Preparação e apresentação de um estudo de viabilidade económica incluindo um plano de negócios para a implementação da Sistema de Tara no contexto da gestão de resíduos e reciclagem em Cabo Verde

Suitable technologies for a deposit refund system

May, 2022.

Implemented by

AHK Deutsch-Portugiesische Industrie- und Handelskammer
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Technologies for deposit refund system

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V. Fraud control
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Need for specific technology

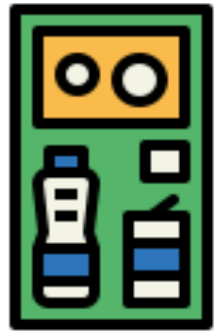
- Deposit refund systems are supported by technologies due to their special nature
  1. Large number of transactions: Each returned package with deposit generates a transaction. Transactions between private stakeholders and with consumers have to be correct and precise
  2. Large value of deposits circulating in the system: If deposit is 5 CVE and volume is 100 Million packages, yearly value of deposits is 500.000.000 CVE
  3. Deposit is an incentive to consumer. Unfortunately it's also an incentive to a crime; both stolen packages and fraud by external and internal parties
  4. High liquidity of deposit packages value: A stolen package can be returned anywhere and money earned with stolen or frauded package comes without delay

- DRS Requirements
  - Each package recognized and booked before deposit is paid out: **INTEGRITY**
  - Speed, reliability, reporting capabilities for very high volumes: **CAPACITY**

Source (TOMRA)

Specific technologies designed for DRS

- Reverse vending machines (RVM) for recognition and approval of returned packages
  - Standalone or with backside sorting and handling systems, installed at stores or community centers
  - Simple or integrated user interface
  - Directly connected to DRS operators for product masterdata updates and reports on bin level, UPC-level or even to single out every individual package received



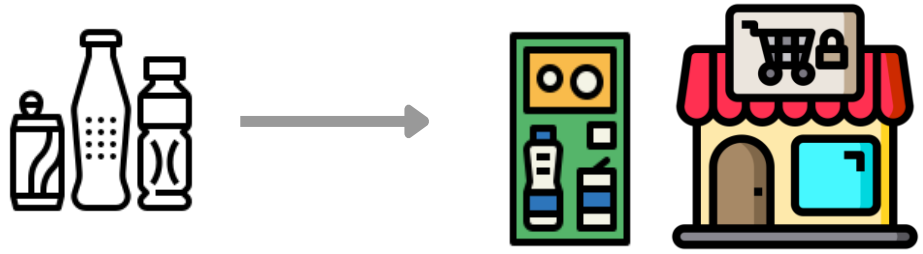
- Counting lines
  - High speed counting of identified units
  - Designed to individually count light weight post consumer packages, feeders built to maximize speed
  - Multi-camera or 360 degree recognition technology
  - Directly connected to DRS operator for product masterdata updates and bin or individual package level counting information

Source (TOMRA)

