Analysis of four primary reusable packaging systems in Belgium - Key activities, barriers and drivers related

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ANALYSIS OF FOUR PRIMARY REUSABLE PACKAGING SYSTEMS IN BELGIUM - KEY ACTIVITIES, BARRIERS AND DRIVERS RELATED

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List of abbreviations

ADEME Agence de l'environnement et de la maîtrise de l'énergie

AJR Atelier Jean Regniers

B2B Business-to-business

B2C Business-to-consumer

BE Belgium

CE Circular Economy

CO2 Carbon Dioxide

COP26 26th UN Climate Change Conference of the Parties

CPG Consumer Packaged Goods

DRS Deposit-Return System

e.g : For example

EMF Ellen MacArthur Foundation

EPR Extended Producer Responsibility

ETA Entreprise de travail adapté

EU Europe

FMCG Fast moving consumer goods

HORECA Hotels, Restaurants and Catering

ICP Industrial and commercial packaging

LCA Life Cycle Analysis

PaaS Product-as-a-Service

PET Polyethylene Terephthalate

PMD Plastic bottles & flasks, Metal packaging and Drinks cartons

PPWD Directive 94/62/EC of 20 December 1994 on Packaging and Packaging Waste

PS Packaging System

PSS Product-Service System

RPS Reusable Packaging System

SMEs Small and Medium-sized Enterprise

SUP Single-Use Plastic

VAT Value Added Tax

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INTRODUCTION

I. Context

This November 2021 at the 26th UN Climate Change Conference of the Parties (COP26), 190 countries have met to take action regarding global warming. Facing the climate emergency, governments are forced to set up long-term goals to facilitate the transition (International Rescue Committee, 2021).

Assuming that the worldwide population will reach 9.7 billion people in 2050 and our current lifestyle does not evolve, we may almost need three planets to satisfy our needs in natural resources (United Nations, n.d.). Our linear economic model is no longer bearable given the environmental constraints. (Plastic) packaging pollution represents a massive threat.

Because it is critical to rethink our consumption and production practices, creative ideas that can lessen the environmental effect of businesses are at the forefront of debate. Indeed, the pressure on packaging professionals to find more sustainable packaging solutions increases through the years. In order to comply with current and expected future regulations while also meeting the rising consumer demand for durable products, companies are forced to choose their packaging model appropriately (Verghese et al., 2012; Zhang et al., 2019).

Previously introduced as the innovation of the 20th century or the low-cost miracle solution that transformed every business, plastic packaging is more and more neglected due to its environmental footprint (BBC News, 2018). However, the problem lies not just on the material itself but on its single-use character since LCA analyses demonstrated that the use of single-use glass containers may have even worse environmental impact.

"Progress has largely been driven by recycling, but that is not enough to solve plastic pollution – much more focus is urgently needed on eliminating single-use packaging" (Ellen MacArthur Foundation, 2021, p. 5). Recycling is not the optimal solution to tackle our high-consumption lifestyles as it still generates emissions and consumes energy, water, and material.

Therefore, it is interesting to turn our solutions towards a higher level of the circular economy: reusing. Packaging circularity may become the new norm in the next decades, especially when seeing how this tendency grows to accelerate the transition into a sustainable economy.

The zero-waste movement is a clear tendency which brings back old habits such as bulk sales and sales with a deposit-return system in Europe. In Belgium, consumers are already used to this last reusable packaging system (RPS) generally used for beer bottles as well as other glass bottles (Golding, 1999). However, this concept is not generalised for other types of primary packaging (in the food sector or other FMCG products). To resumes this issue, we can quote one of our interviewees the Atelier Jean Regniers (15/03/22): *"How can people be educated, and what can be done to ensure that packaging does not end up at the bottom of the PMD litter but rather returns and is reused?"*

Still considered a niche market (Sæter et al., 2020), new models of reusable packaging systems are created and adopted by the biggest FMCG brands (Danone, Nestle, Protect & Gamble, L'Oréal) which can lead to a new global way of producing and consuming in the future (Danielle Wiener-Bronner, 2019; Ellen MacArthur Foundation, 2021). However despite those initiatives, reuse and refill habits have a long way to go before becoming ordinary (Kunamaneni et al., 2019).

Given this whole context, this thesis will present inspiring initiatives of reusable packaging systems adopted by Belgian manufacturers in the B2C market to contribute in the topic novelty regarding primary reusable packaging.

II. Thesis structure

The research proposal is structured as follows:

First, we will present the context explaining the importance of our thesis subject (limits of linear economy, recycling,…) and introduce the main concepts and knowledge around RPS in the literature (using both scientific articles and 'grey literature'). The multiplicity of terms designating reusables packaging can be confusing, moreover that there are various ways to classify RPSs. Those classifications will be reviewed. A review on the barriers and drivers mentioned will also be integrated.

Then, the second chapter will describe the methodology followed for our empirical research. We opted for a multiple case study representing four RPSs. The four cases studies selected (Superzero, Biotop, L'Alternative and Bam!) divided in two different industries (food and cleaning products) and main type of RPS (bulk sale and DRS) will be presented in the results chapter. The results regarding barriers and drivers were analysed following three level of analysis following the configuration theory and subdivided in themes.

Finally, we will summary the main findings and confront it to literature in the discussion chapter. We also defined the limitations of our study and provided potential future research as well as practical recommendations to boost RPS practice.

III. Relevance of the research

Academic motivations

In order to have a better understanding of the challenges, and opportunities brought by the reusable packaging models, it is necessary to carry out further research on the subject. Indeed, the literature review on reusable packaging is quite scare despite the increased pressure to address packaging crisis.

From an academic perspective, reusable primary packaging options have not been widely researched comparing to secondary/tertiary options (Long et al., 2020; Mahmoudi & Parviziomran, 2020). Moreover, this thesis aims to explore the gap of knowledge regarding RPS in B2C market, less prevalent in literature than RPS on B2B market (Coelho et al., 2020).

In general, in the few research on primary RPS, only the consumer perspective was detailed. The roles and decision making choice regarding third-party logistics helping in reconditioning and reverse logistics tasks were not explored in details, according Mahmoudi & Parviziomran (2020) and Zeeuw van der Laan & Aurisicchio (2019).

The fact that we analysed the barriers and drivers through different levels of analysis brough new perspectives in the findings. We responded to gaps identified by Coelho et al. (2020, p. 9), understanding the dynamics between the different RPSs stakeholders, the factors of supply chain playing a role in the adoption of a RPS "including the integration of reverse logistics, transport distances, the role of pooling" and the packaging design factors related to "choice of material (e.g. potential for uptake of aromatics in plastic), standardization and pooling, and reduction of product damage and losses".

Managerial motivations

This research thesis can give insights on the risks, challenges, and advantages to implement a reusable packaging system and the factor that can determine the suitability between the RPS and the manufacturer's business model. It can help future entrepreneurs or current companies to see the opportunity of this type of business. It can encourage them to adopt their circular process in order to anticipate future legislation, limit their environmental footprint, innovate their model in a highly competitive market and meet customer exigences in terms of sustainability among other drivers.

CHAPTER II: LITERATURE REVIEW

1. Linear Economy

Ever since the Industrial Revolution, we live in a model based on the approach of "take-make-waste". Firms extract raw materials to manufacture the goods, then sell them to end user consumers who will throw it away once its value disappears (Ellen MacArthur Foundation, 2013).

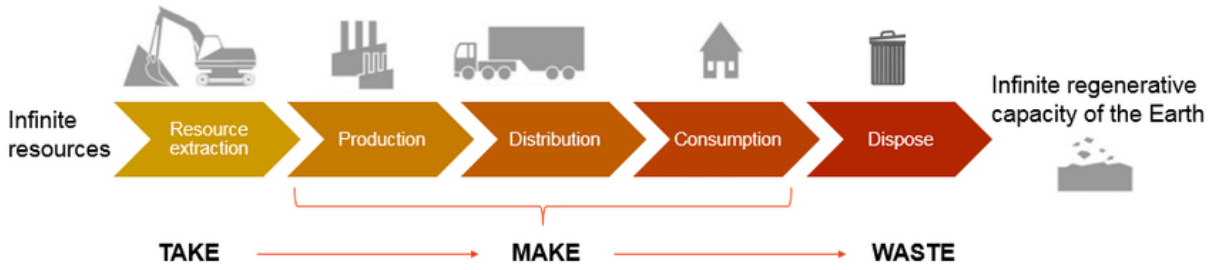


Figure 1: ***Linear process (Wautelet, 2018)***

Since the production is correlated with the demand and the demand keeps increasing due to our consumerism lifestyle and the demographic evolution, the amount of waste also increases. This linear model cannot survive infinitely because it relies on the hypothesis of infinite resources and an infinite regenerative capacity of the Earth (Héry & Malenfer, 2020).

2. Limits of the Linear Economy: Packaging Waste and (Plastics) Pollution

As a result of our linear consumption, it is well known that packaging pollution is one of the current preoccupations. Packaging waste results from the single-use nature of packaging and from its excessive usage such as wrapping layer upon layer around small products for aesthetic purpose rather than to secure the product (Song et al., 2015).

The retail development brought increased volume of packaging, exposing prepacked[1] single-unit products to enhance the customer convenience (Coelho et al., 2020). However, while the worldwide packaging business has increased significantly through the years, the average useful life of packaging is getting shorter and shorter (Bocken et al., 2022). Most packages are usually made of virgin raw materials. They are designed in a linear perspective and are thus used once and then discarded (Grégoire & Chauvelot, 2019).

The challenge of disposing waste has become worse, especially in developing countries relying on their exportation. Additionally, because of poor recycling capabilities, this garbage is frequently discharged into the environment, endangering both the ecosystem and human health (Thomas & Fannin, 2011).

The (Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 on the Reduction of the Impact of Certain Plastic Products on the Environment, n.d.) recognised that: "In the Union, 80 to 85 % of marine litter, measured as beach litter counts, is plastic". Using plastic bottles for short periods of time like days or weeks seems trivial given that they can take over 400 years to

[1] "**Prepacked product**: a product is prepacked when it is placed in a package of whatever nature without the purchaser being present and the quantity of product contained in the package has a predetermined value and cannot be altered without the package either being opened or undergoing a perceptible modification". https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM:l32029#KEYTERMS&locale=en The weight or volume cannot be over 10kg or 10L.

disintegrate in the ocean (SPF Santé publique, 2019), while endangering human health, marine ecosystems and biodiversity (Herrmann et al., 2022).

2. Circular Economy as the Solution

Following the growing environmental constraints, it is necessary to transition towards a more sustainable model: the circular economy (CE) (A New Circular Economy Action Plan For a Cleaner and More Competitive Europe, 2020).

2.1. Definition of the Circular Economy

This circular model defines itself in opposition to the traditional linear model and may be defined in several ways following the perspectives of various practitioners, experts, or regulation bodies (e.g. Ellen McArthur Foundation, the French Agency for Ecological Transition (ADEME), European Commission). However, the definition given by the European Commission (2015) was retained to fit with the scope of this research:

> In a circular economy, the value of products and materials is maintained for as long as possible; waste and resource use are minimised, and resources are kept within the economy when a product has reached the end of its life, to be used again and again to create further value (paragraphe 3) .

The principle is to "make more and better with less" (ADEME, 2013, p. 9). In practice, this "closed-loop economy" may be applied under three different fields of action: "the offer of economic actors", "the demand and the consumer behaviour", and "the waste management". The results are the seven pillars, principles of CE identified by the (ADEME, 2013) **(Appendix 1):**

1. Sustainable supply
2. Eco-design
3. Industrial and territorial symbiosis ecology
4. Product-service system
5. Responsible consumption
6. Longer usage time
7. Recycling

Those pillars should not be used independently from each other to maximise the resource efficiency and prevent waste during the whole life cycle of the product (Héry & Malenfer, 2020).

Reusable packaging is an example of the circular economy in action, so those concepts will be recalled in the rest of this work.

2.2. Responsible Consumption – Zero Waste Movement – Waste Management

The concept of "Zero Waste" appears as a suggested solution to tackle environmental concerns related to packaging waste (Bartl, 2011). The principle resides in avoiding trash by reusing materials in a circular way, which means that output wastes or products at the end of their lives can be used as inputs or redistributed within the system (Song et al., 2015).

Known to guide ecological choices for both consumers and businesses (Song et al., 2015), this philosophy integrates the "3R rule", embedded in the concept of "Lansink's ladder" (Gouvernement wallon, 2018). In a desirable order and in an environmentally sound manner, it is better first to *Reduce*, then *Reuse* and at last *Recycle* (Aurez & Georgeault, 2019). This preferred order of the treatment process in CE is promoted in a similar categorisation in the EU Waste Framework Directive 2008/98/EC[2]

[2] Directive transposed in the Walloon level in the *27 June 1996 - Decret Relating to Waste.* Available *https://sol.environnement.wallonie.be/files/PWDR/WWRP-NTS-EN.pdf*

and the "butterfly diagram" from (Ellen MacArthur Foundation, 2013) **(Appendix 2Appendix 3)**. The "9 circularity strategies" suggested by (Potting et al., 2017) embedding the 3R rule highlights the preference circularity between recycling and reuse, placing "reuse" five ranks above "recycle".

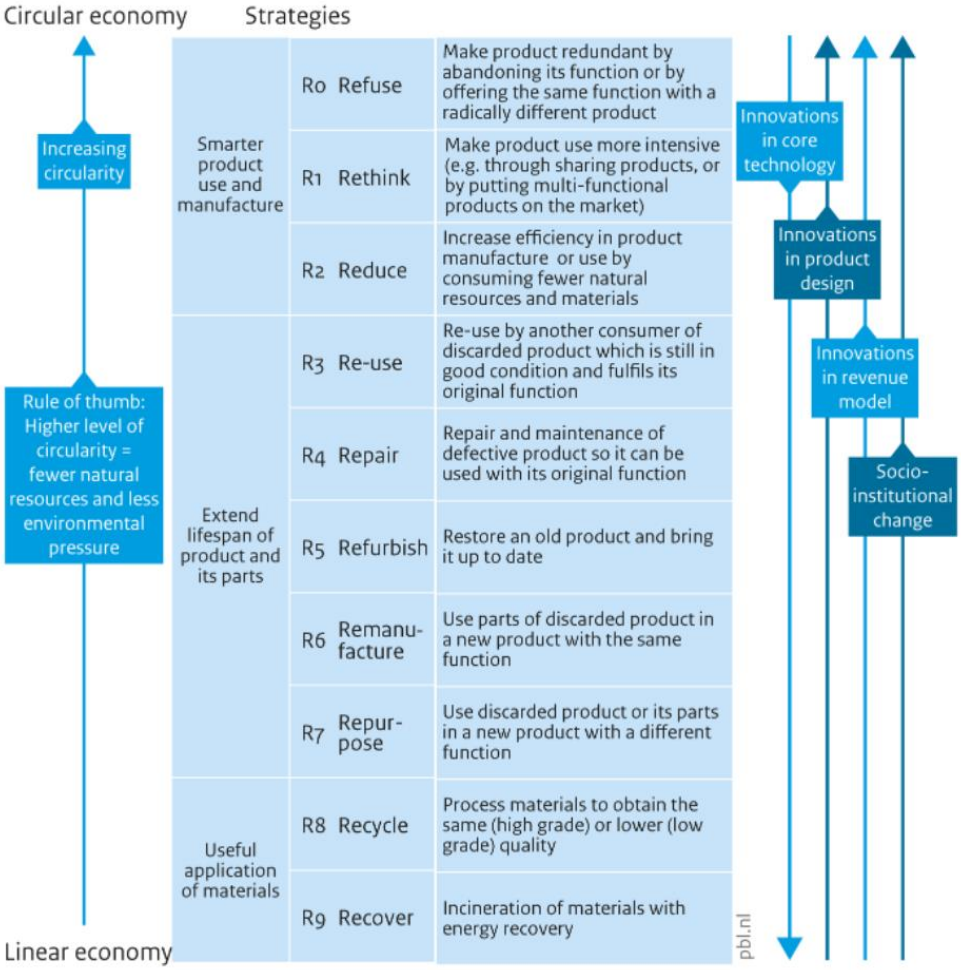


Figure 2: ***The 9Rs framework - "Circularity strategies within the production chain, in order of priority" edited by (Potting et al., 2017)***

2.3. Limits of Recycling

The total weight of packaging waste produced in Belgium reached 1.9 million tonnes in 2019 (39 % of paper and cardboard, 25 % of glass, 18 % of plastics) (Statbel, 2021). All this waste is not fully recycled and if it is the case, nothing guarantees that it will be done locally. According Fost Plus[3] (n.d), almost 20 % of this PMD waste has to be exported to be recycled in France, Germany, the Netherlands or Spain (Fost Plus, n.d.). In 2020, only "around 9 % of plastic packaging was recycled in Belgium" (Bruyninckx, n.d.) and despite glass waste being mostly recycled locally, a certain percentage is sent to the Netherlands (Fost Plus, n.d.).

[3] Fost Plus is the non-profit organisation managing the "collection, sorting and recycling" of household packaging waste in Belgium while Valipac is the organisation responsible of the waste management of Industrial and commercial packaging (ICP). (Valipac, n.d.)

Although these facts are not enthusiastic, it is worth reminding that Belgium is an exemplary country when it comes to recycling, going beyond the targets set by the European Commission.

	Belgian recycling rate in 2019 (%)	European targets for 2025 (%)
Total of recycled packaging waste	84.2	70
Plastics	47.4	50
Glass	100	70
Paper and cardboard	92.3	75

*Table 1: **Comparison of Belgian recycling rates and European targets** (European Commission, n.d.; Statbel, 2021)*

3. Policy Regulations Regarding Packaging Waste (Reuse, Recycling, Plastic, etc.)

At the European level, authorities are motivated to enforce regulations to meet the objectives of the European Green Deal[4], the new Circular Economy Action Plan (CEAP)[5] and the 2018 European Strategy for Plastics[6]. The vision is that "all packaging on the EU market is reusable or recyclable in an economically viable way by 2030" (European Commission, n.d.).

3.1. Lack of Reusable Packaging Consideration

Unlike recycling, there are no EU-imposed quotas or regulatory incentives for reusable packaging (Greenwood et al., 2021b). The (European Environment Agency, 2019) admits that "Regulation and market-based instruments are mainly focused on the end-of-life phases (recycling, energy, waste), while eco-design, consumption and reuse are typically targeted with softer policy instruments". The situation does not seem to have significantly evolved since the nineties. Criticising the Directive 94/62/EC of 20 December 1994 on Packaging and Packaging Waste (PPWD), the author of the European Commission's final report on reusable primary packaging states that "recommendations are missing any direct political instrument to support reuse packaging" (Golding, 1999, p. 92).

