDRS look in a country with an existing DRS?

Countries with an implemented DRS have several options for transitioning to Smart DRS.
One approach is to start by replacing RVMs with Smart Collection Points in closed ecosystems, such as factories or schools, or by adding affordable collection points in locations and events where no return opportunities previously existed, such as festivals or gas stations. This helps prepare for a gradual transition through large-scale pilot projects.

A second option is to use Smart DRS to enhance system security. In this case, DRS operators only pay for access to the Deposit Validation Server and a fee for each connected RVM. The only requirement is that the UCID can be scanned and the material handover confirmed, which necessitates an integrated scanner within the RVM. Additionally, operators can purchase several RVM add-ons to improve functionality:

- AI camera
- SmartGate
- BulkApp (for an improved customer experience)

The final option is a gradual transition to a fully implemented Smart DRS. Parallel operation of two systems (crushed and non-crushed bottle handling) should remain temporary, as it can become annoying for the consumers. This transition could follow the principle: "From next year, SCPs will be introduced. You may continue using RVMs, but they must feature a front scanner and accept crushed bottles."

Finally, Smart DRS offers the significant advantage of simpler and more efficient manual collection, compared to today's systems, which rely on scanning EAN codes on labels of uncrushed bottles.

CONSUMERS

What are the main benefits for the consumers?

Consumers can finally return bottles and cans the way they've always preferred - crushed. This eliminates the need to store and transport unnecessary air, making the entire process more efficient and environmentally friendly.

The return process itself is much faster and far less frustrating. Beverage containers are not rejected without inexplicable rejections or the need to reinsert items, making the experience smooth and convenient.

This consumer-friendly approach not only improves satisfaction but also encourages higher participation rates in the deposit return system.
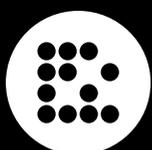
Vision

Every beverage packaging in the world will get a second life via
well-functioning, secure, and affordable Deposit Return Scheme.