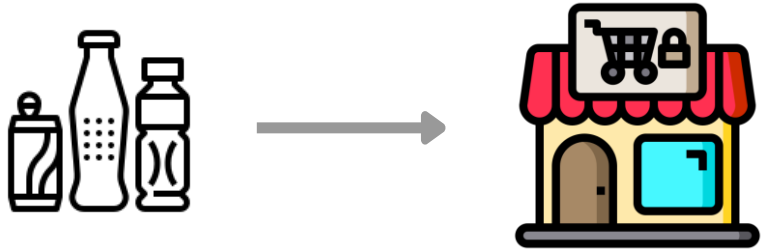
Recap

Collection mechanisms

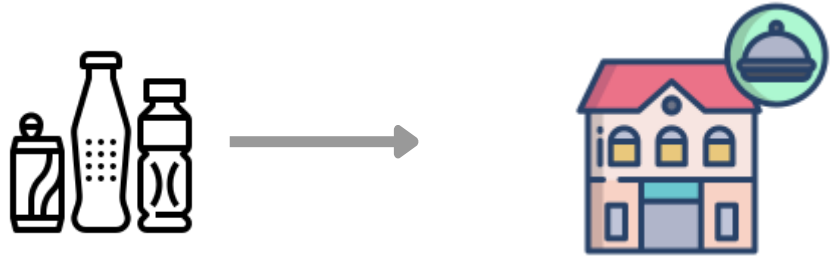
RVMs at retailers



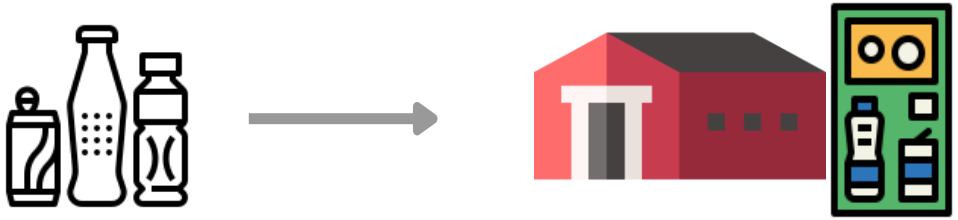
Manual collection at retailers



Manual collection (HoReCa)



Redemption centers



Source:(Gandy, et al., 2008)

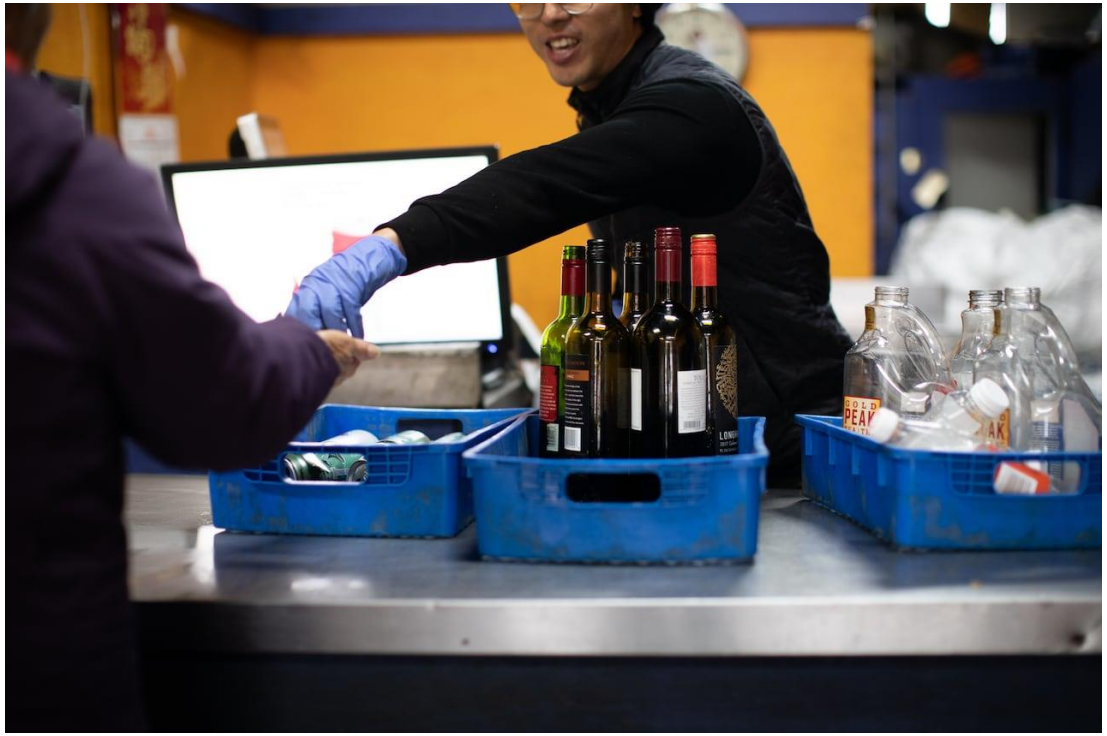
Recap

Collection mechanisms

Reverse Vending Machines (RVMs)

RVMs return of beverage containers.

Over the counter (OTC)



Manual OTC return of beverage containers.

Recap

Collection mechanisms

Counting Center

Counting line at counting center.

Redemption Center

Example of redemption center.