Directive (EU) 2018/852 amending the PPWD is a timid advance as it encourages the Member States to implement suitable policies to promote an increase in the share of reusable packaging and reuse number of those packages. In this Directive (EU) 2018/852 , the EU Commission suggests:

- the use of deposit-return schemes;
- the setting of qualitative or quantitative targets;
- the use of economic incentives;
- the setting up of a minimum percentage of reusable packaging placed on the market every year for each packaging stream. (Article 5)

At this time, there is a clear lack of reliable qualitative and quantitative data to understand the volumes and market shares of reusable packaging which slows the adoption of this packaging option (Ellsworth-Krebs et al., 2022; Rigamonti et al., 2019). Even though we tried to find up-to-date quantitative data

[4] For more information: *https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en*

[5] Available in https://ec.europa.eu/environment/topics/waste-and-recycling/packaging-waste_en accessed on 05/15/2022

[6] For more information: https://ec.europa.eu/environment/strategy/plastics-strategy_en

regarding reuse share on a national and regional level, the only data found regarding reusable packaging in Belgium is a report written by Ronald Jansen in the late 90s. Moreover, the research is not very thorough and mostly focuses on reusable liquid product packaging **(Appendix 4).**

3.2. Policies and Public Initiatives Promoting Reuse

Although there is still a way to promote reusable packaging on a regulation level, some actions may be highlighted. The legally acted principle of "extended producer responsibility" (EPR) is a key path to adopt more consequent practices for reuse, although it also seems to focus on the waste stage of the packaging life cycle. The "polluter pays" principle aims to make "the manufacturer of the product responsible for the entire life cycle of the product and especially for the take back, recycling, and final disposal of the product" (Lindhqvist, 2000, p. 37).

Although recycling is again targeted in the Art. 6 of Directive (EU) 2019/904 on single-use plastics (SUP) products, imposing a minimum of 25 % recycled plastic in polyethylene terephthalate (PET) beverage bottles, the regulation prohibiting specific SUP items promotes flourishing alternatives (including reuse). Indeed, considering this directive, from the 1st of January 2021, the Walloon Government banned specific SUP products in publicly accessible establishments, in the hotels, restaurants and catering (HORECA) sector and the event sector (Wallonie, 2020). The interdiction targets among other things[7] plastic containers such as cups, food containers[8], and plastic bags.

Moreover, in the Walloon Waste Plan[9] adopted by the Walloon Government (2018, p. 90), they "encourage the limitation of packaging (primary, secondary and tertiary) through reusable packaging, bulk sales or the promotion of concentrated products (detergents), provided they have a positive environmental balance (packaging/product)" [free translation]

Each year, the Public service of Wallonia Environment issues a call for projects to assist various publics in implementing waste prevention, treatment, and management measures including reuse practices (*Moins de déchets*, n.d.).

4. Plastic Single-Use vs Glass Single-Use & Reusable Glass Bottles vs Recycled Glass Bottles

Plastic packaging seems more targeted and criticised in the regulations, although containers made of other materials (glass, metal, aluminium, cardboard) also have their environmental footprint. Using a glass bottle once is not necessarily better than a PET bottle, as the fabrication of the glass, its transport and its recycling process are really energy consuming (Accorsi et al., 2015). When the whole life cycle assessment (LCA) is analysed, single-use PET bottles may perform even better than their alternative (Wever & Vogtländer, 2013). Another comparison realised by the ADEME suggests that a one-use plastic pot may be preferred environmentally speaking than its glass substitute (Gueudet et al., 2021).

Furthermore, it is worth saying that despite a 100 % recycling rate in Belgium (Statbel, 2021), glass recycling still results in material and quality losses through repeated recycling processes (Herrmann et al., 2022).

According to some studies (Landi et al., 2019) empirically verified, reusing glass bottles generates a lower carbon footprint than recycling them. Indeed, according to (Bruxelles Environnement, 2018), a

[7] The legal text with all SUP products targeted can be found here: http://environnement.wallonie.be/legis/dechets/degen044.htm

[8] For take away, fast food or meal ready for immediate consumption

[9] Plan Wallon des Déchets-Ressources (PWD-R)

glass bottle may be reused twenty times or even fifty times. On one hand, it saves at least 19 bottles and up to 49. On the other hand, the melting of glass needs to reach a temperature between 1300° C and 1550° C, compared to the 80° C needed for the cleaning of the bottle. Moreover, the returnable bottle produces almost four times less carbon dioxide (CO2) than a single-use one and it can help save up to 33 % of water. In a 2018 study ran by Deloitte and validated by the ADEME, the environmental benefit of a returnable bottle over a recycled bottle revealed a 79 percent decrease in greenhouse gas emissions. The findings are related to an analysis based on a 260-kilometre perimeter, which is the average distance travelled by METEOR (a French brewery) from the factory to the point of sale (ADEME, 2018).

It is worth saying that reusing and recycling should not be considered as two different options, but as complementary options. Ideally, reuse models should be adopted in conjunction with recycling to enhance their environmental efficiency (Muranko et al., 2021).

5. Packaging (Definition and Role)

5.1. Product-Packaging Relation Justifying Reusable Packaging

The environmental impact of a product cannot be separated from the one of its packaging (Verghese et al., 2012). Even though usually the environmental impact of the product is greater than its packaging system, this assumption should not prevent the company from including the package in its strategy. Indeed, "packaging affects the logistics and the environmental efficiency in supply chains because it interacts with material handling equipment, information systems, manual handling, transportation and waste management" (Pålsson, 2018 p 5).

This idea of coherence between the value of the product and its packaging was also discussed with E. Mossay, a CE Belgian expert. According to him, the quality of the product should, in a way, justify the logistics that is created in order to reuse its packaging. If the product is harmful for the environment, it is incoherent to put all these efforts to try and make its packaging eco-friendly. Therefore, there should be a coherence between the values defended by the product and the logistics around it to avoid greenwashing. (E.Mossay, personal communication, May 5, 2021).

5.2. Types of Packaging (Following the Layers and Functionality)

According to (European Parliament and Council Directive 94/62/EC of 20 December 1994 on Packaging and Packaging Waste, 1994, p. 62; Pålsson, 2018), three different levels of packaging exist, divided according to their functionality or layer:

- The primary packaging (also called sales, consumer or retail packaging) is the one that wraps and directly protects the product, the sales unit purchased by the consumer or the user (European Parliament and Council Directive 94/62/EC of 20 December 1994 on Packaging and Packaging Waste, 1994). Its main functions are "protection, promotion, convenience, information, handling, [and][10] safety" (Verghese et al., 2012, p. 8). The packaging may be already filled or intended to be filled at the point of sale (e.g. cans, glass pots for jam, or paper carrier bags).
- The secondary packaging (or grouped packaging) groups multiple sales units. This one is not necessary for the protection and handling of the product. It can be removed from the product without affecting its characteristics (European Parliament and Council Directive 94/62/EC of 20 December 1994 on Packaging and Packaging Waste, 1994).
- The tertiary packaging (alternatively named transport packaging) refers to all packaging allowing an efficient distribution and protection of the product during transportation excluding the road, rail, ship and air containers. Warehouse or transit packaging enabling the distribution

[10] Added word in the citation

in the sales point such as boxes or pallets used for the transport fall under this category (Pålsson, 2018).

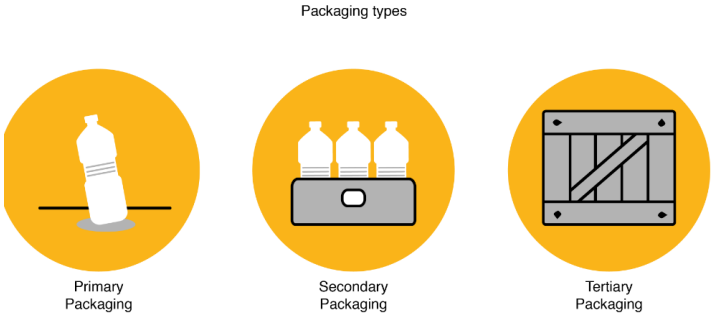


Figure 3: ***Packaging types ('4.1.4 Packaging Systems', n.d., p. 4)***

There are different ways to define a packaging system (PS). Following Pålsson (2018), a packaging system combines the three packaging layers mentioned earlier. This vision points out the interaction between these levels and the product itself, which determines the performance of the packaging system. However, for Mahmoudi & Parviziomran (2020) and Mansour et al. (2019), each layer constitutes its own packaging system, which means that it exists primary PS as well as tertiary PS, for example.

This work will focus on primary reusable packaging systems in the business-to-consumer (B2C) market.

6. Reuse in Packaging (Definition)

Reuse in the packaging field may be defined in the Article 3 of the PPWD as:

> "any operation by which packaging, which has been conceived and designed to accomplish within its life cycle a minimum number of trips or rotations, is refilled or used for the same purpose for which it was conceived, with or without the support of auxiliary products present on the market enabling the packaging to be refilled"

As Ecoconso (2022) and Lust et al. (2009) point out, it is difficult to specify what a reusable packaging even is in the Belgian transpositions of those official texts. In reality, a lot of consumers can choose to reuse single-use packaging even if it was not designed with this aim (Sousa & Souza, 2021). For example, it is still possible to refill a plastic jar even if it was not designed and marketed by the producer to be reused. Therefore, there is no clear border between single-use, reused and repurposed packaging as it depends mostly on the perception of the consumer that chose to find a secondary purpose of the waste (Greenwood et al., 2021b).

Regarding the different definitions of reusable packaging, we can consider that the term also takes into account packaging reused for a different product than the one it contained in the first place (Guiot et al., 2021). In this sense, bulk sales with the consumer's own packaging are included in the definition of reusable packaging.

Bulk sale has no proper definition in Belgian regulation. It is only recently (at the end of 2021) that the French regulation adopted the definition provided by Réseau Vrac (2020) stating that:

> "Bulk sale is defined as the sale to the consumer of products without packaging, in quantities chosen by the consumer, in reusable containers. Bulk sale is offered on a self-service or assisted service basis. It may be concluded as part of a distance selling contract. All everyday consumer

products may be sold in bulk, except for exceptions[11] duly justified on public health grounds". [free translation] (Article L120-1 - Code de La Consommation - Légifrance, 2021)

7. Presentation of the Different Classifications of Reusable Packaging Systems

Since reuse models are receiving increased attention, a few researchers such as Coelho et al. (2020), Ellen MacArthur Foundation (2019), Guiot et al. (2021), Long et al. (2020) and Muranko et al. (2021) tried to build a classification of the different reusable packaging systems (RPSs). To understand the variety of RPSs and their characteristics, multiple points of comparison can be considered. It is complicated to balance the number of categories to avoid simplistic classifications lacking details to be widely applied or complex classifications with blurred differences between categories. We created a table to synthesise the different research we could apply to primary RPSs **(Table 3 pg 22).**

Some studies consider reusable products as well as refillable packaging in their FMCGs cases. However, it may be interesting to differentiate them. In this research, we will focus on reusable packaging and not reusable products such as razors or disposable cameras. Additionally, most of the studies include RPSs involving the support of auxiliary products to enable the reuse of the packaging at home (e.g. flexible plastic bags to pour into a container, concentrated refill pods, etc.). Those cases will not be analysed in the thesis as they usually involve a single-use intermediate packaging (Guiot et al., 2021).

Multiple authors such as Muranko et al. (2021), Tassell and Aurisicchio (2020) and Zeeuw van der Laan and Aurisicchio (2019) analysed the opportunities of reusable packaging in the fast-moving consumer goods (FMCG) sector. Also known as consumer-packaged goods (CPG) and usually sold in supermarket chains, those FMCG are particularly affected by packaging waste since they are purchased regularly to satisfy everyday needs and sold in disposable forms (Kuzmina et al., 2019). Their low-value character, both in financial and time input for both manufacturers and customers, results in "lighter minded attitude towards the potential impacts of the industry" (Park, 2015, p. 40). The sector includes food and beverage products as well as personal and home care (Bocken et al., 2022).

Various authors (Coelho et al., 2020; Long et al., 2020; Mansour et al., 2019; Zeeuw van der Laan & Aurisicchio, 2019) consider RPS as a product-service system. Beyond delivering a product, an attached service is provided to the consumer. According to Zeeuw van der Laan and Aurisicchio (2019, p. 3), the service provided is a "revalorisation service" allowing "to close the consumption loops of products, components, or material" through the reuse of the packaging.

Most classifications including Muranko et al. (2021), Long et al. (2020) and Ellen MacArthur Foundation (2019) use the ownership of the package as a criterion to categorise RPSs. A close concept of this ownership is the definition of exclusive or sequential reuse characteristics involving respectively an "individual and unlimited access" or a "sharing through successive access" to the reusable packaging (Muranko et al., 2021, p. 8). Another common element used for mapping RPSs is the location of the reuse enabling infrastructure closely attached to the delivery methods to refill the packaging.

Ultimately, several classifications include two main categories depending on the role of the consumer or the business in the refilling of the package. Similarities between different studies are emphasised in **Table 2**.

[11] Olive oil, flour, yoghurt and fermented mil products are banned from bulk sale (Réseau Vrac Belgique & Sylvie, 2020) However, these restrictions seemed contradicting information from Bruxelles L'Environnement https://document.environnement.brussels/opac_css/index.php?lvl=notice_display&id=12098

(Ellen MacArthur Foundation, 2019)	**Refill (packaging refilled by user)**		**Return (packaging returned to business)**	
	At home	On the go	At home	On the go
Consumer behaviour (Zeeuw van der Laan & Aurisicchio, 2019)	Keep Bring		Bring Consign Abandon	
(Tassell & Aurisicchio, 2020)	Consumer replenishes/ reconditions. Consumer replenishes at home via service.	Consumer replenishes on the go via service	Company replenishes for consumer via service	Consumer brings and company replenishes/ reconditions via service
(Long et al., 2020)	Services to enable consumers to reuse the packaging		Companies' take back services	
	Refill pods service	Refill station service	Collection service	Offering drop-off locations
(Guiot et al., 2021)	The reuse action is carried out by the consumer		The reuse action is carried out by a professional	

*Table 2**: Comparison between classification from (Ellen MacArthur Foundation, 2019; Guiot et al., 2021; Tassell & Aurisicchio, 2020; Zeeuw van der Laan & Aurisicchio, 2019)***

As far as our research went, typologies of RPSs focus on consumer key behaviour and perspective, and interactions with upper levels enabling the reuse are overseen. The business perspective is vaguely referred to, without specifying the organisations and partners involved. Indeed, the different business stakeholders involved in the RPS (the brand, the store, the third party enabling the reuse and selling those reuse solutions to the business, the washing operator…) are not presented in detail. The role of those businesses is mostly presented implicitly or summed up in specifying if the "company" is responsible for the replenish or reconditioning of the FMCG. Only studies on B2B packaging, secondary or transport packaging seem to analyse more deeply the business activities required for the reuse and possible role of a third party for cleaning, sorting, and return logistics.

According to Mahmoudi & Parviziomran (2020), who reviewed articles on reusable packaging (primary, secondary and tertiary), logistic system design classification is mostly discussed in the literature for tertiary packaging, in a B2B dimension. However, it would be helpful to define activities and responsibilities of the different stakeholder organisations of RPS involving returnable primary packaging refilled by the initial conditioner. Articles like (Hellström & Johansson, 2010; Kroon & Vrijens, 1995; Twede & Clarke, 2004) better develop the role of third-party logistic providers and product senders as well as how the tasks are distributed among the RPS components.

The ownership of reusable containers as well as the responsibility of monitoring, cleaning, regulating, maintaining, transporting and storing returnable containers must be taken into consideration to design a reverse logistics system (Mahmoudi & Parviziomran, 2020; Pålsson, 2018). Kroon & Vrijens (1995, p. 56) define reverse logistics as:

> "the logistic management skills and activities involved in reducing, managing and disposing of hazardous or non-hazardous waste from packaging and products. It includes reverse distribution,

which causes goods and information to flow in the opposite direction from normal logistic activities".

Kroon & Vrijens (1995) referencing Lützebauer (1993), distinguished three models of reverse logistics systems:

1. ***Switch-pool systems***: Each participant has its own fleet of containers and is responsible for its cleaning, control, maintenance, and storage. In the first variant, the ownership switches between the sender and the recipient, the carrier transporting empty or filled containers between them. In the long term, all the containers placed in the system by the sender should return to him. In the second variant, the carrier is responsible for the flow management; for every exchange of containers, the ownership switches among each participant. While picking up filled packages, the transport provider who also owns an allotment of empty packages refurnishes the sender with the same number of empty ones.
2. ***Systems with return logistics:*** A third party now owns the containers and is responsible for the return of the empty containers coming from the recipient. Following this logic, the recipient stores the empty containers after being used until reaching a cost-effective number. There are also two variants to this system. In a transfer system, the sender has full responsibility for the control, cleaning, maintenance, storage, and inventory management of the containers. In a deposit system, two configurations exist: a deposit-return system (DRS) with booking and deposit. The difference resides in the packaging ordering system. In the first option, the central agency closely monitors the packaging flow (including relative data such as the number of containers, type of package, etc.) through the account of the sender and the receiver. Each movement is registered in the account. For example, the sender's account is debited accordingly when he receives the containers. Then, the relative amount is credited to the sender's account and debited in the recipient's when the packages are sent to the recipient. In the latter option, for each transaction of the package, a deposit is paid or refunded. When the container is returned to the depot, the third party collects it and gives back the deposit to the party.

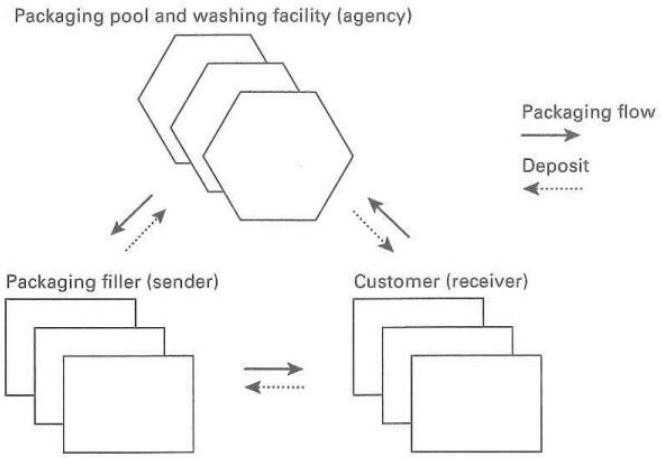


Figure 4: ***Depot system with deposit and possible nodes in a reverse logistics system for reusable packaging (Pålsson, 2018, p. 97)***

3. ***Systems without return logistics:*** The central agency also owns the containers that are rented to the sender who is responsible for all the logistic activities (cleaning, maintenance, etc.). This method reduces high investment costs for reusable packaging.