Pros and cons of different collection methods

Type	Pros	Cons
• Reverse vending machines RVM in stores	• Consumer friendly: fast and fun • Enables sorting and compaction in stores • Fraud control, logistics efficiency	• High investment cost compared to labor cost savings • Space requirement increases pressure for limited commercial space
• Manual collection from stores	• No investment needed in return locations • Flexible, same process used for retail and HoReCa	• Lines to consumers in peak times • High logistics cost of empty packages • Higher risk for fraud and for stolen packages
• Redemption centers equipped with RVM	• High capacity, operational efficiency • Operated by personnel; consumers get support and fraud is mitigated	• Accessibility to consumers • Needs setup and locations from municipalities

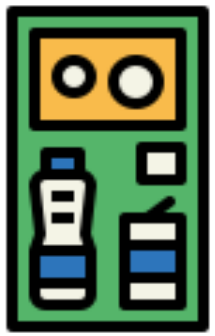
RVM, reverse vending machine

RVM

Automated machines, used by the consumer, into which customers insert their used beverage containers in order to obtain their refund.

Basic functionality:

- Identify container and beverage type.
- Confirm deposit.



Additional options:

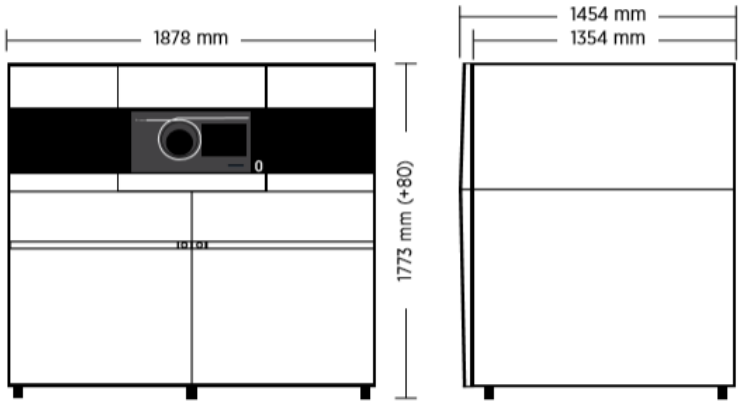
- Automatic sorting of identified packages
- Compacting containers to improve storage and transportation efficiency
- Online connection to the system operator.
- Identify redemption patterns.
- Enable advertisements or promotions.

Typical capacity of RVM is 15-30 packages per minute (consumer speed)

RVM can recognize
- Barcode, QR code
- Dimensions, shape
- Material, special inks

RVM, reverse vending machine, example

Dimensions



Weight:
525 kg (max weight)

Footprint:
2.5m²

Storage capacity (appr. figures with shakedown mixed sizes)

PET crusher:	Up to 1500 PET (based on mix)
Can crusher:	Up to 6000 cans (based on mix)
Glass:	300 objects (weight limited)

Based on bin size: B: 800 x D: 1200 x H: 1000 mm
Effective height of bin 850 mm
(pallet height 150 mm. appr. figures with shaking down).

Container specifications

Bottle size
Diameter 50-130 mm
Height 85-380 mm

Can size
Diameter 50-100 mm
Height 80-200 mm

Speed capability

Shape & barcode reading
Up to 45 containers per minute

Environmental

Humidity
Maximum 90% relative humidity, non-condensing

Temperature
+10°C to +40°C

The machine has been designed for indoor use only

Electrical

Power consumption
Idle 60W, Max 2500W,
Can/PET Crusher nominal in use

Mains EU
400 V AC 3-phase w/ground,
50Hz, 16A

Mains US
208 V AC 3-phase w/ground,
60Hz, 20A

Connectivity

LAN (Ethernet TCP/IP) interface

POS compatible

Source (TOMRA)

RVM, reverse vending machine installations

Source: Returpack

Source: K-Citymarket

Source: Tomra

Source: RVM systems

Source: Tomra

RVM, reverse vending machine manufacturers

- Tomra
- Remondis (Diebold-Nixdor as of 2022)
- RVM Systems
- Sielaff
- Repant

Counting line

Counting line

Machines operated by counting plant personnel, into which identified transport bags collected from manual return locations are emptied and contents of the packages is reported

Basic functionality:

- Idntifying and sorting the containers.
- Report containers to system operator database.

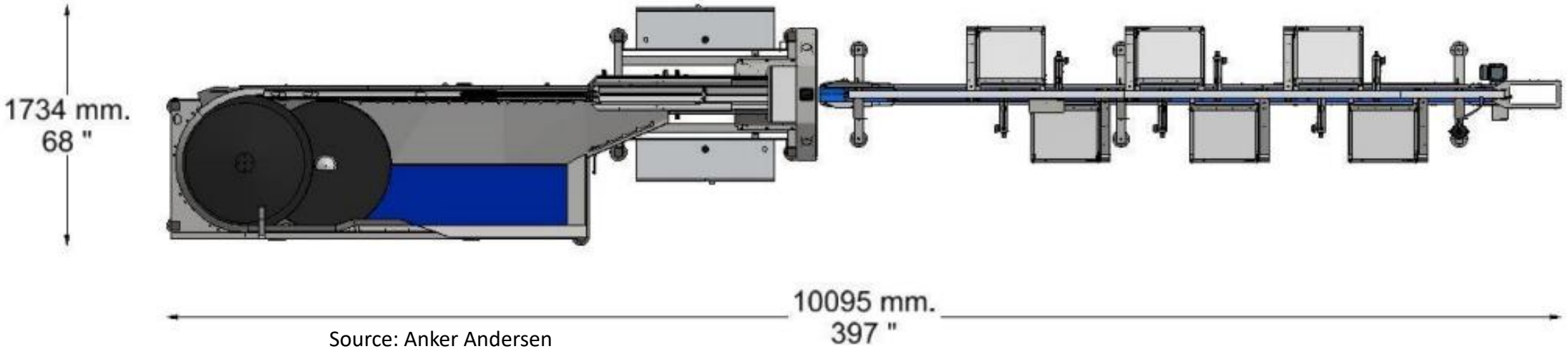
Additional options:

- Bulk feeders
- Two bag feeding options

Typical capacity of one counting line is 100-300 packages per minute

Machines are operated in continuous basis, 2-3 shifts per day

Counting line, example



Source: Anker Andersen

Counting line installations

Source: Tomra

Source: Anker Andersen

Counting line manufacturers

- Anker Andersen
- Tomra

Technologies support for different packages vs. DRS scope

Material:

- Plastics (predominantly PET)
- Metal (predominantly Aluminum)
- One-way glass.

Beverage type: Almost all soft drinks

- Water
- Sport drinks
- Juice and beverage concentrates
- Beer
- Liquor / spirits / wine

Excluded:

- Strong alcoholic beverages
- Dairy products
- Glass jars
- Cartons (i.e. Tetra Pak)

1. **EASY: Supported by technologies**
   - Alu-can, PET bottle max 3 l
   - Cylinderical shape
2. **LIMITED: Supported by part of technology**
   - Glass bottles of beer, wine and water hadled by RVMs, but require manual counting
3. **HARD: Not supported by technologies**
   - Carton packages: wedge the conveyers causing machine breakdowns
   - 3l+ packages: require manual processes
   - Strong alcoholic beverage bottles with heavy packages: difficult shapes

Recap

Fraud Control

Fraud Control

→ When a **refund is claimed on a deposit that was never paid**, usually because containers have been imported.

→ **Double redemption of containers** and/or receipts is another possibility; in this case, the deposit only paid once is refunded multiple times.

→ At the front-end of the process, there is the potential for **producers or distributors to under-report their sales data**, meaning not enough deposits are initiated, and fees are avoided.

Labelling and fraud control

Visual information logo: Enables consumers to identify items that can be returned)

Barcode for :
Primary purpose is identifying the package (UPC).