A table summarising the characteristics of those three systems may be found in **Appendix 5.**

Author date	Type of packaging – Sector - Topic	Type of actors mentioned in the RPS (stakeholders identified)	Number of categories of RPSs	Evaluation of the RPS: Barriers and drivers	Methodology
(Kroon & Vrijens, 1995)	Secondary returnable packaging for transportation in B2B dimension	Third party (central agency) Sender Receiver Transport provider	3 types of systems of reverse logistics systems. **Appendix 5**	Analyse benefits and drawbacks following the 3 models.	Case study in the Netherlands
(Lofthouse et al., 2009)	Consumer packaging only (including refill parent packaging not necessarily reusable, and reusable products) Aim: "Investigate the potential that refillable packaging systems can offer the consumer and the environment"	Customers Business Retailers	15 types of refillable packaging categorised "with respect to their delivery approach and level of consumer/business interaction". **Appendix 6**	Potential business barriers and drivers analysed in specific business areas (cost, space, marketing, etc.) and remarks following the type of refill. Consumer barriers and drivers associated with each type of refillable packaging	For consumers perspective ➔ Questionnaire For business perspective ➔ Workshop with Boots personnel from Product Bank and Environmental affairs to investigate potential implementation in a company ➔ No empirical evidence
(Ellen MacArthur Foundation, 2019)	B2C packaging focus (B2B and packaging free products not included in the framework) Aim: "Providing a framework to understand reuse"	Users Business Retailers	4 reuse models categorised "in terms of packaging 'ownership' and the requirement for the user to leave home to refill/return the packaging". **Appendix 7**	Presents 6 typical benefits and some potential implementation challenges for the 4 RPSs. The benefits are illustrated in the appendix cases but not the challenges which limits the reflection, to understand them and know how to overcome them.	Mapping of 69 worldwide reuse examples categorised by sectors and reuse models. Basic description: "Evaluation of more than 100 initiatives and interviews with over 50 experts"
(Zeeuw van der Laan & Aurisicchio, 2019)	FMCG: reusable products and packaging Aim: "Understand and define the role of consumers in closing the resource loops of FMCG"	Consumer Manufacturer Retailer Third parties	18 Product-service systems in FMCG. **Appendix 8**	/	Analyse a data set of PSS cases in FMCG through secondary data (website, FAQ, etc.)

(Coelho et al., 2020)	B2B and B2C packaging mixed Aim: "Review the background, opportunities for and experiences with reusable packaging".	Consumer Producer Warehouse Retailer	4 categories "based on the practical characteristics of such a system". **Appendix 9**	Analysed opportunities for RPS with the perspectives of the retailers, consumers, and producers. Studied environmental and economic impacts of RPSs	Literature review "with an emphasis on peer-reviewed scientific literature
(Tassell & Aurisicchio, 2020)	FMCG Industry Study reuse and recycling together	Consumer Company	5 reuse models categorised following the "key enabling behaviours". **Appendix 10**	/	Literature review
(Long et al., 2020)	B2C primary packaging (Food and household products industry) Aim: "Develop a design tool to classify current RPSs". **Appendix 11**	End consumer Business (provider's client) PSS provider (owning the package)	15 identified archetypal models following "product's characteristics (ownership of the packaging)", "service type (what do end consumers pay for?)", "place of service touchpoint (location)", and "delivery methods". **Appendix 12**	Environmental benefits and limitations (from literature review)	Theory building through theoretical saturation. Analyse of 53 cases through secondary data (company's reports, websites, and newspapers)
(Muranko et al., 2021)	FMCG industry – B2C market Aim: "Develop a comprehensive characterisation of reuse models and to evaluate their potential to deliver environmental value"	Consumer (user) Store Provider	5 mains reuse models and their variants following the reuse behaviour, the reuse-enabling infrastructure, and ownership of the reusable product. **Appendix 13**	No specific evaluation but remarks following some RPS models. Environmental value discussed	Use 92 cases to build the framework, analysing secondary data accessible on the internet
(Guiot et al., 2021)	Consumer packaging & Industrial and commercial packaging (ICP) Aim: "Mapping current reuse of packaging in France, allowing identification of current solutions for household packaging as well as ICP"	Consumer Point of sale and collecting point Professional	5 type of reusable packaging (1 concerning ICP). **Appendix 14**	French regulations/standards context that may encourage or discourage reusable packaging initiatives	Qualitative and quantitative analysis of reusable packaging thanks to the ADEME research

*Table 3: **Synthesis of nine research on primary RPSs***

8. Barriers and Drivers of the Different Reuse Packaging Systems

Empirical studies aiming to identify barriers and drivers for the different stakeholders of the RPS are rare. Those elements are mostly analysed through secondary data from case studies and business models, as we saw in **Table 3.**

The barriers and drivers in the literature (Coelho et al., 2020; Lofthouse & Bhamra, 2006) are mostly divided between businesses (producers, retailers) and consumers. We decided to present it in this same perspective while pointing out some specificities related to specific type of RPS and factors emphasised by other studies.

8.1. DRIVERS

8.1.1. Consumer Drivers

Consumer engagement and cooperation are important to ensure the effectiveness of RPSs (Greenwood et al., 2021b; Zeeuw van der Laan & Aurisicchio, 2019). Indeed, the value of the business proposition is built with the "*working consumer*" participating in the business process (Cova &Dalli, 2009 as cited in Kuzmina et al., 2019).

In the long term, reusable articles enable saving costs in purchases. The cost per use in the reusable version is lower than the disposable one even if the acquisition cost of a reusable packaging is generally higher than its single-use form (Mollenkopf et al. 2005 as cited in Carrasco-Gallego et al., 2012).

Refill trough dispensing systems offers customisation benefits; customers can choose their packaging, product and flavour combinations, as well as the quantity they want to purchase (Ellen MacArthur Foundation, 2019). Consumers may also benefit from convenience through delivery and pickup of returnable packaging (Coelho et al., 2020).

High Quality and Durable Design of Packaging
This criterion may influence consumer participation as the packaging should be practical, easy to transport and keep its beauty and its efficiency through multiple reuse according to (Bocken et al., 2022). Reusable packaging are now considered as a high-value asset, and businesses may offer some with better functionality, aesthetic, and look than disposable packaging since the initial investment is split across several uses (Ellen MacArthur Foundation, 2019). This superior design offers an improved user experience (EMF, 2019). Despite design analysis being frequently cited as being essential for an effective and efficient RPS, Coelho et al., 2020 and Mahmoudi & Parviziomra (2020) agree that few studies examined this aspect. The key factors include "shape and dimensions" but also "(re-)sealability, user-friendliness of (refill) systems, choice of material […], standardization and pooling, and reduction of product damage and losses" (Coelho et al., 2020, p. 9).

8.1.2. Business Drivers (Brand Owners and Producers)

Environmental Drivers
The depletion of natural resources forces industries to opt for reusable packaging instead of disposable packaging (Carrasco-Gallego et al., 2012).

Multiple authors such as Mansour et al. (2019) and Muranko et al. (2021) agree that reusable packaging has a higher environmental value than disposable packaging. We can refer the reader to the analysis in chapter 5. However, reusable packaging are not necessarily the best option for all supply chain packaging (Coelho et al., 2020). It depends on several factors. Indeed, even though they help reduce waste production and extraction of raw materials, RPSs may be questioned on the transportation scheme (Pålsson, 2018, p. 88), added weight following the material chosen, gas emissions and energy consumption for the reconditioning (cleaning, refilling, etc.) of the package (Mahmoudi & Parviziomran, 2020) and the number of reuse and recycling rate of the packaging (Błażejewski et al., 2021; Muranko et al., 2021). All the life cycle of a reusable packaging should be considered as it involves hidden environmental and financial costs (Song et al., 2015).

Reusable packaging may be a means to educate consumers on responsible consumption, encouraging them to consider their environmental impacts through resource efficiency (Lofthouse & Bhamra, 2006).

Cost Savings

Cost savings are directly linked to saving resources and positive environmental impacts. Companies can benefit from the same revenue while reducing their use of new materials through the reuse of the packaging by a same consumer in refill system or another consumer receiving the returned packaging (Lofthouse & Bhamra, 2006). Moreover, while reducing waste generation, the business can benefit from a cut to "landfill tax duties" (Lofthouse et al., 2009).

Bulk sale requires especially less elaborate sales packaging and materials, which reduces transport costs and emissions as well as packaging expenses (Kuzmina et al., 2019). The products are shipped in larger volumes and with less packaging for an on-site constitution of the final product for the consumer (Kuzmina et al., 2019). The EMF (2019) and Muranko et al. (2021) also point out additional cost savings by delivering products in concentrated form through dispensing machines, which will be diluted by the consumer with local available ingredients such as tap water.

According EMF (2019, p.6), "*globally, replacing just 20% of single-use plastic packaging with reusable alternatives is conservatively estimated to be an opportunity worth at least USD 10 billion."*

Marketing

RPSs can build a stronger relationship between the brand and its customers, as they rely on long-term use of the product (Lofthouse & Bhamra, 2006). It can be forced with a "refill subscription service" or "automatic reordering" that binds the consumer to a system (Ellen MacArthur Foundation, 2019). According to the EMF (2019), implementing a deposit and reward schemes to return the package in one's business may improve brand loyalty towards the firm. (Coelho et al., 2020) further note a possible customer loyalty to the shop in which the consumer returns his packaging.

Those reuse systems reflect a sustainable image of the brand to consumers, as many recognise the reduced negative impact on the environment compared to normal consumption schemes (Coelho et al., 2020; Lofthouse & Bhamra, 2006). Therefore, RPSs may constitute a comparative advantage in an increasing competitive market place (Lofthouse et al., 2009). These responsible business models can also attract more investors (Lofthouse et al., 2009).

Consumer Demand
The increased sustainable awareness of consumers on packaging pollution is a key factor to increase the demand for eco-friendly and reusable packaging (Coelho et al., 2020). The growing group of "green" consumers are especially seeking products offered in RPSs (Lofthouse & Bhamra, 2006).

8.2. BARRIERS

8.2.1. Consumer Barriers

Because FMCG items are nondurable and have a "low perceived value", persuading customers to participate in a reuse plan is challenging (Kuzmina et al., 2019, p. 76). As working consumers, they must complete some duties to secure the reuse of the packaging. Refilling a container through bulk dispensers, or returning containers to a location may be viewed as complex activities that require extra efforts, and may be considered inconvenient (Coelho et al., 2020; Lofthouse & Bhamra, 2006). To improve consumer convenience, it is critical to ensure the availability of products supplied in reusable packaging through a distributed and dense network of retailers, drop-off sites and refilling stations (EMF, 2019). Frustration elements may also arise from the waiting time needed to empty the package before refilling it, which imply a possible running out of the product (Lofthouse & Bhamra, 2006). Reuse models depending on technology may face technical failure, which can lead to customer frustration (Lofthouse & Bhamra, 2006).

8.2.2. Business Barriers

Logistic Complexity
In the case of returnable containers, the brand owners have to manage the returns and their stocks of packaging (Coelho et al., 2020). It is difficult to determine the right fleet size, particularly at the beginning of the RPS implementation. This uncertainty can cause overinvestments (Carrasco-Gallego et al., 2012; Hellström & Johansson, 2010).

As Twede & Clarke (2004, p. 11) observed in transport reusable packaging, it is important to get "the number of right kind of empty containers to the right place at the right time". Indeed, according to the authors, inefficient allocation can result in higher costs.

Managing the reverse logistic flows can be challenging. EMF (2019), Mahmoudi & Parviziomran (2020)and Pålsson (2018) suggest the use of tracking or tracing control (such as barcode system, radio-frequency identification (RFID) tags, etc.) to ensure the efficiency of the RPS and ease in inventory management. The risk of damaged packages, loss, and long cycle times[12] may induce supply uncertainty and additional expenses. The use of a "third party packaging/service provider" and the establishment of "shared logistics and cleaning facilities" can help to optimise operations (EMF, 2019).

Although "standardization allows for automatization and cost reduction, reaching larger markets" (Coelho et al., 2020), some manufacturers can be reluctant to accept it, especially because of marketing and/or technical reasons (Carrasco-Gallego et al., 2012). As Carrasco-Gallego et al. (2012) explain, for marketing visibility, manufacturers also prefer their own packaging showing the brand spirit. Moreover, depending on the product, special measurements may be required for conservation or security reasons, for example. The authors observe that developing pool systems for primary

[12] Also called turn-around, the cycle time refers to the "time required to prepare the packaging for a new cycle" (Coelho et al., 2020, p.8)

packaging is less common than secondary or tertiary packaging since standards permitting item interchangeability is necessary.

In addition, Coelho et al. (2020) explained that this lack of standardisation (interchangeability) between packaging designs with different suppliers generates higher investment in space and labour for the retailer to sort the different returnable containers.

Cost

One-way packaging is chosen over its reusable counterpart primarily due to lower energy, raw material, and labour costs (Golding, 1999). Indeed, RPSs generate additional operational costs for transporting, handling, storing, cleaning, repairing and managing (tracking and quality control among other things) compared to single-use packaging (Pålsson, 2018; Twede & Clarke, 2004). Moreover, higher investment costs may be required to ensure a durable and efficient packaging through time.

Multiple producers also reject reusable packaging options to avoid change costs related to their production and supply infrastructure already put in place (Kunamaneni et al., 2019).

A company may face higher costs from consumers keeping or disposing refillable packaging or reacting to deposit/refund return incentives by reducing their demand (Grimes-Casey et al., 2007).

Retailers may also face additional labour costs to manage the in-store refilling infrastructure, which happens less for prepacked products that imply a quick and simple purchase from the consumer (Lofthouse & Bhamra, 2006).

Space

Some refill models imply the supply of a product in large bulk containers, and its dispensing system alongside to its specific refillable containers. This leads to a reduced shelf and storage space for the retailer that could have been used to expose or store other brands (Lofthouse et al., 2009). Additional storage space is also needed for returned packaging from consumers that should be sent back to the producer (Lofthouse et al., 2009).

Health and Safety

Health and safety risks are a concern, especially in the cosmetics and food sector (Coelho et al., 2020). The worries are related to product quality that may be altered due to a decrease in the quality of the packaging by reusing and washing it several times (e.g. possible plastic migration). For example, strong flavour from the previous product may stay in the packaging and be mixed with the new filling.

Following a survey conducted by Tetrapack at the end of 2021, it is well accepted that the Belgian consumer considers glass (64.4 %) and cardboard (46.1 %) alimentary packaging as the safest packaging options, ahead of cans (29.1 %), plastic (21.8 %) and aluminium (21.4 %)(Sports+, 2022).

Due to “safety, spoilage, and contamination risks”, delivering some products such as “ harsh detergents and refrigerated or perishable foods” through bulk dispensing systems with current technology is challenging (Muranko et al., 2021, p. 26).

Customer Buy-In

Some upfront costs may be too high to engage the consumer in the RPS, either by a high pre-purchased container cost or deposit (Lofthouse & Bhamra, 2006). Finding the right deposit or reward scheme to compensate the efforts and pre-purchase costs is therefore a challenge for businesses (Ellen MacArthur Foundation, 2019)

“Rewards schemes (e.g. loyalty points, discounts, etc.)” are effective incentives for reuse in the case of refilling in a store (Muranko et al., 2021, p. 22). In the case of returnable containers, return rates are positively “affected by deposit fee systems” (Coelho et al., 2020, p. 7). Although “financial incentives

and subscriptions can influence", they cannot "enforce or guarantee consumer behaviour"; customers may tolerate the loss of deposits and discard reusable goods instead (Muranko et al., 2021, p. 25). If consumers are unlikely to return packaging, a bulk RPS or a high deposit in proportion to the replacement cost of this lost package is recommended to minimise financial negative impacts (Grimes-Casey et al., 2007).

Consumer Perceptions

As long as customers continue to consider a reusable or refillable packaging as disposable packaging, RPSs cannot deliver their environmental benefits (Lofthouse & Bhamra, 2006).This issue may also come from ineffective communication from the provider (Coelho et al., 2020).

The "limited understanding" of the consumer on the impact of the different packaging options and RPSs prevents them from making an educated choice (Coelho et al., 2020).

8.2.3. Other Barriers

"A concentration on international brands and long distribution distances in the retail channel are other reasons retailers prefer one-way packaging" (Golding, 1999).

Due to the different relationships within the supply chain and the number of actors influencing the system (producers, transporters, retailers, third party), operating a RPS is challenging (Coelho et al., 2020). Indeed, reaching an overall sustainable ecological and economic efficiency balance is complicated with all those processes and actors influencing the RPS (Golding, 1999).

Recycling imposed itself as the optimal solution, slowing other environmentally friendly initiatives such as reducing or reusing. The largest FMCG brands including Nestlé, Protecter&Gambler, PepsiCo and Unilever (Bocken et al., 2022) have signed up the New Plastic Economy Global Commitment led by the EMF, and joined the Plastic Pact Network[13] to investigate on possible reuse packaging schemes (Greenwood et al., 2021a). Nevertheless, recycling remains their favoured waste management approach although this option focuses on the end-of life of the product and "fails to address the overproduction and consumption of virgin resource material" (Bocken et al., 2022, p. 800). The greater the recycling rate, the easier it may be to remove the shame that comes with our high-consumption lifestyles because recycling is seen "as a get out of jail free card that makes consumption more acceptable" (Catlin & Wang, 2013 as cited in Kunamaneni et al., 2019, p. 254).

(Coelho et al., 2020) highlight that policy instruments such as the SUP banning, or tax on single-use packaging systems are important factors in the development of the RPS in B2C market. According to them, industry and national culture also play a role.

[13] "The Ellen MacArthur Foundation's Plastics Pact Network is a globally aligned response to plastic waste and pollution, which enables vital knowledge sharing and coordinated action. It is a network of national and regional (multicountry) initiatives which brings together key stakeholders to implement solutions towards a circular economy for plastic, tailored to each geography" (*Plastics Pact Network*, n.d.).

9. Reuse Not a New Concept – Reuse Models Updated

Applying the words of Aurez & Georgeault (2019) regarding the circular economy on reuse models is relevant. Although nowadays those practices are presented as new and recognised as solutions for our future, circular models as reuse models have always existed. Through history, multiple reuse practices stand as evidence. In the UK for example, until 1989, the milkman model was a common form of purchase, enabling bottle reuse through a "doorstep delivery and return service" (Muranko et al., 2021, p. 3). In Belgium, the DRS of beer bottles[14] is still anchored in the culture compared to France (L'Echappée Bière, 2020; Maurice, 2019).

At first, those reuse models are common sense, although their operational application in our "current global industrial economy" is less obvious (Aurez & Georgeault, 2019, p. 22). Hence, those reuse models should be updated and adapted to this new society changed by technical progress, the Industrial Revolution, the demographic evolution and the emergence of new society values such as the spread of the consumerism mindset (Aurez & Georgeault, 2019).

Even if reuse practices may seem known and natural, they are not yet generalised in every type of industry and products. As(Coelho et al. (2020) showed, RPS adoption experiences are mixed. As an illustration used by the authors, reusable glass bottles may be the standard in the brewery industry while soft drinks and water industries switched to disposable.