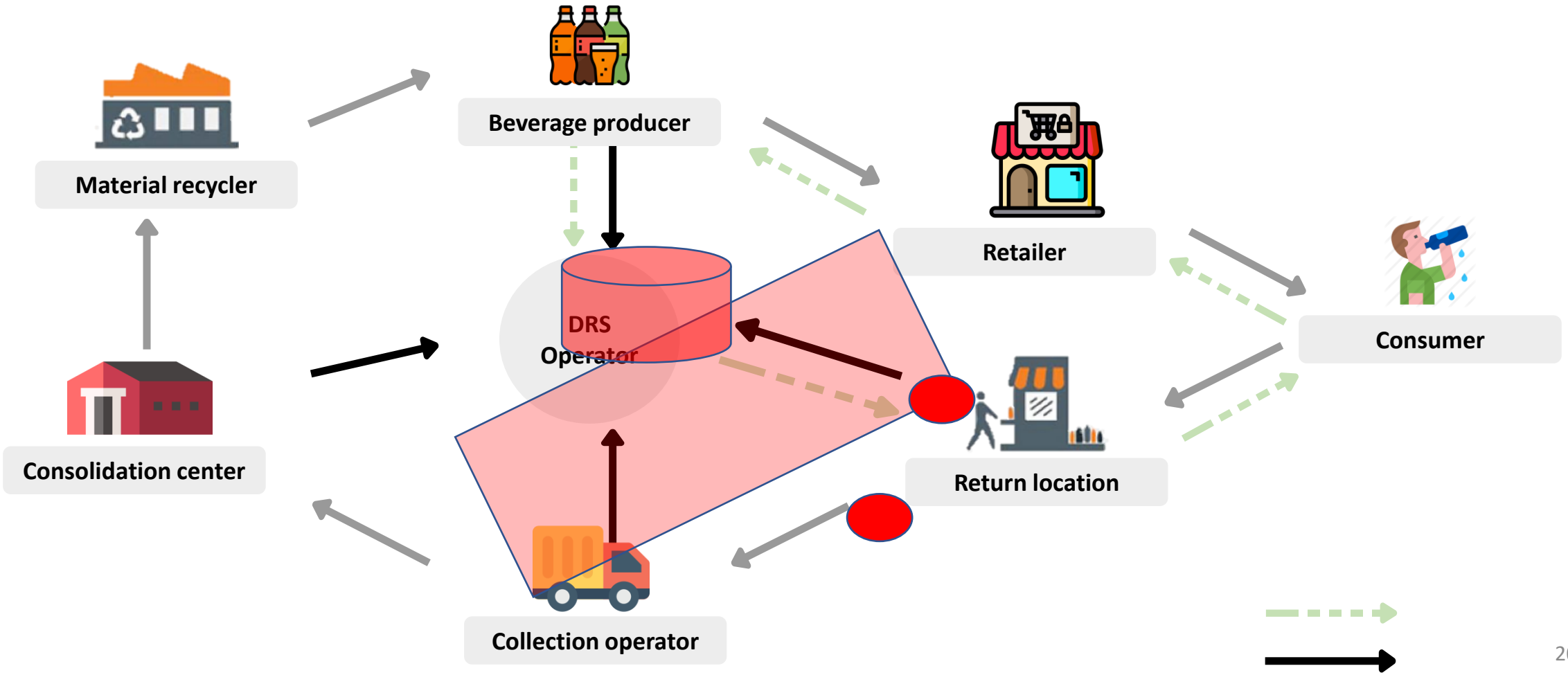
Fraud

Fraud is more common in the back-end if **refund is claimed on a deposit that was never paid**, usually because containers have been **imported to the country** or when **containers excluded from the scope** of the DRS are returned.

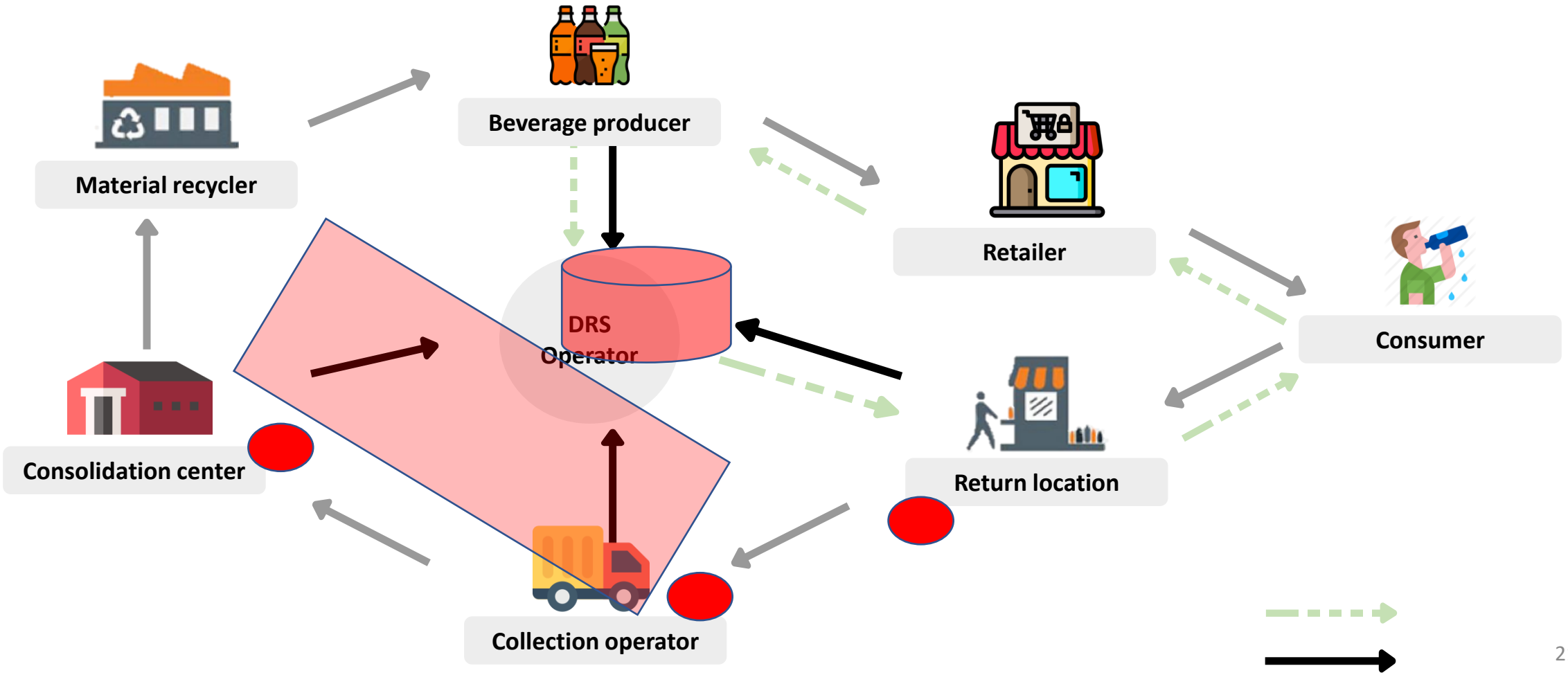
Double redemption of containers and/or receipts is another possibility.

At **the front-end** of the process, there is the **potential for producers or distributors to under-report their sales data**, meaning not enough deposits are initiated and fees are avoided