10. RPSs and Their Stakeholders

10.1. Importance of the System and Its Components

The whole supply chain/packaging system **(Figure 5)** should be taken into account to build an optimised business strategy. Brand owners, packaging suppliers, material producers, retailers, and waste recovery businesses have to collaborate to reach an equilibrium between packaging waste and product waste (Verghese et al., 2012). (Ellsworth-Krebs et al., 2022) add that communication, coordination and collaboration is a must to close the circular loop of packaging: one actor may not be able to close the loop alone, but the whole system around it can.

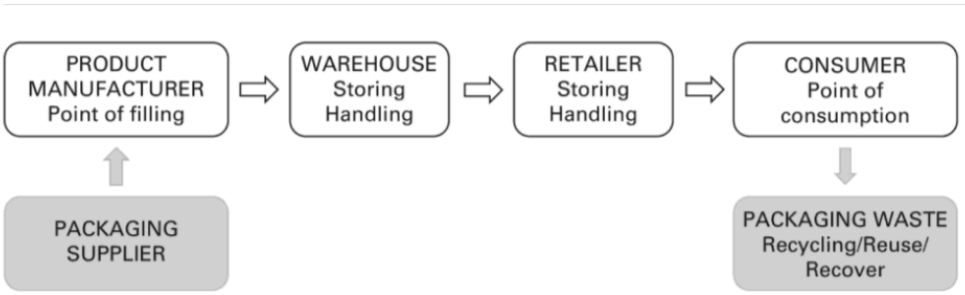


Figure 5: ***A simplified supply chain for a packed product (Pålsson, 2018, p. 10)***

Ellen MacArthur Foundation (2013, p. 23) also highlights the need to "think in 'systems'" when we develop circular economy practices. Indeed, "the ability to understand how parts influence one another within a whole and the relationship of the whole to the parts, is crucial. Elements are

[14] Consumers return their beer case with the empty bottles in the supermarket once the bottles are empty.

considered in their relationship with their infrastructure, environment, and social contexts."(EMF, 2013, p. 23).

10.2. RPS in an Organisational Configuration Perspective

In the same idea, the theory of "organisational configuration" can be applied in our research, analysing what the components of RPSs are, their interaction, and the context in which they operate. Ideally, there should be internal coherence within one organisation and between organisations in addition to external coherence with the environment of the whole system.

Grandori & Furnari (2008) refers to "technical laws of combination" that should be respected to create a structure, and in extension with our scope, a RPS. They develop the "'chemistry of organization': a science specifying how the basic elements composing organization systems can be defined, how they can and cannot be combined, what results they produce in different combinations" (Grandori & Furnari, 2008, p. 460). This concept is illustrated analogically with the creation of a new drug, associating different elements in a chemistry formula. Following the way the blocks of the organisation systems are combined, the results, the performance and effectiveness differ (Grandori & Furnari, 2008).

This theory explains that different barriers and drivers of RPSs appear since it depends on the composing organisations, their relations and the external environment of the system. The success of a RPS is determined by the aggregation and cooperation between the different stakeholders participating in the RPS. Mahmoudi & Parviziomran (2020) also emphasised that the design of the different components of the system together with the definition of the role and activities of the different stakeholders involved in a RPS are necessary steps to implement RPSs.

It is important to "specify the nature of organizational components or elements to be combined" and analyse deeper the "microscopic structure of elements composing the organised bodies or entities" (Grandori & Furnari, 2008, p. 460). In our research, it can mean analysing the different actors of the system more deeply, but also on a lower level, the reusable packaging and the technical infrastructure enabling the actual reuse.

11. Conclusion

We defined the contextual problem related to our linear economy and the environmental impact of excessive packaging. Although reuse should be the preferred waste management, authorities have focused on recycling practices. Specific objectives and incentives in regulations regarding reuse were overviewed, hidden behind recycling objectives (European Environment Agency, 2019). However, small improvements such as the directive (EU) 2019/904 banning some SUP and the Walloon Waste Plan promoting reusable packaging may be highlighted.

As FMCG are particularly concerned by pollution related to our throwaway consumption lifestyle, reusable primary packaging practices are particularly pertinent (Sousa & Souza, 2021) and will be analysed in our research.

The literature review presented multiple classifications of reusable packaging systems with two main categories separating RPSs following the role of the consumer and the business in the reuse of the package. Consumer behaviour towards reuse models is well studied in the literature. We may note that the different articles (Lofthouse et al., 2009; Muranko et al., 2021; Tassell & Aurisicchio, 2020; Zeeuw van der Laan & Aurisicchio, 2019) analysing reusable packaging in B2C market focus more on the customer point of view and not necessarily the retailer, the producer or the third parties' roles and activities.

Although multiple papers (Mahmoudi & Parviziomran, 2020, Ellsworth-Krebs et al., 2022) agree on the importance of cooperation between the stakeholders to ensure a successful RPS, an analysis of the whole system and its components was lacking in our review. However, this systemic perspective is important to better identify and understand barriers and drivers towards RPSs since the organizations, relationships and the external context influence those RPSs. Moreover, the different barriers and drivers related to RPSs seemed limited to explanations on the surface, and empirical evidence fail to deeply understand their impact.

In conclusion, applying the configuration theory and considering the gaps in literature, it would therefore be interesting to analyse and describe the interactions, roles and activities of the different organisations composing the RPS within their external context. Moreover, it is relevant to investigate on the different opportunities and drivers created by those organisational characteristics and external context following the different RPSs.

This reflexion leads us to formulate two research questions that will lead our study:

- **What are the roles and activities of the different stakeholders in their related reusable packaging system?**
- **What kinds of barriers and drivers do these different systems face?**

METHODOLOGY

Research Method

Since academic literature on the primary reusable packaging and/or in the B2C sector is scarce, we conducted exploratory research without a preliminary hypothesis but using the literature review as a foundation to understand the different elements and concepts mentioned in our empirical research.

The objective is to present the roles and activities of the different stakeholders involved in a reusable packaging system and identify the barriers and drivers related to the implementation and success of the RPS.

To do so, a multiple case study research was particularly interesting to carry out. Indeed, according to (Yin, 2003, p. 13), a case study is "an empirical enquiry that investigates :

- a contemporary phenomenon in depth and within its real-life context, especially when
- the boundaries between phenomenon and context are not clearly evident".

In our research, B2C reusable packaging is a new topic area, and it is therefore contemporary. The contextual conditions are important and complex to understand. This research method enables a collection of in-depth data to understand how a RPS works within its context and with its involved stakeholders.

A multiple-case study approach is appropriate to provide a stronger base for theory building (Eisenhardt, 1989) and explore the different types of RPS possible in different industries with their distinctive barriers and drivers.

Case Selection

At the beginning of our research, it was complicated to find a list of brands available in reusable packaging in Belgium. A review of the different brands and possible RPSs that could have been potentially analysed is available in **appendix 15**[15]. During this research, we quickly realised the necessity to understand the RPS from a systemic point of view, and not just from the brand's perspective choosing reusable packaging. Since those organisations are not isolated, we talk about systems; they have partners, and those relations determine the RPS. This finding was confirmed by the gap spotted in the literature.

Finally, the cases were mostly chosen through a judgmental process and following some criteria:

- **Market:** our research is focused on primary packaging, used by the end-consumer but also the business package enabling the refilling of the consumer container. We will focus on the FMCG sector and therefore exclude the HORECA sector or other takeaway services as well as reusable packaging for e-commerce used as transport packaging.
- **Diversification:** this thesis seeks to appreciate the diversity of RPSs knowing that a different combination of settings creates a unique model of reuse. We wanted to explore "unconventional examples", avoiding industry sectors with a "wide and long experience with reusable systems (e.g. beer, mineral water, soft drinks)"(Coelho et al., 2020, p. 10).
- **Geography:** We decided to only observe Belgian companies offering their products in a RPS in Belgium[16].

[15] The suggestions from our promoter and Mr Mossay were helpful. This list was reviewed several times to ensure back up cases cases to contactsince some main actors of the initial chosen case studies were not quickly available.

[16] Hence, the French company, Jean Bouteille, was not specifically chosen even though its refilling dispenser where available in Belgium. It was the same for Cozie, the cosmetic brand in bulk.

- **Established RPS:** The RPS should be in operation[17] at the time of the research to gather accurate data on the system.
- **Availability of the main interviewees**

We finally chose four cases, namely Superzero, Biotop, L'Alternative, and Bam![18]. Those were also selected to present extreme situations and replication within categories (Eisenhardt, 1989).

	Food	**Non-food**	
Solid	L'Alternative, Bam!		
Liquid	L'Alternative	**Personal care** (Biotop)	**Home care** Superzero Biotop

Table 4: ***Types of Products Sold by the Analysed RPS***

Reconditioning process done by the consumer	**Reconditioning process done by a professional**
Superzero Biotop	Bam! L'Alternative

Table 5:Main Type of RPS of the Cases

Data Collection

To analyse our cases, we chose a qualitative method through semi-structured interviews to collect the primary data needed to answer our research questions. Such a method allows flexibility in the answers, and gives the possibility to discover unexpected aspects (Qu & Dumay, 2011). The questions were grouped by themes and the interview guide was refined following the "type of actor" and their RPS. Those may be found in **appendix 16.**

Regarding the number and the sample of interviewees, for each case, we tried to identify[19] and have an interview with all the actors of the chain enabling the reuse of the packaging, from the producer, the retailer, and the possible third parties to the consumer. The difficulties lied in the choice of the "best" partner to interview, which explains why different actors with the same role were interviewed for the same case. The availability of participants also complicated the tasks. We tried to directly interview consumers for each case; nevertheless, this was unsuccessful for some cases due to a lack of time and the complexity to find participants.

Multiple Data Sources

To have a better understanding of the different cases, triangulation of evidence was relevant. Hence, beyond the interviews, we collected data from observations[20] (remembered through notes, pictures,

[17] For example, Tarh, an online bulk shop was rejected since it was still in its beginning at the time the choice was done.
[18] To know more about those brands:
[19] This was done through secondary data found before interviews and thanks to interviews of some actors in a snowballing method.
[20] In the ethnography method, our own experience as testing consumer for all 4 RPS could have been used to support or add new insights, however due to a lack of time and the amount of other data, we decided not to integrate it.

and videos), small discussions, and internal documents furnished by organisations (e.g. reports, research on environmental justification for RPS, presentation for business customers, etc.).

Secondary data on the cases was also useful. It provided new insights on the topic, helped us understand the role of the different actors and the system embedding those companies, which was also helpful to prepare our interviews. The sources were diversified: official websites, press articles, social media, reports, etc.

Data Analysis

Thanks to transcriptions, we first synthesised the data for each interview (stakeholder) in tables using the categories of the interview guide. Through the process, we discovered the role of each participant of RPSs. To provide a tool for the reader to picture the RPSs with their stakeholders and within their external context, we built an individual "stakeholder map" for the four RPSs **(Figure 6,7,8,9).**

The barriers and drivers were analysed following three[21] levels of analysis (the package, the organisations, the macro-context), later subdivided in frequent mentioned themes coming from our code. This creates a data structure with different codes order as suggested by (Gioia et al., 2013). Secondary data was used to complete lacking information and highlight important barriers or drivers.

	Name and position of the interviewee[22]	**Role in the organisation**	**Source of the data collected (primary**[23] **and secondary data**[24]**)**	**Interview n° & Transcripts in Confidential Appendix**	
CASE 1: Bakery producer selling his products in returnable Weck jars supplied by a DRS operator, and washed, collected by himself.					
Boulangerie L'Alternative	Pierre Henen, founder	Producer and Business customer of L'Empoteuse, reconditioning operator	Online call 31/01/22- 50 min Observation 26/01/22 -1h	I1	
L'Empoteuse	Marie Jemine, founder	DRS operator, jar reseller	Online call 14/01/22- 1h10 Observation 01/02/22- 4h Confidential reports	I2	
Bring Back*	Laurent Halmes, founder	Cleaning operator in partnership with Terre and DRS operator, jar reseller	Face-to-face- 1h -28/01/22	I3	
Vrac in box *	Manager	Bulk store. Customer of L'Empoteuse, Biotop, Bam! (formerly)	Face to face 17/05/22- 17min	I4	
Entreprise de travail adapté (ETA[25]**) Axedis**	Yannick Quataert, Operations manager	Warehouseman for L'Empoteuse, previously cleaning operator	Online call 02/03/22 - 40 min	I5	

[21] Those will be described in the "Results" chapter.

[22] Some interviewees were used for different case studies as those actors are linked with different RPSs.

[23] All the interviews were conducted in French and recorded to facilitate the analysis backwards through transcripts.

[24] For the actors not interviewed (such as the ETA Travie or Superzero's cleaning actor), we refered to secondary data and information collected from their partners.

[25] "The Adapted Work Enterprise (ETA - formerly known as a sheltered workshop), a unit for the production of goods or services, primarily employs disabled people for whom this type of company constitutes, temporarily or permanently, a tool for work and social promotion" [Free translation] (Le Guide social, 2006)

Entre-Pot	4-year employee, managing the shop	Bulk store. Collection point of L'Alternative. Customer of Biotop, Bam! (before) & Jean Bouteille	Face-to-face 31/03/22- 46 min	I6	
Piu Sani	Co-manager with a salesperson	Gluten-free Italian specialised store. Customer of L'Alternative	Face-to face 19/05/22 -15 min	I7	
Consumer A	Man	Consumer of L'Alternative from Piu Sani	Face-to face 19/05/22 - 10min	I8	
Consumer B	Woman	Consumer of L'Alternative from Piu Sani	Face-to face 19/05/22 - 10 min	I9	
CASE 2: Brand of dried mix solutions in returnable screw-top jars, organising the whole process of reconditioning itself with sub-contractors.					
Bam!	Florence Posschelle, cofounder and CEO	Producer & DRS operator	Online call 09/03/22 – 26 min. Phone call 15/03/22- 10 min Confidential reports	I10	
ETA Travie	/	Warehouse, cleaning and conditioning operator	/	/	
Entre-Pot	4-year employee, managing the shop	Bulk store. Collection point of L'Alternative. Customer of Biotop, Bam! (before) & Jean Bouteille	Face-to-face 31/03/22- 46 min	I6	
Vrac in box	Manager	Bulk store. Business customer of L'Empoteuse, Biotop, Bam! (before)	Face to face 17/05/22, 17min	I4	
Bio 4 Seasons	Co-manager	Organic shop customer of Biotop (single-use form), Superzero and Bam!	Face-to-face 15/03/22, 48min	I11	
Tarh	Employee and manager	Online and in-store bulk store. Biotop's customer (bulk form with first-purchase bottles & single-use form)	Short discussions face-to face, 03/02/22 & 12/06/22	/	
CASE 3: Cleaning bulk products brand sold through an automatic dispenser rented by the retailer. In-store refills of fixed volume in the first-purchase consumer packaging. (B2B Returnable jerrycans)					
Superzero	Olivier Potvin, co-fonder	DRS operator for the jerrycans, Dispenser's owner and co-creator of the products	Online call 27/01/22 -1h08	I12[26]	
Cleaning actor	/	Cleaning actor for the jerrycans	/	/	
Atelier Jean Regniers	Eric Bernard, sales manager for the detergents and bleach sections	Sub-contractor for the production	Online call 15/03/22 – 47 min	I13	
Supermarket X	Director	Testing customer of Superzero	Face-to-face 25/02/22- 15 min	I14	
Bio 4 Seasons	Co-manager	Organic shop customer of Biotop (single-use form), Superzero and Bam!	Face-to-face 15/03/22, 48min	I11	
CASE 4: Cleaning bulk product brand selling its products through a manual dispenser. In-store refill in any package chosen by the consumer. (B2B Returnable jerrycans)					

[26] Due to technical issues, the recording was lost, therefore our analysis was based on our notes.

Biotop	Elisabeth Horn, director & Kelly, employee	Producer, reverse logistic operator for the jerrycans, cleaning operator	Online call 17/03/22, 1h	I15	
Vrac in box	Manager	Bulk store. Business customer of L'Empoteuse, Biotop (bulk form), Bam! (before)	Face to face 17/05/22, 17min	I4	
Entre-Pot	4-year employee, managing the shop	Bulk store. Collection point of L'Alternative. Customer of Biotop (bulk form), Bam! (before) & Jean Bouteille	Face-to-face 31/03/22- 46 min	I6	
Bio 4 Seasons	Co-manager	Organic shop. Biotop's customer (single-use form), Superzero and Bam! customer.	Face-to-face 15/03/22 48min	I12	
Tarh	Employee and manager	Online and in-store bulk store. Biotop's customer (bulk form with first-purchase bottles & single-use form)	Short discussions face-to face, 03/02/22 & 12/06/22	/	
Biotop Consumer	Woman	Consumer	Online call, 06/05/22, 15 min	I16	

Table 6: ***Description of the Respondents***

RESULTS

Structure

Although we agree on multiple common points between the four RPSs (similar barriers and drivers for B2B containers from Biotop and Superzero and B2C returnable packaging from L'Alternative and Bam!), to facilitate the reading and the differentiation between the two main RPSs presented, we divided the analysis in two:

1. RPSs of cleaning bulk products (Biotop and Superzero)
2. RPSs of food products in returnable packaging (L'Alternative and Bam!).

First, we described each RPS of cleaning bulk products, presenting the roles and key activities of their related stakeholders. Then, we reviewed the commonly the barriers and drivers of those two RPSs following two levels of analysis while specifying differences when needed:

1. Design packaging: Elements directly related to the reusable packaging itself and the functions it should have to be reused, optimise the RPS and be convenient to all stakeholders. Those elements create barriers/drivers impacting the RPS.
2. Organisations and their relationships: Barriers and drivers coming from or impacting specifically one actor of the system (the brand, the third party, the retailer or the consumer). Those factors may impact the rest of the system due to the existing relationships in the supply chain. They also influence the creation or the impossibility to create a relation between specific actors.

We followed the same process for the two RPSs of food products in returnable packaging. The last level of analysis of the barriers and drivers is common to the four RPSs (differences highlighted when needed):

3. External context: Aspects impacting the success of RPSs and resulting from the general macro context over which the organisations have little/no control. It is related to the legal, social, economic environment and the industry sector in which the central organisations (Biotop, Superzero, L'Alternative, Bam!) operate.

To have an overview of the four RPSs studied, the lector is invited to consult a comparison table in **Appendix 17**. The conclusion of this chapter offer a synthesis of the barriers and drivers following the type of RPS and the three level of analysis.

CLEANING BULK PRODUCTS

CASE 1 – Superzero

Created in 2019 by Olivier Potvin and Arthur Peemans, Superzero is a brand of cleaning liquid bulk products. To ensure the best user-friendliness for shops and consumers, they developed an automatic electric dispenser to provide their products in their specific first-purchase plastic recyclable bottles **(Appendix 17)**.

Although the machine now only uses Superzero goods, the start-up is open to suggestions of items from other companies. Actually, they initially wished to provide companies with their dispenser equipment. However, the ones contacted did not want to invest to change their established logistic supply chain. They finally decided to partner with the ETA Atelier Jean Regniers (AJR) instead of producing their own products, believing that their "real added value is in developing the right distribution system allowing a large-scale transition towards zero-waste consumption rather than reinventing the wheel on existing products." (ecotapsuperzero, n.d.)