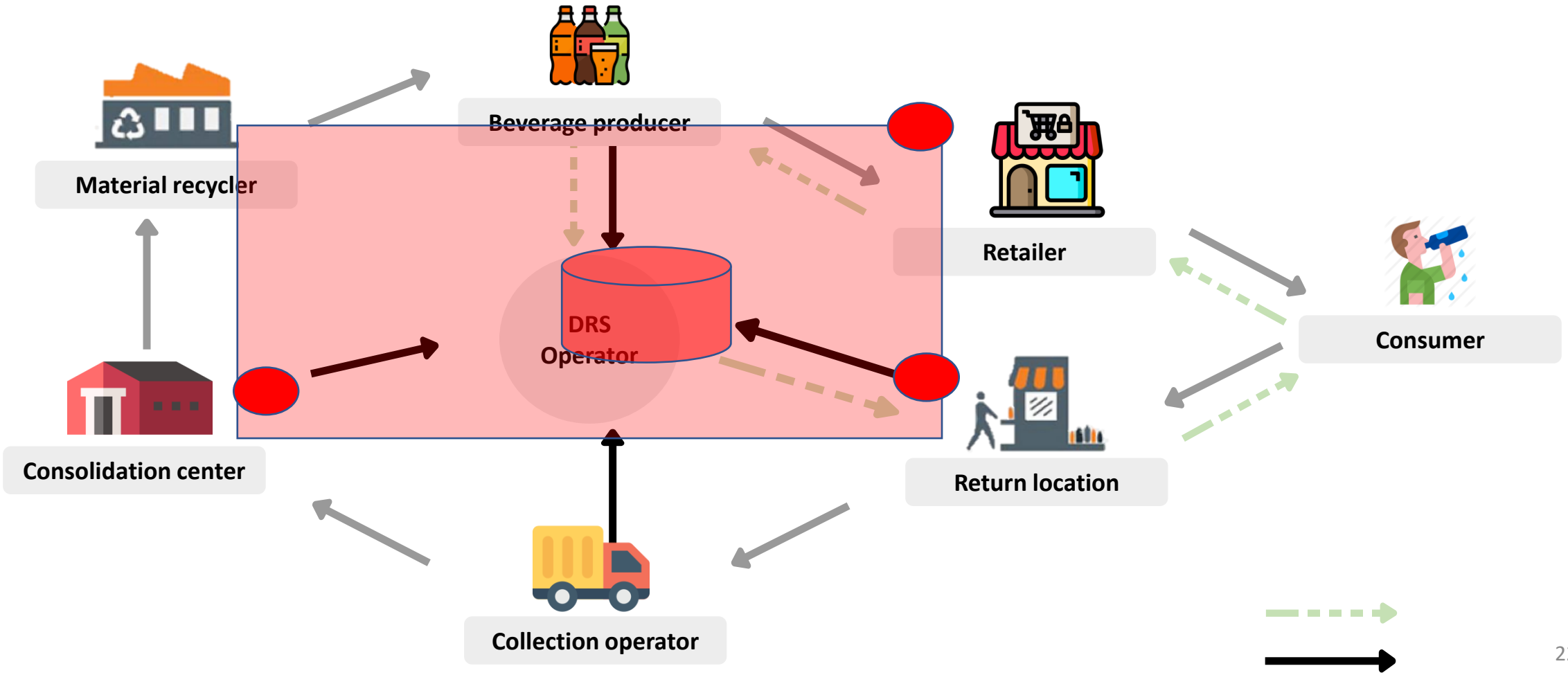
Fraud control: Consumer & Store personnel



Fraud control: Transport operator



Fraud control: Producer & Importer



Fraud control: Summary

Type of fraud	Guilty in fraud	Fraud mechanism	How to control	Means & equipment	Data
Non-deposit packages	Consumer	Adding barcode stickers to non-deposit packages	Shape & dimensions control, return pattern control	Multiple recognition technologies	Product masterdata including dimension and shape information
Returns of full packages	Store customer or personnel operating RVM	Return of packages before buying them	Scale in RVM	RVM equipped w/ scale	Product masterdata – package weight
Multiple return of same package	Customer operating RVM	Return and catch for new return	Pullback stop / alarm in RVM	RVM safety technology	-
Multiple returns of packages through RVM	Store personnel operating RVM	Circulation inside the store	Compacting. Control transport packages vs. Returns	Transport operators w/ handheld scanners	Transport data vs. Return data analysis
Under-reporting	Producers / importers	Producer underreporting POM to reduce cost	Item level follow-up	DRS operator database	POM data vs. Return data on unit level
Stealing of transport	Transport employees	Deposit packages stolen in transit	Scanning of package in several points in the chain	Transport operators w/ handheld scanners	Transport vs. Counting data

Summary & conclusions

Technologies for deposit refund systems

- DRS requires specific
  - Ensuring system integrity against fraud and financial sustainability
  - Managing high transaction volumes
- Technologies include RVMs, counting lines, transport package scanners and IT-systems & databases for analysing and controlling

- Our conclusion is that RVM investments in stores are not needed for Cape Verde DRS. Feasible collection systems are
  - Counting lines for manual collection in OTC and HoReCa
  - RVM supported redemption centers
    - Ensure capacity for consumers
    - Ensure efficient collection from unorganized trade and markets
    - Improve logistics efficiency and reduce collection logistics cost