Responsibilities and Roles of the Actors in the RPS

As the RPS operator, Superzero manages the system enabling the reuse of the final consumer packaging but also the intermediate packaging, the 20 L jerrycans. They own the dispensers, manufacture them in Brussels and are in charge of their corrective maintenance in the tenant shops. The brand ensures the distribution of the jerrycans to the stores and their collection so that they may be cleaned in Flanders.

Superzero's client (organic, local, bulk store or supermarket) rents the dispenser and orders its replenishment (the returnable jerrycans and bottles). They oversee the preventive maintenance[27] to properly present the machine to the customers and ensure a smooth refilling.

AJR produces the ecological cleaning products respecting Superzero's specific recommendations (regarding viscosity, colour, and perfume). Another washing company looks after the cleaning of the jerrycans since the ETA is not equipped for this process. They only control their quality before refilling it to avoid any product contamination.

The consumer should bring back the €1.5 bottle he bought during his first purchase to refill it. He should ideally rinse it out to avoid contamination of the product with residuals.

	Responsibilities and key activities	**Cost of the reuse**
Superzero	• Organise the system, choose the right bottle, first purchase price & product properties and price • Build the dispenser • Collect the jerrycans while delivering or maintaining the dispensers	• Cost of the dispenser, plastic bottles • Reconditioning & Reverse logistic cost of the jerrycans

[27] They should wash the drip tray and verify the cleanliness of the nozzle through which the products flow.

	• Store and order the empty bottles and full jerrycans from AJR before the delivery	
ETA AJR	• Produce, condition the products in the jerrycans • Store	/
Retailer	• Tenant of the dispenser • Preventive maintenance (+ change the empty jerrycans) • Storage of the machine, the bottles, and empty jerrycans	• Rental of the dispenser • Product cost per 20L jerrycans • Empty bottles
Cleaning actor for jerrycans	• Cleaning responsibility	• Energy
Consumer	• Buy and bring back his bottle to fill it in-store • Maintain his bottle (rinse out the residual product)	• €1.5 first purchased packaging cost • Fixed volume filling cost

Table 7: Responsibilities and Key Activities of the Stakeholders in Superzero's RPS

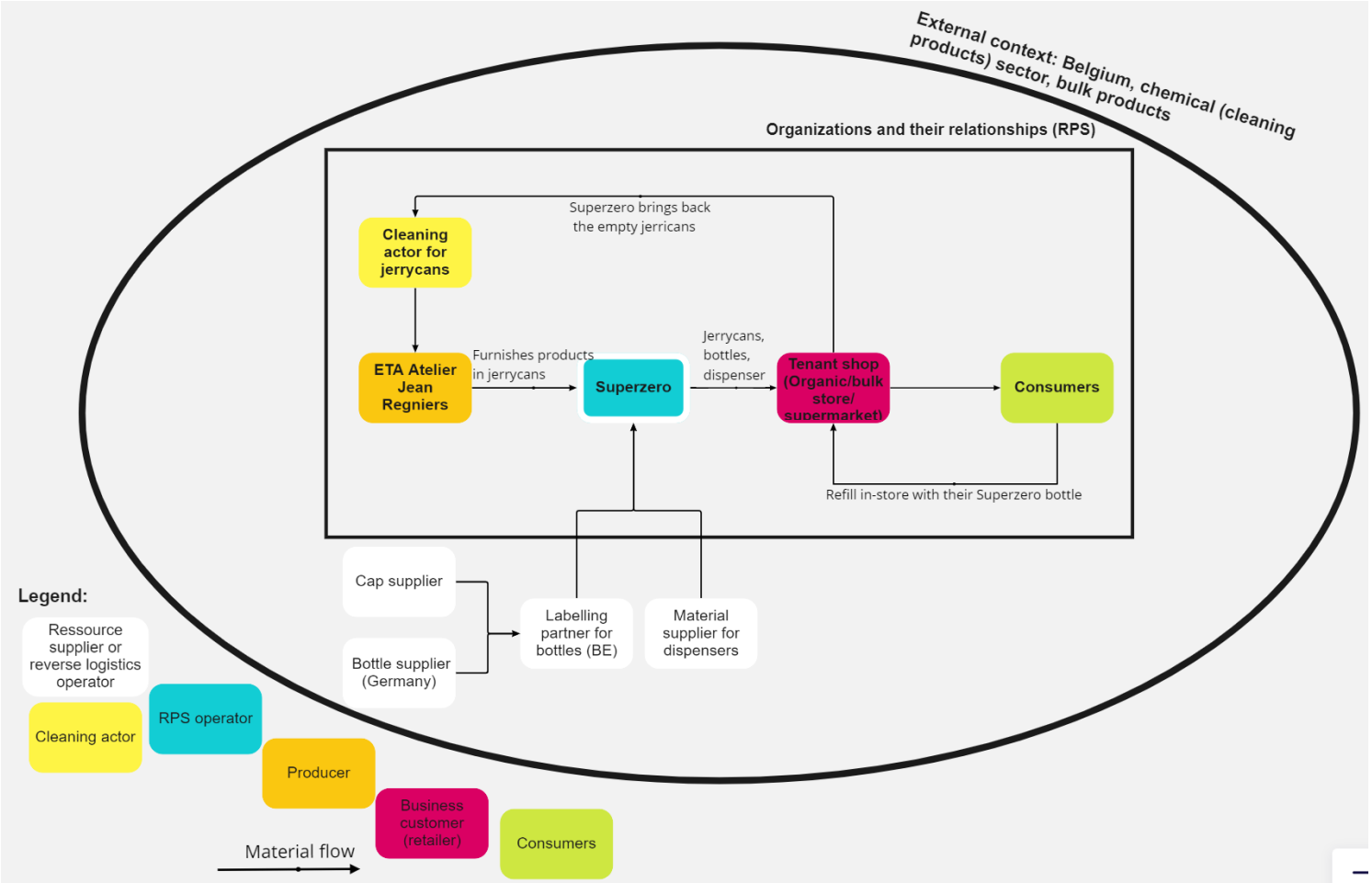


Figure 6: Superzero RPS stakeholder map[28]

[28] All the following "Stakeholders map" where realised by our work.

CASE 2 – Biotop

Created in 1996 and acquired in 2012 by the couple Elisabeth Horn and Richard Ceulemans, Biotop is a brand producing organic cleaning and hygiene products. They sell their products in bulk through 25 L returnable jerrycans[29] using a manual dispenser (a pump or a tap) to enable the filling of the end-consumer package **(Appendix 18).** The same range of products is available pre-packed using 100% recyclable plastic.

Responsibilities and Roles of the Actors in the RPS

Biotop produces and conditions all its liquid range products in their factory. They ensure the collection of the empty jerrycans in stores before washing and refilling them. The distributor or a carrier takes care of delivering the products.

Biotop clients (organic, local, and bulk stores) should ensure a smooth refilling experience for the consumers through accompaniment, and maintenance of the pump. They should return the empty jerrycans with their initial cap and labels, as well as ensure they contained the original Biotop products to avoid product mixture.

Biotop consumers must use their own container, purchase one or receive one for free in the store. They should ideally reuse their container and maintain them though refills to ensure their own safety.

	Responsibilities and key activities	**Cost of the reuse**
Biotop	• Organise the system • Produce cleaning liquid product and furnish labels • Reverse logistic operator • Clean the jerrycans	• Cleaning & Reverse logistic costs
Retailers	• Preventive maintenance (+ change the empty jerrycans) • Help the consumer through their refill experience • Store the empty jerrycans	• Product cost per jerrycans • Pump first purchase cost
Consumers	• Prepare or acquire a container • Refill it in the store • Label, store and maintain it appropriately	• Refill cost per chosen volume

Table 8: Responsibilities and Key Activities of the Stakeholders in Biotop's RPS

[29] The brand also offers bulk powder products in 10 kg single-use paper bags. However those products were not described enough in our interviews, and we thus focused on their liquid range in the thesis.

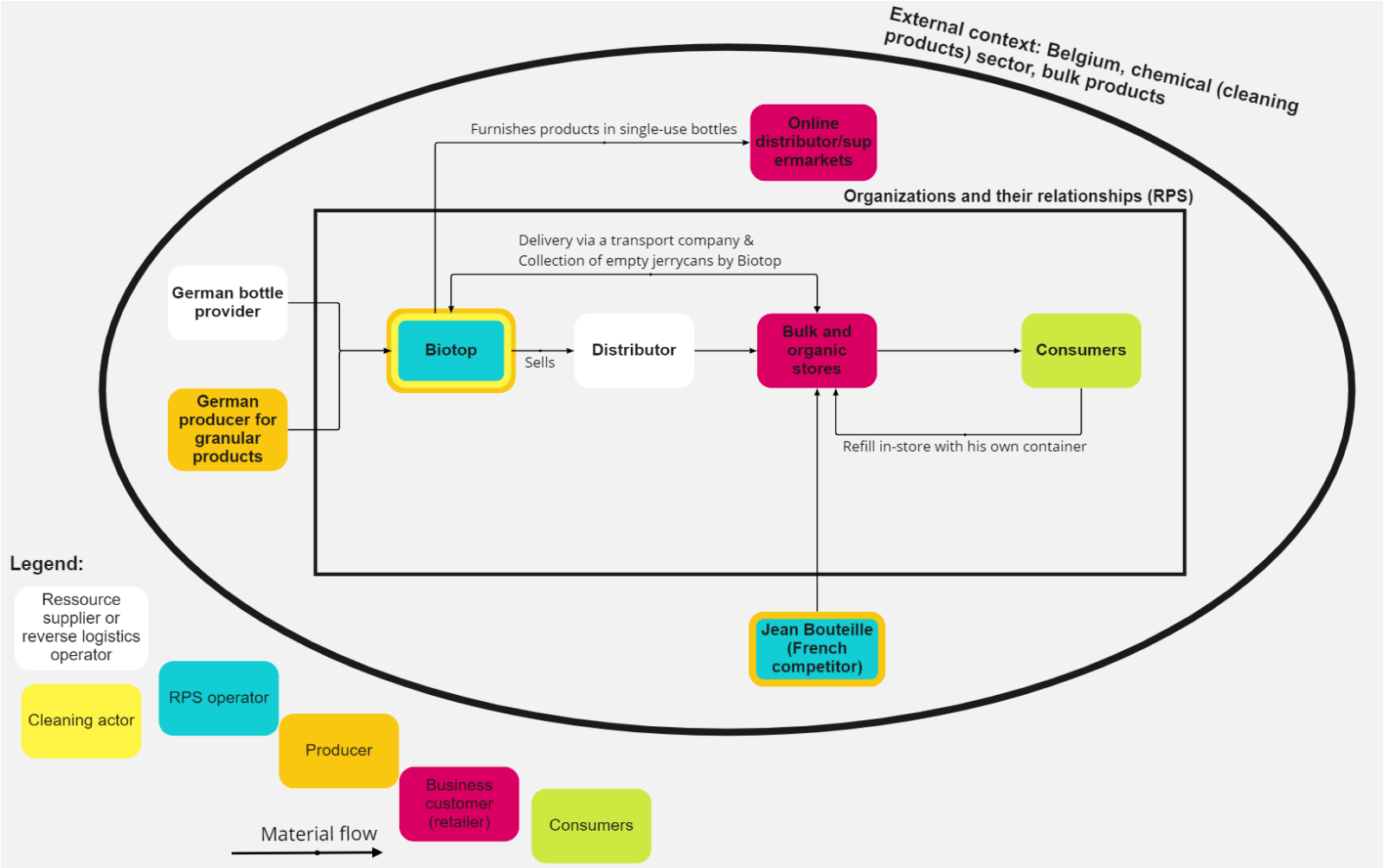


Figure 7: Biotop*'s RPS stakeholder map*

1. Design Packaging Analysis

Choice of the Reusable End-Packaging (B2C Packaging)

Plastic is the most used material for liquid cleaning products even in single-use packages. Unlike Biotop's case, Superzero imposed its choice for the packaging: only their bottles can be used through their dispenser. Traditional bulk like Biotop allows the consumer to reuse his existing waste (e.g. old household plastic cans, glass bottles, etc.). Vrac in Box's manager adds that consumers can also opt for free shared containers (hers or brought by consumers) she makes available, "*to help out if they don't have their cans" (I4).* Filling Biotop products in another household product brand, a competitor such as Ecover[30] is fairly annoying for Ms Horn but the aim, avoiding waste, is more important: *"Whatever container is used, I think there's enough waste." (I15)*

Superzero reviewed multiple settings for their bottles to take into account consumers' convenience, durability through reuse, legal requirements, and technical requirements of their products. Their criteria finally reflect the reflection followed by customers to choose their container in traditional household liquid bulk purchase:

- **Appropriate volume:** The need for a specific volume depends on the customer: L'Entre-Pot's manager explains, "*I fill my 5 L detergent so I can relax for a while"* (I6), while Biotop's consumer says, *"the one litre size is actually a good size"* (I16) talking about the milk glass bottle she always refills. Superzero 1 L bottles will always be fully filled up.
- **Lids characteristic:** The Superzero cap bottle was chosen to be reused and dose products.
- **Product preservation:** The packaging's material should avoid chemical reactions with the products.
- **Eco-friendliness:** Although glass is infinitely reusable, Superzero plastic bottles can be reused 25 times in average and even go up to 50 times. Moreover, plastic "production and recycling process require much lower temperatures" than glass (ecotapsuperzero, n.d.).
- **User-friendliness:** Superzero's and Biotop's consumers agree that the packaging should be easy to handle, washable and transparent to see the volume left. Superzero bottles offer in some way prepacked product convenience, showing through the label all the necessary information for the consumer and the cashier (the tare, the barcode with the fixed price for the fixed content volume, legal mentions required for chemical products).
- **Strength:** *"Unlike glass, plastic is resistant to little shocks"* (ecotapsuperzero, n.d.). This criterion is important to protect the product from damages during its transportation and ensure a safe customer experience during its use.
- **Weight:** A light packaging lowers transport costs (financial and environmental) or burden for the consumer and the brand. Plastic is lighter than glass, and the Biotop consumer admits that **"***when you have four glass jars with 1 kg inside them, it quickly becomes heavy" (I16).*
- **Affordability**: Some materials such as inox are expensive and require a high initial purchase price (e.g. €8) to cover potential losses, which is a barrier to purchasing.

Choice of the Returnable Jerrycans Used as Dispensers (B2B Packaging)

Biotop and Superzero chose rigid plastic jerrycans to directly refill the consumer's packaging. They both decided to reuse them, organising their reverse logistics without deposits.

[30] "*Household cleaning products company 'Ecover' provides refill stations across Western Europe"* (Kunamaneni et al., 2019, p. 253).

2. Organisations and Their Relationships Analysis

2.2. Barriers

Brand

Poor Reuse Rate of the Packaging

According to Mr Poncin, consumers do not reuse their bottles enough and buy new ones. This implies additional costs for the start-up and the retailers that must also buy new bottles. To encourage consumers to reuse their bottles, they added an icon on the label saying "*refill me*". This reuse problem of the consumer packaging is not financially internalised in Biotop's case, although their aim is also packaging reduction, which implies consumer packaging reuse.

This challenge really depends on the consumer. Vrac in Box observed: *"for three years, there's been a lady for example who always has the same cans"* (I4) and Biotop's consumer also confirms that she reused an old milk glass bottle for several years.

Need to Build a Network of Refilling Points

Building a network with multiple refilling points is important to encourage the adoption of an RPS and to ensure consumer convenience and product availability. Bio4Seasons explained that consumers may be discouraged from trying Superzero products and adopt the concept of reuse if there is no refilling point nearby to "*run fast around the corner"* (I11) in case of shortage. With its longer existence, Biotop already is available in multiple stores.

Retailers

Work Burden

In general, bulk products necessitate more attention, organisation, and labour than pre-packed products for retailers. However, for bulk "beginners", cleaning bulk products may be easier to begin with in the zero-waste movement, observing the case of Bio4seasons. Unlike bulk food products, the store worries less about controlling how long the products stay in the bulk dispenser, their expiration date, or their sales rotation.

Convenience of the Dispenser System

Offering a dispenser solution that is affordable, practical, and effective for the bulk distribution of liquid products is challenging. The dispenser should be adapted to the nature of the product, its viscosity to enable a smooth refill and be "*easily pumpable"* (I15) according to Biotop, Superzero and Vrac in Box.

According to feedback collected to launch Superzero and Mr Poncin's experience, the refill procedure of liquid products is frequently dirty and not convenient: the liquid leaks on the hands, the ground, and the container. Ms Horn agrees: "*the general problem with bulk like this is that there is always a little drop, even with our pumps."* (I15).

According to Vrac in Box and L'Entre-Pot, this results in a negative experience for the retailer managing preventive maintenance and the consumer. They should clean and ideally help the unaccustomed consumers to serve themselves. However, once the consumer gets used to the manual pump, its correct utilisation is easy, confirms Biotop's consumer. According to Biotop, client education on how

to operate the dispenser correctly and store help throughout the refilling process is therefore critical to ensure efficient distribution.

L'Entre-Pot also emphasises that messy filling process also implies product waste and lost sales due to the difficulty of entirely emptying the jerrycans: *"you always have at least 1 L in the bottom that you can't get back" (I15).*

High Cost of Technological Dispenser Enhancing Convenience for Liquid Bulk Purchasing

The use of "advanced" technology to dispense the product may be an opportunity when we observe Superzero and Jean Bouteilles's solution, a French company selling liquid bulk products through a manual fountain working with compressed air[31]. "*Obsolete in terms of technological progress"* (I15), L'Entre-Pot replaced Biotop[32] by Jean Bouteille because they deliver a more convenient system reducing product waste: "*The pockets are emptied up to 99.5% […] it's very easy to use and that's why the customers like it a lot"* (I15).

Albeit a little impressive for initial purchases, Superzero's electrical dispenser also offers a simple and clean refilling process for consumers and preventative maintenance for the retailers. Indeed, this RPS was built around the dispenser and eco-conceptualised regarding the technical barriers usually encountered for liquid cleaning bulk products.

However, this technology comes with higher financial costs. To soften the building expenditures of the dispensers, Superzero decided to rent the machines, which is an additional cost for the retailer. As a tenant shop, Bio4Seasons indicated the location charge as a constraint since product sales must be sufficient to cover the fixed cost.

Space for the Dispensers

The size of the store limits the space for the bulk dispensers. Superzero's dispenser can take up to one square metre and according to L'Entre-Pot, Biotop jerrycans and its pump system are also cumbersome. It is hard to convince stores to sacrifice the space they could use to display more products. The Supermarket's director agrees that "*freeing up that space*" (I16) may be the biggest challenge.

Lack of Environmental Consumer Interest

Bulk services are directed towards a certain type of customer profile. Supermarket X decided to remove Superzero's dispenser as it did not generate enough revenues during the test period. The director explains that they did not have the right customer base but that it would have worked better in another province where "*there is a lot more demand for everything that is bulk, […] ecological, even organic and all that*." (I14) This issue is also pointed out by Bio4Seasons: Superzero's system may be more attractive for city residents, like Brussels since "*they're more into the bulk vibe"* (I12) than in the countryside.

[31] Their system works like wine box with a tap. The lector may note that plastic pockets in their dispenser are not returned to the brand to be reused but recycled for the dispenser's construction. More information is available here: https://jeanbouteille.fr/en/retail-et-metier-du-vrac/rayon-vrac/

[32] Only products that are not available in Jean Bouteille's range remained in L'Entre-Pot.

Consumers

Mental Burden

Reuse necessitates a certain level of organisation from the consumer: he should prepare his containers before shopping and bring them. *"But, like when you go shopping, […] without a bag it doesn't work either"* (I16) points out Biotop's consumer. Therefore, it is a question of habits.

Barriers Regarding the Reusable Jerrycans (B2B Packaging)

Those barriers were mostly discussed in Biotop's case but they may apply to Superzero's case since they also reuse the jerrycans. Some of those barriers may explain why, according to Vrac in Box, most bulk brands do not reuse their package. Biotop confirms: *"We are one of the only ones to do that in Belgium"* (I15).

- **Cost of the Reuse**

According to Biotop, reusing a jerrycan may cost more than buying a new one, taking into account the transportation, the energy to clean it, the labour to organise the collection and the rising prices of energy and fuel. AJR would want to offer cleaning services but "*it requires a lot of pressurised water, hot water to clean the jerrycan and remove the residues"* (I13) and therefore another investment.

- **Reverse Logistics Management**

It requires **ti**me and organisation to collect the jerrycans. Both brands decided to use this reverse logistics to "*have a direct exchange with the shops, with the customer"* (I15).
Biotop chose joint collection for all the retailers outside of the delivery; Superzero delivers, maintains the dispenser, and takes back the jerrycans at the same time. According to Biotop, a joint collection entails finding a suitable time for multiple stores in a region until which all shops can wait according to their space. The other reverse logistics option followed by Superzero may be interesting to avoid an accumulation of stock, but it also complexifies the journeys.

- **Storage Space at the Retailers**

With a limited storage space, L'Entre-Pot and Vrac in Box agree that it is *"difficult when the jerrycans [are] piling up"* (I4). This limited space involves a higher frequency of collection for the producer.

- **Lack of Efficient Information Sharing Through the Supply Chain**

Although passing through a distributor (used to driving to all the shops for deliveries) is efficient for the reverse logistics, the more intermediaries in the supply chain, the more communication is critical to ensure the reuse, and some information enabling the efficiency of the RPS may be lost through the supply chain. Biotop says "*there are still customers who don't know that we collect the cans back*" (I15) because the distributor did not relay the information. This is the case for Bio4Seasons, which bought the disposable range but was not aware of their bulk range and Tarh, that assumed that the 5 L jerrycans were likewise returnable. To address this issue and avoid losing packages (thrown away or repurposed), Biotop added an informative label on the 25 L jerrycans.

2.3. Drivers

Brand

Be in Accordance With One's Values

Both brands and their managers are environmentally driven. Therefore, as Biotop says, offering their products in bulk and reusing the jerrycans is *"just a way to be aligned with our values":* they *"do it by choice"* (I15). Sharing the zero-waste approach, actors of RPSs accept to sacrifice their convenience and financial savings for the reuse of the package to be possible. Observing the cases of Biotop and Superzero, work burden and poor margin products are better tolerated in stores sharing the desire to offer eco-friendly products. According to AJR's sales manager, choosing supermarkets such as Carrefour or Delhaize is probably more complicated for Superzero since they are profit-driven and at the moment, their solution does not generate enough revenues.

In B2B relations, a deposit system is not necessary since their retailer partners do not really need incentive: they are happy to give back the cans and avoid waste. Even if L'Entre-Pot and Vrac in Box complain about the storage space for the empty jerrycans, their zero-waste mentality (and the volume and robustness of the package) discourages them from throwing it away.

Consumers

Relative Low Cost per Refilling

Economically speaking, bulk purchasing is interesting since the consumer will just pay once for the package (in Superzero's case) and then only pay for the consumable. The Supermarket X's director agrees: *"We [don't] pay for the packaging that we pay for when we buy a traditional Dreft bottle, for example. So […] it was very competitive in price*[33] *compared to others."* (I14) L'Entre-Pot also confirms: "*For the same quality, bulk organic is cheaper than packaged organic"* (I6).
Biotop and Superzero have the same aim, being *"affordable for anyone who wants to take the step of using environmentally friendly, effective products"* (I18). Therefore, the content price is kept relatively low to attract the largest possible audience to zero waste consumption. AJR supports this idea: "*it is not because it is zero waste that we have to pay more."* (I13) Biotop's consumer also realised that it was financially more interesting to buy bulk household products instead of single-use products: *"If I compare the price of Colruyt's Eco brand laundry and the price per litre of Biotop laundry in bulk, they were almost the same, except that there is one less plastic can"* (I16).

[33] The price for washing powder is 24 to 25 cts/dose, or €5.99 per litre. A low price compared to the brands, Bonus (17 cts/dose or Ecover (30 cts/dose). https://www.lalibre.be/lifestyle/magazine/2021/03/22/diminuer-par-20-notre-consommation-de-bouteilles-plastique-a-usage-unique-cest-facile-QQSNIMQ2DFAT3KVH5FHMBE4NOA/

CASE 3 – L'Alternative (& L'Empoteuse)

Founded in 2019 by Pierre Hennen, L'Alternative is a small artisan bakery using organic, gluten-free, and lactose-free ingredients for intolerant or coeliac people. Part of his products are pre-packed and sold in reusable glass jars (Wecks[34]), the rest is mostly wrapped in paper bags. The products are available in his physical shop, online with home delivery services, or through a partner store that may serve as a collecting point or reseller.

Responsibilities and Roles of the Actors in the RPS

Marie Jemine, known as L'Empoteuse, is L'Alternative's container supplier. As a DRS operator, she mostly sells glass containers in a shared pool system (customers might receive already used and washed containers from other DRS network members). They are permanently marked with L'Empoteuse's label, including her name, the pot number and a code bar for the deposit.

The cost for a container bought by a producer, a bulk store[35] or a HORECA actor to this supplier is composed of two parts:

- The service subject to 21% VAT (value-added tax) includes L'Empoteuse's costs for labelling, commercial and marketing work, logistic deployed, etc. It may include additional costs for a collection service at the producer's retailers or for a cleaning service if required by the producer. L'Empoteuse works with a cleaning[36], labelling, storing partner: the Axedis ETA. Charging the service separately is a means of protection for her, as her expenses are paid from the customer's first order even if the container never comes back to her.
- The deposit not subjected to the VAT is the net value of the container.

To keep it simple for all members and final consumers, the deposit amount is standardised for each type of container. For example, all the Wecks cost €1 (jar and lid included), no matter their volume. In contrast, the service depends on each type of container and its volume. It is the "*small adjustment variable to have enough margin on the larger jars"* (I2) which are usually more expensive and require more space. An example of a customer order to L'Empoteuse may be found in **Appendix 20.**

Like 95% of L'Empoteuse customers, L'Alternative decided to internalise the cleaning of the Wecks, which are normally pre-cleaned by the consumer. He also manages their collection in his retailers' partners through logistic operators: his own delivery man and Terre d'Herbage[37], a distributor.

The retailers (e.g. Piu Sani) should refund the deposit to the consumer and store the returned jars until collection.

[34] https://weckjars.com/

[35] Vrac in Box is one of her customers, she uses the Pyrex returnable containers to pack cheese and other products on display at the counter.

[36] Axedis used to wash for L'Empoteuse, but the partnership quickly stopped (reasons will be developed in the barriers). The ETA stopped entirely its cleaning activity due to the loss of the equipment with the floods in Belgium in July 2021.

[37] https://www.terredherbage.be/

	Responsibilities and key activities	Cost of the reuse
Axedis	• Storing L'Empoteuse's stock • Prepare, label, palletize the orders (lids and jars) transmitted by L'Empoteuse • (Wash the returnable containers, dry them in controlled premises to avoid contamination bacteria) • Sort containers per shape, size, owner	• Energy • Cost of the dishwasher, labour, etc.
Empoteuse	• DRS operator: Choose the model of shared containers and their deposit • Supply the producers • (Sales representative for Bring Back)	• Cost of the containers (+/-= Deposit amount) • Subcontracting costs
L'Alternative	• Production • Stock management of his fleet of containers • Clean (once a week by an employee) • Condition (with a removable label) • Manage the reverse logistics (through a distributor and his delivery man)	• Deposit of containers (= permanent capital invested if he does not return them) + L'Empoteuse's service • Reverse logistics cost • Reconditioning costs
Retailers (Collecting points)	• Store the empty jars • Refund the deposit	• Product price (if reseller) • Deposit
Consumer	• Buy • Ideally, wash the empty packaging • Return it to the bakery or L'Alternative's retailer partner	• Product price (including possible contributions for washing operations) • Deposit

Table 9:Responsibilities and Key activities of the Stakeholders in L'Alternative's RPS

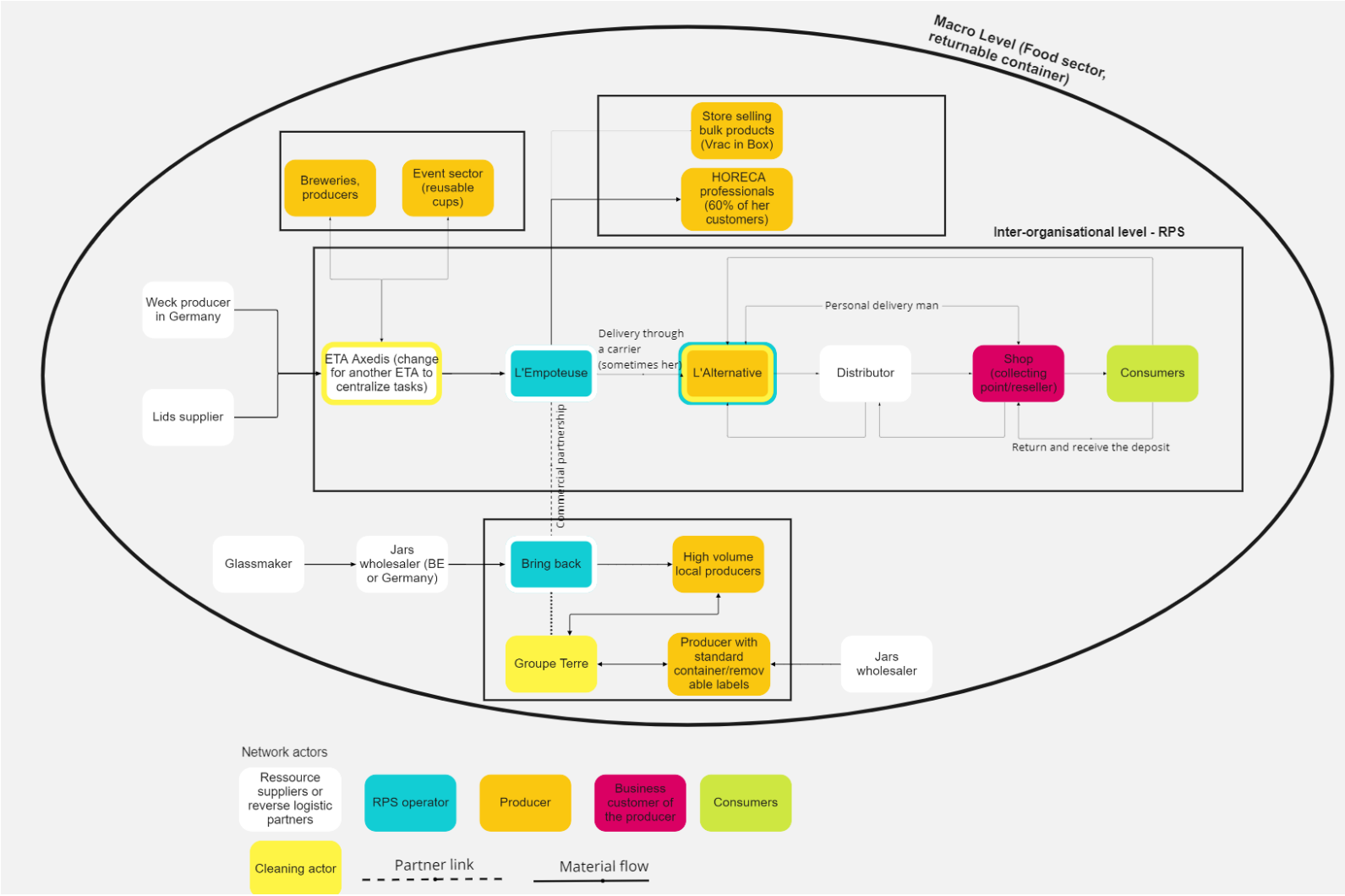


Figure 8: L'Alternative's RPS stakeholder map

CASE 4 – Bam!

In their early stage in 2017, Lili Bulk was an online bulk store offering simple grocery products delivered at home with returnable containers (Appendix 21). The brand operated a business model change in 2021[38] to become Bam!, a brand offering bio, ready-to-cook solutions in returnable screw-top jars. The brand also sells the same range of products in compostable craft packaging for online and classic supermarket distribution.

Responsibilities and Roles of the Actors in the RPS

The brand subcontracts the ETA Travie to produce the mix they created and ensure the reconditioning of the package (cleaning, labelling, etc.). Failing to find partners to share their pool fleet of containers, Bam! created its own DRS and set a 25-cent deposit that covers their reconditioning and reverse logistics costs. They define themselves as precursors of the DRS for producers, arriving before actors who created network systems such as L'Empoteuse and Bring Back. The deposit goes through Bam!, distributors, retailers and consumers. The reverse logistics is carried in partnership with a distributor that directly brings back the jars to the ETA.

	Responsibilities and key activities	**Cost of the reuse**
Bam!	• Creation of the mix formula • DRS operator: choose the model of containers and their deposit • Collection through distributor partnership	• Subcontracting costs • Reverse logistics costs
ETA Travie	• Production • Reconditioning process (cleaning of the jars) • Order preparation • Storage	• Energy, dishwasher, labour,…
Retailers	• Store the empty jars • Refund the deposit	• Product price • Deposit (taking in count the reconditioning cost)
Customers	• Buy • Ideally, wash the empty jar • Return it to the retailer	• Product price • Deposit

Table 10: Responsibilities and Key activities of the Stakeholders in Bam!'s RPS

[38] This change will be discussed later in the result chapter. However, for more information about this change: https://bamfood.bio/fr/blog/lili-bulk-devient-bam-n102

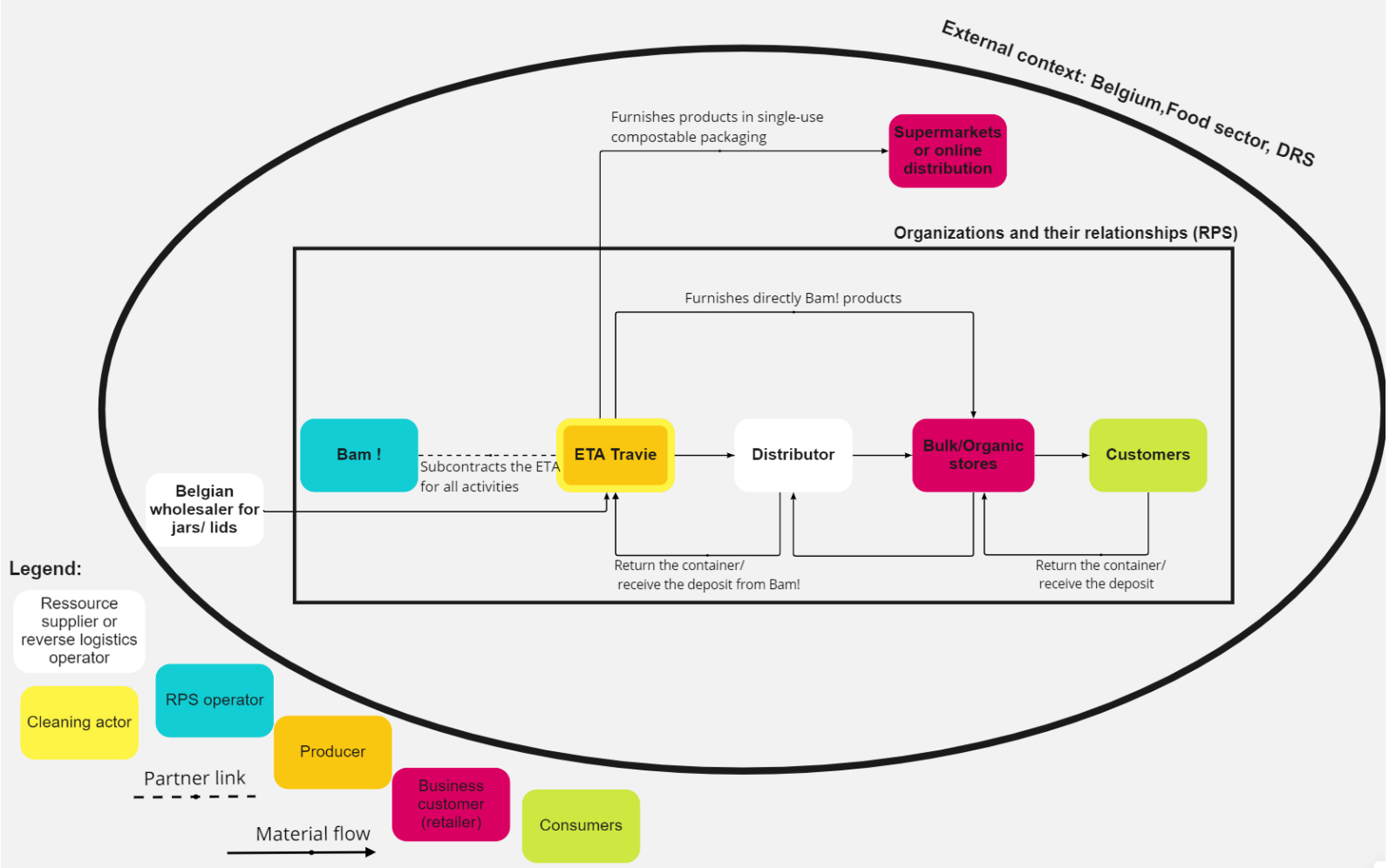


Figure 9: ***Bam!'s RPS stakeholder map***

1. Design Packaging Analysis

In the food industry and our two RPSs, glass seems to impose itself as the best reusable material, although having drawbacks compared to reusable plastic, textile packaging or single-use alternatives (paper or compostable bags). Those are the criteria that lead L'Empoteuse to choose glass jars and especially the Weck model for her DRS. The characteristics were highlighted by Bring Back and confirmed by L'Alternative from his experience:

- **Appropriate form and volume**: Glass jars are difficultly stackable which increases the storage space needed. The standardised shape of shared jars is not suitable for all types of products.
- **Lids characteristic:** L'Empoteuse chose the Wecks specifically because of their reusable glass or plastic lids. The metal screw-on lid cannot be reused for Bam!.
- **Product preservation:** As an inert material, glass is easier to wash and less subject to bacteria, mould problems or persistent odour compared to other materials. Compared to paper or textile bags for example, glass helps the product last in time and protects it during transportation, states Consumer A.
- **Eco-friendliness:** This factor is biased since it also depends on material perceptions regardless of scientific evidence. Indeed, consumers (like Consumer A) and producers usually prefer glass whether for reusable or single-use packaging, and plastic is avoided because *"it doesn't look craft, […] ecological*" (I2). Glass is generally perceived as pure, clean and "*nobler"* (I3).
- **User-friendliness:** The product is enhanced by a qualitative packaging used as a marketing element. Wecks have better aesthetic characteristics than kraft paper or a simple screw-top jar. "*The jars are visually beautiful, the customer sees the product, it makes him want to eat it*", explains L'Alternative (I1).
- **Strength:** The material should last through multiple reuses before being obsolete: *"when plastic is washed several times, it also changes colour, whereas the glass remains intact."* (I3) Wecks are made of borosilicate glass which is stronger than the untreated glass used by Bam!.
- **Weight:** Glass is heavy compared to textile, paper bags or plastic containers. This weight increases transportation expenses and reduces environmental justifications for long-distance exportation, according to Bam!.
- **Affordability:** Plastic approved for food contact and reuse is quite costly compared to glass, especially for a European manufacturer. Containers may be 10 to 20 times more expensive than glass containers. Since the investment is significant, L'Empoteuse explains that a DRS operator would not accept the chance of losing money if parcels get lost or damaged, thus he would incur a higher deposit amount. He may also invest more to deploy sophisticated technological logistics to trace the package (using a scan app, labelling with a unique QR code, etc.) or avoid the deposit payment at the purchase for the consumer by establishing a credit system. With the credit system, after a limited time, if the consumer does not return the container, the deposit money is debited from his card.

2.2. Barriers

Brand

Hidden Costs of Reusable Packaging

For L'Alternative and most producers, the first barrier to reusable containers is the price and hidden costs (reverse logistics, reconditioning, labels): "*if it was cheaper, we would definitely only use that"* (I1). Indeed, it is often *"more expensive to wash a jar than buying a new one"* (I3).

According to L'Empoteuse, "*almost all deposit systems that end up breaking down are due to labels"* (Personal communication, L'Empoteuse, 01/02/22). To reuse his containers, the producer either acquires more expensive labels that could be removed during the washing process or he will spend time scratching his cheap paper labels off his containers. To integrate a shared RPS, L'Empoteuse or Bring Back network, the producer must use removable labels to allow a switch of packages between the different members of the network and an efficient washing. According to Bring Back, the constraint of changing the labels is more important for small producers than industrial ones due to the different financial means.

In the end, according to Bring Back, the ecological benefits such as offering a reusable package *"that's five times more environmentally friendly"* is often not enough to overcome the financial barriers (I3).

Reconditioning Process

While trying to understand the reason why producers do not reuse their packages, Bring Back came to this conclusion: "*their business is to produce good things and not to wash"* or organise the reverse logistics (I3). The package is not the core business of the producer, their added value is in the content first. L'Alternative agrees that his efforts to adopt reusable packaging will be restricted to what he can do as his production will always be his priority.

According to L'Empoteuse, most producers do not want to take care of the cleaning themselves because it is time consuming, costly and "*the psychological constraint is enormous"* (I2). Unlike professionals in the HORECA sector, producers are less used to washing and less equipped for it.

Reverse Logistics Management

The collection of the containers in all the partner shops requires organisation to optimise the journeys and get a maximum number of containers. Bring Back, L'Empoteuse, L'Alternative and Bam! agree that partnerships with distributors to carry the reverse logistics operation is interesting thanks to their frequent collection rate and already scheduled journeys for deliveries.

Lack of Cleaning Operators to Externalise the Cleaning at a "Reasonable" Cost

L'Empoteuse's offer was primarily directed to prepacked product manufacturers and canneries. However her business model was mostly welcomed in the HORECA sector for takeaways since "*the canned food producers […] often need large volumes"* (I2) *a*nd they prefer to externalise the washing process like Bam!.

Bam! exposed the fact that the number of actors offering cleaning services for such volumes is very low. The criteria that lead them to work with Travie was just the availability, cost, and quality of the cleaning service.

"L'Empoteuse's system is not yet competitive in handling" requests for high volume producers since *"it requires a bit too much financial investment"* for a performing cleaning station (I2). Her Wecks' unstandardised form, the small volumes of her producers and the lack of professional cleaning equipment from Axedis made this externalisation unattractive. Since she was unable to offer the right offer for externalised cleaning service, Ms Jemine accepted a partnership with Mr Halmes, another DRS operator that opened the first "cleaning centre in Belgium" this June 2022[39], in collaboration with the group Terre (*Bring Back | Groupe Terre*, n.d.). Because of the cooperation with Terre, which allowed to invest in a massive industrial washing machine, Bring Back can ultimately provide a "*solution that is five times more ecological but not more expensive*" than throwaway packaging (I3).

Distance and Channels Distribution Choice Limitation

The location of the reconditioning operations and the proximity of the actors are the key to ensure the environmental benefits and a rapid cycle for returnable packaging. *"It is a system that is by its short circuit, if you are badly installed on a map, you risk losing out"* (I5) states Axedis.

Bam! and L'Aternative believe that selling returnable jars online directly to consumers through home delivery is difficult with the weight and distance constraints: "*we are limited to approximately 200 km, otherwise ecologically, it makes no sense."* (I10) L'Aternative also notes that given the lack of drop-off points for the consumers, jars may have a low likelihood of returning to the bakery. Because of these constraints, Bam! opted for biodegradable packaging for online and supermarket distribution and exports.

Stock Management

Since reusable packaging is often more expensive when purchased (either because of the material or the service included to integrate a network), the producer should ideally estimate his initial purchase stock and prevent a buffer stock to face shortage and long cycle time (time for the containers to return to the retailer, their collection, and their reconditioning process). *"This is the whole problem of stock management that I hate,"* states L'Alternative (I1): keeping track of those data is a burden.

Waiting for the end of the reverse logistic and reconditioning process before being able to refill the container and selling the products is frustrating in terms of cashflow management for producers. It is latent cash "*because storing waste is also storing money, because waste is worth the price of the deposit",* explains Bring Back (I3).

Poor Return Rate

Bam! only has a 30% return rate. Before recently reaching an equilibrium of around 100 containers washed and sold every week, L'Alternative also had to frequently buy new jars due to poor return rates.

There are multiple reasons for this lack of return. "*People keep the jars or put them in the bubble"*, Ms Posschelle says (I10). According to L'Empoteuse, who also had a similar experience, the problem with classic screw-top jars is that nothing visibly distinguishes them from reusable jars. L'Entre-Pot also

[39] Economic actor active in social labour insertion and circular economy. To learn more : https://www.groupeterre.org/bring-back

points out *"consumer laziness":* it is easier *"to go to the glass bubble than to have the jars returned to the circuit" (I6).* The beauty of Wecks seems important to give the consumer the will to not throw it away but it is also a reason to keep it at home which is warming for the RPS. Mr Hennen says: *"a lot of people have re-equipped their kitchens with their jars*", including himself (I1). Aware of this phenomenon, L'Empoteuse explains that "*once customers have built up their little starter stock"* and are not able to stock more, they will return them, and the producers will *"become very efficient on returns."* (I2)**.** Many consumers also forget their jars at home and continue to buy new containers before returning them.

The jar supplier defines an objective return rate of 80% for all her customers although initially, most of them have a return rate of 30–60%. According to L'Empoteuse, communication is critical to increase it by informing customers on the DRS and encouraging a quick return, which is why she also assists manufacturers with their communication plan.

Non-cooperation of Retailers to Manage the Returnable Containers

Currently, conventional supermarkets and "*almost all distributors and organic wholesalers in Belgium"* (I2) prefer not to handle returnable containers and the duties they entail (collection, storage, etc.). To distribute their products in reusable jars in supermarkets, Bam! examined the possibility of using the TOMRA[40] automatic reverse vending machine (typically used to return beer bottles in supermarkets). However, making the jars recognised by the system requires a high investment. This solution may be appealing if a group of manufacturers decides to form a network and share a standard stock of containers. Nevertheless, as we will see, reaching an agreement on standardised containers is challenging.

Third Parties

Cleaning Management of Unstandardised Containers From Different DRSs

Offering cleaning service requires a certain level of investment according to Bring Back and Axedis:

- the costs of the dishwasher and the technical requirements[41] to install it;
- the space for the dishwasher and the different space to dry and stock the container;
- the maintenance of the equipment, cleanliness control, and sorting of the different containers if we are not in a pool system.

The quality of the cleaning determined by the chosen equipment is important to prevent hygiene hazards and avoid product contamination or mixtures going against allergens indications. As Bring Back explained: *"in the food business, we have no right to make mistakes"* (I3).

Unstandardised containers complexify the cleaning process and increase the financial and environmental costs. Washing different containers (e.g. Wecks, bottles, screw-top jars) requires different washing cycles which multiply "*the amount of water, the amount of energy, the amount of staff*[42] *or rather time"* (I5).

[40] "Reverse vending machines provide an automated method for collecting, sorting and handling the return of used beverage containers for recycling or reuse."(ASA, n.d.)
[41] A gas and water supply, plus water drain
[42] Cleaning tunnels of industrial dishwasher require human labour. Four employees are required to operate the machine.

Since this cleaning activity has a low return on investment, Axedis explains: *"it's either you have the best equipment and customers who bring huge quantities to make it profitable or you abandon the idea"* (I5). Because of those limitations, L'Empoteuse and the ETA quickly agreed to end their partnership[43] for the cleaning operations.

Building a Shared Fleet of Standardised Containers

Finding a reusable packaging that meets the many requirements of manufacturers while also striking a balance between the design and packaging qualities mentioned above is challenging. L'Empoteuse explained: "*it was necessary to find the right product range for the right market segment*." (I2) Wecks are defined by Bring Back as "*the Rolls-Royce of jars"* (I3), but are not adapted for industrial volume manufacturers since they use much cheaper jars with screw-on disposable lids. All their logistics[44] put in place to condition the product is calibrated for this type of jars.

Bam! confirms that it is complicated to find actors who want the same type of container. Producers need customised packaging to fit their products and differentiate their brands. After unsuccessfully trying to network with producers[45] already using returnable containers, Bam! believes that standardisation is only well adapted for beers or beverages products "*because there is a real standard in terms of use for a beer, meanwhile for food products, each producer has his desiderata in terms of format."* (I10)

Setting the Right Deposit to Encourage Return and Product Purchase

According to L'Empoteuse, €1 deposit requirement is not a barrier to purchase for the consumer. Customers may, however, decline to purchase a product with a deposit higher than €2.5[46]. L'Empoteuse understands: "*The packaging must not cost much more than*" the consumable inside (I2). L'Alternative confirms: *"I can't charge the same price for just the packaging, it's not right."* (I1)

In another way, the deposit should be an incentive to return the package and should not be too low to avoid the mentality mentioned by Bam!: "*for 25 cents, […] if I put it in the bubble, it's not dramatic"* (I10)**.**

Retailers

Storing Space for the Returned Containers

According to L'Empoteuse and Bam!, "*organic shops and even supermarkets are already used to stocking quite a lot of deposits for drinks and it is a bit more surprising for them to have to do so for food"* although it means *"just having an extra pile"* (I2). The problem mostly comes from the number of brands using returnable containers and their collection frequency. Vrac in box declares: *"It's complicated because you need space, if you're small, […] it's impossible to store 10,000 deposits"* (14). Furthermore, the storage should also ensure hygiene conditions: *"you have to make sure that there's no rot, […]no fly in it if it's food, things like that"* (I4).

Deposit Management

According to Bam!, for L'Empoteuse's customers (e.g. L'Alternative and most of the retailers encountered like L'Entre-Pot and Piu Sani), managing the cashflow with the deposit system is a burden.

[43] L'Empoteuse currently tries to work with another ETA to centralize her stock and cleaning operations.
[44] It could be the automatic labelling, the closure of the package, the transport packaging, etc.
[45] For instance, Bam! contacted Chouke Soup (https://www.choukesoup.be/) and a yogurt producer.
[46] For example, reusable textile bags at €5. See L'Empoteuse order example at Appendix

It is complicated to manage in accountability as it is an additional cashflow with a distinct VAT application to control aside from the product price. The retailers must keep track of the number of returned jars to receive a refund from the manufacturer, change their invoice system, communicate with the container collector, and keep extra money (coins) in their cash register. Piu Sani explained that "*if someone comes in with 20 jars at once",* they *"have to give them 20 euros back"* and this requires a certain organisation (I7).

Consumers

Cost of the Reuse

It is quite difficult to determine how the cost of reuse is shared between business stakeholders and consumers.

In Bam!'s case, the consumer pays the reconditioning cost only if he does not return the package since Ms Posschelle stated it is only included in the deposit and not the sale price of the product.

For L'Alternative, this cost is shared with the consumer since the producer sometimes[47] includes 50 cents of reuse/washing service per container in the sale price. ***To amortise the initial cost of L'Empoteuse's service, the jar supplier advises*** producers to integrate a part[48] of the cost of the service fee in their sales price and review their calculation after reaching an efficient return rate.

Therefore, the sale price may become too high for consumers. Consumer B insisted on this price challenge, extending the problem to reusable glass bottle of water and disposable plastic bottles: "*If returnable water was cheaper, […] or even the same price, etc. but it's more expensive, that's the stupidity of Belgium".*

2.3. Drivers

Brand

Be in Accordance With One's Values

Like Biotop and Superzero, RPSs usually gather stakeholders (producers, third parties and retailers) with common values (organic, eco-friendly products, local production,…). The brands chose those zero-waste option *"because we believe in it as well"* (I1) as L'Alternative says. "*Out of pure ecological conviction*", l'Entre-Pot accepted to welcome products in DRS despite the extra work *(I6).*

Through their conditioning choices, producers also want to increase environmental consciousness by helping consumers not used to RPS to integrate a zero-waste approach and reduce packaging pollution. For L'Alternative, selling products in reusable packaging is a way *"to make people […] realise it is not normal to use so much packaging*"(I1). Consumers do not have the choice if they want to buy the product, since it is "*presented like this"* and like Consumer A, they may adopt DRS without noting challenges.

[47] An equilibrium is found between low and high margin products. Mr Hennen states he uses a very approximative decision making calculation to ensure him a right remuneration but also not scare the consumer away.

[48] According to her, this amount may be calculated by dividing the total price of the service by the projected number of re-uses of the jar.

Sustainable Brand Image

While reducing its environmental impact, reusing packaging may be a means to improve the brand image of a company, *"its attractiveness"* (I3), states Bring Back. With returnable containers, "*people know right away that it's local and it's a short circuit, it's impossible to do that in complex distribution chains or in distant export chains"* (I2), agrees L'Empoteuse.

Therefore, RPSs may offer a competitive advantage over other producers. L'Alternative thinks that his choice would benefit him if his bakery was more conventional and not already in a niche market. "*It's not the number one thing that differentiates"* (I1) him because consumers first come for his gluten-free products.

Future Cost Savings on Packaging

In the long run, after a certain number of reuses, reusable packaging help saving costs for the producer compared to disposable containers. However, the necessary number of reuses to compete against the low cost of single-use depends on all costs incurred by the reuse (reverse logistics, reconditioning, DRS operator service costs, etc.). With a simplified calculation and a certain number of hypotheses (found in A**ppendix 22**, a producer may have *"to reuse the container six or seven times before it becomes cheaper than disposable"* (I2) found L'Empoteuse. After that, the producers "*really earn money if they use it several times and therefore the ecological objective coincides with the financial objective."* (I2) The higher the cost of the single-use is, which is the case for most ecological packaging (compostable for example), the faster the reusable option will be cheaper than the disposable one.

Advantage to Go Through a DRS Operator Compared to Organising One Closed-System

According to Bring Back, having an owned DRS system may be easier for industrial producers like Bam!. However, joining a network has multiple advantages. L'Alternative used to buy the jars himself, but he quickly realised that constructing the right DRS and build a network to reach economies of scale were difficult. At the right time, L'Empoteuse offered her service. Here is a review of the advantages highlighted by L'Empoteuse and discussed with Bring Back and L'Alternative:

- **Lower initial investment required**: The producer has the possibility to order in dribs and drabs and not an entire pallet at a time to a glass wholesaler. L'Alternative agrees: *"Even if it was a bit more expensive, [..] I didn't have to spend so much money all at once."* (I1)
- **Wide range of containers (different sizes and volumes):** With her simple system, L'Empoteuse can easily adapt to the requests from her clients, although her system is not suitable for industrial washing and less scalable. Informatised systems with QR codes, booking systems or automates for the collection such as TOMRA, limit the format of the containers to not complexify the system.
- **Possibility to return the containers to the DRS operator:** The producer can test the concept, find the right containers for his products, and change his mind without losing all his investment. Only the service cost per container will be lost as the deposit is refundable.
- **Higher chance of reuse:** Finally, with this network and shared containers, the same container may be reused by different consumers, the original producer or another DRS's member. L'Alternative highlights: "it *doesn't matter if they're reused by me as long as people or other shops reuse them"* (I1). This still raises a risk for the producer to lose his containers that may be returned to another network member. *However,* according to L'Empoteuse, migrations of containers from one client to another are rare (less than 5%), or at least not observed since the containers are identical without the producer label, and there is no tracking system. According to her and Bring Back, a standardised deposit reduces potential migration issues

since there is no incentive for the consumer to return the container in a particular shop to get the biggest refund.

Consumers & Retailers

DRS as a Zero-Waste Alternative to Bulk Sale

According to L'Empoteuse, the bulk purchase and its "*local, ethical and humanly responsible, socially responsible, fair pay approach"* are praiseworthy, "*except that it puts a huge, mental burden on the shoulders of consumers and in general women"* (I2). Axedis' director agrees: "*going to a bulk shop to do your shopping, you have to plan a lot of things beforehand and then when you come back home you have to wash them again."* (I5) Moreover, because of those requirements, the bulk purchase and its zero-waste mentality often finish with *"lots of small purchases in kraft paper where, in the end, we're halfway to bulk".* (I2) Therefore, a DRS with a network of professionals may be seen as the solution to smooth the zero-waste experience for consumers and ensure the reuse of the end packages.

Bulk stores also welcomed returnable container options because *"it allowed them to have a zero-waste offer without specifically doing bulk"* (I10) explained Bam!, referring to their previous business model. With this prepacked option, consumers could choose the products directly without obviously having to help themselves which saves time.

Moreover, due to safety and health limitations, not all consumers and products may be found in bulk stores. Due to a higher chance of product contamination, consumers with strong allergies or intolerance cannot risk purchasing products in bulk. L'Alternative used to deliver his products in bulk since it was the ultimate zero-waste option for him, and he *"wanted to use zero plastic and minimise paper packaging".* (I1) However, he had to give up this selling distribution. Indeed, gluten- and lactose-free products cannot be sold in bulk: **"***because it's too dangerous for the consumer, we don't know how the shop will treat the product and we are never safe from gluten contamination"* (I1). This barrier forced him to find another zero-waste alternative and therefore choose prepacked products in returnable containers.

EXTERNAL CONTEXT ANALYSIS

1. Barriers

Reusable Packaging in a Niche Market

The fact that most consumers and big FMCG brands, and traditional supermarkets have not yet embraced reusable packaging slows down the practice's development and poses a significant obstacle for the four different RPS. As Bio4seasons explained, "*bulk is not yet part of our environment"* (I11). Axedis agrees that supermarkets started off selling bulk items "*but compared to the size of the shop, it is minimal" (*I5) and it is limited to dried food, fruits, and vegetables. Furthermore, returnable containers are rare, or even inexistent, except for beverage products. According Bring Back, producers are suspicious of the success of a DRS in the food sector : *"That's the problem with doing something a little bit new" (I3).*

DRS adoption still concerns a niche customer segment. Bam! stated, "it is more for motivated people and pro-organic quite wealthy[49] *people, who are interested in zero waste"* (I10). Only early adopters with high environmental consciousness and existing customers of bulk and organic network stores are ready to adopt this consumption style. Beyond switching to zero waste purchase (DRS or bulk), the classical consumer must often abandon the convenience of regular supermarkets, go to smaller grocery stores and be willing to try new items instead of well-known international brands.

Changing consumption habits is challenging because "*finally humans, we like the routine"* (I11) and we need some psychological time to adopt reuse practices since we are used to disposable, pre-packed products.

Due to the lack of adoption of reuse practices, in the same way Bam! decided to adopt compostable packages for supermarkets, Biotop ultimately opted to preserve two sales systems as *"the best trade-off"* (I15): pre-packed products for mostly organic shops and bulk jerrycans for bulk stores refusing single-use solutions. Biotop also provides unlabelled empty plastic bottles to requesting bulk stores (e.g. Tarh) with clients not yet accustomed to bulk purchasing that frequently forget their containers. The demarch is to help new adepts of bulk purchase at the beginning and encourage sales, but the aim remains that they come back with it later to reuse the packaging. L'Entre-Pot also decided to offer the Jean Bouteille first-purchase bottle, as an alternative to their free stock of shared containers. This alternative is not encouraged since it adds plastic into the network, but the manager explained: "*if we have a customer who comes empty-handed and we do not offer the 2L plastic cans, he leaves with nothing"* (I6) which is a loss of sales.

Compliance with Health and Safety Regulations

- **For Food Products**

Bulk service for food products is complicated for consumers with allergens due to product contamination as we saw for L'Alternative. L'Empoteuse explained that the reuse of the bulk packaging in the food sector is rare since the test regarding migration particles for plastic containers is really costly. Competent authorities in Belgium like the Federal Agency for the Safety of the Food Chain

[49] Translation subject to interpretation as it is familiar word in French : "bio-bobo"

(AFSCA)[50] support zero-waste practices as long as producers take care of consumer safety and ensure hygiene requirements (*AFSCA - Faire Ses Courses Alimentaires Avec Ses Propres Récipients : Bien Sûr !*, n.d.).

- **For Chemical Products in Bulk Selling**

In France, after an inspection of bulk stores in 2020, the "Directorate General for fair Trading, Consumer Affairs and Fraud Control"[51] (DGCCRCF) tried to change regulations for the bulk sale of household products. Indeed, Biotop and AJR explained that the DGCCRCF considers that refilling a beverage or any food packaging with chemical products, is hazardous to the consumer, particularly younger people. Therefore, the authorities want to establish a regulation requiring the purchase of an initial labelled container to be refilled after. Furthermore, self-service systems for bulk detergents would be banned: the bulk store should accompany the customer to fill the package on their behalf and/or provide a system that would avoid any human error in the filling process.

According to Ms Horn, this is no longer bulk sale but a case of "refilling". The previous Biotop business model followed this refilling system, in which "*you have to first buy the product, the initial packaging filled and then you can refill and buy the same amount each time"* (l15). However, after taking over the company, the couple decided to develop only the "*real bulk*[52]" in which "*the person can […] take his own container, buy the amount he needs"* (l15).

According to Biotop, the purchase of an initial *container "makes no sense, […] we have enough containers, we do not have to create new ones, to make people buy new waste."* (l15) The producer is engaged in the *Réseau Vrac*[53] in France and at the Belgian level in a network named *ConsomAction*[54], launched by Sylvie Droulans to defend the traditional bulk sale with other actors of the market (bulk stores, producers,…). In their opinion, the consumer is responsible enough to avoid the risks defined previously: he is not going to "*leave his laundry bottle in the fridge next to the orange juice, he will write down the information on the bottle"* (l15). Biotop consumer confirms she takes her precautions.

Despite this opinion, in 2021, in order to cover the store in case they get controlled and provide the consumer with all the necessary information, Biotop began to provide **labels** to stores containing the mandatory legal[55] information for pre-packed products: the product name, the ingredients, the eventual allergen risks, the safety hazard pictograms, Biotop and Poison Centre contact number. Vrac in Box admits: "*it is practical to have at least one indication, […] to know what is in it."* (l14)**.** However, the manager agree with Biotop: "*people have the choice to take the label and note the batch number. They can do it, but they do not always do it."* (l14). Anticipating potential regulations at the Belgian level, L'Entre-Pot also decided to use Jean Bouteille automatic label dispensers that print instant labels for any product in-store with their lot number.

[50] To know more about FASFC point of view on bulk practices: https://www.favv-afsca.be/consommateurs/viepratique/achats/propreemballage/#:~:text=L'AFSCA%20est%20100%25%20%C2%AB,ils%20effectuent%20dans%20un%20magasin.

[51] « Direction générale de la concurrence, de la consommation et de la répression des fraudes » in French. To know more about the anomalies identified in bulk sale during the investigation: https://www.economie.gouv.fr/dgccrf/denrees-alimentaires-la-vente-en-vrac-besoin-dun-peu-dordre

[52] The "proper definition" in French regulation may be found in the literature chapter.

[53] "Réseau Vrac was created to democratise bulk sales in France and throughout the world in order to reduce food waste and disposable packaging." https://reseauvrac.org/

[54] "The Network of professionals of zero waste consumption, local, ethical, responsible and sustainable, for shops, suppliers, Horeca and other zero waste professionals in Belgium." https://www.consomaction.be/

[55] To know more about those legal label requirements of chemical substances and mixtures: https://eur-lex.europa.eu/FR/legal-content/summary/classification-packaging-and-labelling-of-chemical-substances-and-mixtures.html

In the light of this legal threat, according to AJR, Superzero is in advance and ensures consumer safety through product traceability[56]. In the event of poisoning or any other incident, the customer has all the necessary information on the bottle obligatory purchased to buy Superzero products. Moreover, it is impossible to fill a bottle of laundry with household cleaner thanks to bar code recognition, so even if the consumers do not properly clean their bottle, bar codes avoid mixing up different products.

Covid and Current Energy Crisis for Organic and Bulk Stores

Until today, organic and bulk stores have been in an economic crisis due to the Covid crisis and the current energy crisis linked to Russian gas cuts. Even though there is an increased desire for sustainable consumption, consumers have other priorities because of the increased prices reducing their purchasing power. According to AJR, "*a lot of people are abandoning the organic, zero waste shops because they are sometimes more expensive."* (I13) This comment is similar to L'Entre-Pot's statement*: "unfortunately they cannot come here anymore because for them it is a luxury […] and they have taken away the luxury*" (I6). The store closed in April 2022 and other organic and bulk stores are struggling. Their crisis directly impacts the four brands since those are their B2B customers. It is complicated to retain those resellers (or drop-off points in the case of L'Alternative), especially Superzero customers[57] that must pay the rental fee of the dispenser.

Low Cost of Disposable Containers

The low price of single-use containers compared to reusable ones encourage producers to buy new containers instead of adopting RPS. L'Empoteuse explained that new containers have *"extremely competitive prices on the market"* (I2), a standard screw-top jar usually used for jam producers, for example, may cost about 20 cents. Taking the example of cups[58], Axedis explained that ecological alternatives to single-use plastic may be more expensive but still less than the returnable option with all its hidden costs. The director regrets: *"The limit of ecology is the economy, it is always the same thing."* (I5)

[56] "Product traceability is the ability to identify, track and trace elements of a product as it moves along the supply chain from raw goods to finished products. It provides numerous benefits such as the ability to investigate and troubleshoot issues related to a component or ingredient." https://www.holded.com/blog/what-is-product-traceability#:~:text=Product%20traceability%2C%20is%20the%20ability,to%20a%20component%20or%20ingredient.

[57] However, Superzero may be more protected in supermarkets which are less impacted.

[58] The ETA used to offer a "Sale, rental, cleaning of cups" service before the floods. To know more about this: https://www.axedis-eta.be/service/nettoyage-de-recipients-alimentaires

2. Drivers

Environmental Impact

All the brands made the choice to offer their products in reusable packaging form (whether in bulk or returnable containers) because they (as well as their partners) believe in the positive environmental impact through the reuse of packaging. Superzero states they can *"significantly reduce the creation of single-use plastic bottles, water consumption (needed to manufacture these bottles), CO2 emissions*[59] *(from the manufacturing, transport, and recycling of these bottles)"*. (*Trade Marketing Internship | Jobservice*, n.d.)

Awareness-Raising of Ecological Practices Regarding Packaging Through Scientific Research

At the beginning of their activities, Bring Back and L'Empoteuse discovered ADEME research[60] LCA between single-use plastic containers versus glass, and also the positive environmental impact of returnable containers compared to recycled ones. Bam! also researched ways to justify the relevance of their returnable containers by using ADEME and a 2013 study by Ecoscience Provence[61]. Since they are aware of the potential of reusable packaging, all those actors justify their business model on those scientific evidence, knowing that multiple factors also influence it (the number of reuse, reverse logistics distance, etc.).

Growing Demand for Ecological Solution Regarding Packaging

There is a growing demand from consumers for eco-friendly packaging which encourages the producers to opt for **ecological packaging solutions in recycled, compostable, reusable form.**

Supermarket X explained that they accepted the Superzero solution because "*it could be an added value for the store. Customers are still looking for ecological products"* (l15). Bio4Seasons also stated that multiple customers were asking for bulk products.

Change in the Consumer Habits Towards Reuse Practices Through Time

Bio4Seasons finds the changing habits of consumers encouraging for the RPS. She illustrates changing consumption habits towards reuse practices with this example: a few years ago, buying plastic bottles was the norm, and now people are used to refilling their water bottles. It was the same with plastic bags, or craft paper bags for vegetables and fruits, now everyone prepares their bag to do their shopping[62].

[59] In 2021, according to the brand, 1 ton of single-use plastic, 41K litres of water consumption and 2.7 tons of CO2 emissions were avoided ((33) Post | LinkedIn, n.d.) https://www.linkedin.com/posts/eco-tap-by-zero-waste-solutions_yearend-superzero-super-activity-6882333968876802048-7erR?utm_source=linkedin_share&utm_medium=member_desktop_web

[60] The lector may find those analysis in the chapter 9 of the literature or more information through this link: https://librairie.ademe.fr/consommer-autrement/1042-analyse-de-10-dispositifs-de-reemploi-reutilisation-d-emballages-menagers-en-verre.html

[61] https://www.bio-provence.org/IMG/pdf/support_presentation_ecosciences.pdf

[62] In 2014, statics showed that almost half of Walloons are used to use reusable lunch box or water bottle and 95% opt for reusable bags to do their grocery (Gouvernement wallon, 2018, p. 89).

Furthermore, the historical presence of certain RPS is also a **good start to widen reuse practices. Indeed,** the fact that *"in Belgium, the deposit is nothing new"* (I3) and that **consumers are already used to bringing their beer bottles back is an example to adopt for other products.**

Authorities' Action (Tax and Subsidies)

According to Bring Back, to reach its carbon neutrality target, Europe has two instruments: offering advantages (subsidies, more exoneration) or punishing (taxation). Nowadays, authorities use subsidies to encourage reuse practices and "*support the entrepreneurs"* having difficulties *"in launching something ecological"* (I3). Axedis noted that subsidising everyone opting for ecological solutions is complicated, therefore authorities should directly ban some practices "*so people are bound to turn to"* other solutions as they did with the SUP directive (I5). Mr Halmes believes that, *"tomorrow, polluting things will be taxed so much that […] in 20 years' time we will be earning more than someone who sells single-use packaging."* (I3) Tax instruments such as the eco-tax instituted in Belgium for individual beverage containers[63] already encourage beverage producers. "*Breweries […] work with deposits, because it is an economic advantage"* (I3), they can save 8,45 cents[64] tax per litre using reusable vessels instead of single-use. A tax like that could be applied to the food sector, or other sectors.

In Germany, the situation is even more advanced for reusable beverage containers. This country is often cited as an exemplary model for its deposit system (named *Pfand system*) which has "*been working for years"* (I3): "42% of beverage bottles are reused and around 80% of beers are sold in reusable glass bottles" (Zero Waste France et al., 2019).

Economic Crisis with Energy, Transport, Raw and Recycled Material Rising Costs

Finally, the economic crisis may also be a way to encourage reuse practices, because the raw materials and energy used to produce packages, especially plastic packages, are more expensive. AJR explains that "*today with the economic crisis, with COVID, the war in Ukraine and in Russia, the price of plastics*[65] *[…] is completely crazy."* (I15) Indeed, the pandemic crisis already disorganised the packaging production, and the Russo-Ukrainian conflict at the end of February 2022 worsened the situation: prices are soaring whether it be for the plastic, cardboard, or glass (*Carton, papier, verre... La guerre en Ukraine fait flamber le prix des emballages*, 2022).

Recycled alternatives are also costly. Indeed, AJR explained *that "today recycled material is more expensive than raw materials"* (I15). With the increasing demand for eco-friendly packaging and the targets for recycled content in PET bottles from the SUP Directive, the price for recycled material skyrocketed (Les déchets de plus en plus intéressants à recycler, n.d.).

[63] Except for milk-based beverage product

[64] €8.45/hectolitre = €9.86/hec they normally pay for individual single-use containers - €1.41/hec they would pay for individual reusable containers. Those figures may be found in the official website of the Official Federal Public Service of Finance of Belgium: https://finances.belgium.be/fr/entreprises/accises . With Bring Back's new industrial dishwasher, the service price match the tax savings the producer would have lost if he had worked with disposable containers.

[65] To know more about the current rise in plastic costs: https://www.polyvia.fr/fr/le-point-sur-les-tendances-de-prix-du-plastique-au-printemps-2022#:~:text=On%20a%20en%20g%C3%A9n%C3%A9ral%20constat%C3%A9,%C3%A9nergie%2C%20mati%C3%A8res%20premi%C3%A8res%20et%20logistique.

Promoting Local and Social Employment Through Short Circuits Economy

According to Bring Back, L'Empoteuse and Axedis, DRSs promote local economy while creating non-relocatable employment. The reuse of the packaging (and the reverse logistics implied) means proximity "*because to make these glass jars travel miles to wash them and then bring them back here is an ecological and economic nonsense"* (I5).

Moreover, cleaning operations promotes socio-professional integration of disabled people (Axedis and Travie ETA), or poorly qualified people (Terre).

SUMMARY OF THE FINDINGS

The findings from the multiple case study have been used to fill the conceptual framework designed **(Figure 10 pg 67).**
A synthesis of the barriers and drivers explained through the three different levels of analysis may be found below **(Table 11,12)** . Thanks to our separate analysis, we noticed the difference in barriers and drivers between the two main RPSs (bulk and DRS). The barriers seemed to be transferred from one actor to another following the transfer of activities needed to reuse the consumer package. Indeed, returnable containers require less efforts from consumers but more from businesses and the contrary goes for bulk sale. This idea is illustrated in a table comparison **in Appendix 23.**

	Barriers	Drivers
Appropriate form and volume	Not standardised Not stackable	Customisation thanks to reuse of existing waste (traditional bulk)
Lids characteristic		Reusable
Product preservation		Protection and preservation of the product during transportation and through time (inert material, poor porosity,…)
Eco-friendliness	Depends on material perceptions, weight (transportation pollution), end-of-life (recycling)	
User-friendliness		Qualitative packaging – Beauty Convenience
Strenght	Breakable	Durable through washing
Weight	Heavy	
Affordability	Cost implying high deposit & first-purchase price	Same purchase price as disposable container

*Table 11: **Design Packaging Barriers and Driver***

	BARRIERS		DRIVERS	
	Cleaning bulk products (& returnable jerrycans)	**Food in returnable containers**	**Cleaning bulk products (& returnable jerrycans)**	**Food in returnable containers**
Organisations & their relationships	**Brand** • Poor reuse rate of the packaging • Needs to build a network of refilling points **Retailers** • Work burden • Convenience of the dispenser • Cost of advanced technological dispenser • Space for the dispenser • Lack of environmental consumer interest **Consumers** • Mental burden ***Regarding reusable jerrycans*** • *Cost of the reuse* • *Reverse logistics management* • *Storing space at the retailers* • *Lack of efficient information sharing through the supply chain*	**Brand** • Hidden costs of reusable packaging • Reconditioning process burden • Reverse logistics management • Lack of cleaning operators • Distance and channels distribution choice limitation • Stock management • Poor return rate • Noncooperation of retailers to manage the returnable containers **Third parties** • Cleaning management • Building a shared fleet of standardised containers • Setting the right deposit **Retailers** • Storing space • Deposit management **Consumer** • Cost of the reuse	**Brand** • Be in accordance with one's values **Consumers** • Relative low cost per refilling	**Brand** • Be in accordance with one's values • Sustainable brand image • Future cost savings • Benefits of a DRS operator packaging supplier, shared network **Retailers & Consumers** • Convenience of prepacked products for consumers (compared to bulk sale)
External context	• Reusable packaging in a niche market • Health and safety regulations • Covid and current energy crisis • Low cost of disposable containers		• Environmental impact • Awareness-raising of ecological practices regarding packaging • Growing demand ecological solutions regarding packaging • Change in the consumer habits towards reuse practices through time • Authorities' action (tax and subsidies) • Economic crisis (energy, transport, raw and recycled material rising costs) • Promoting local and social employment through short circuits economy	

Table 12: ***Synthesis of the Different Barriers and Drivers Following the Organisations & Relationships and External Context Level of Analysis***

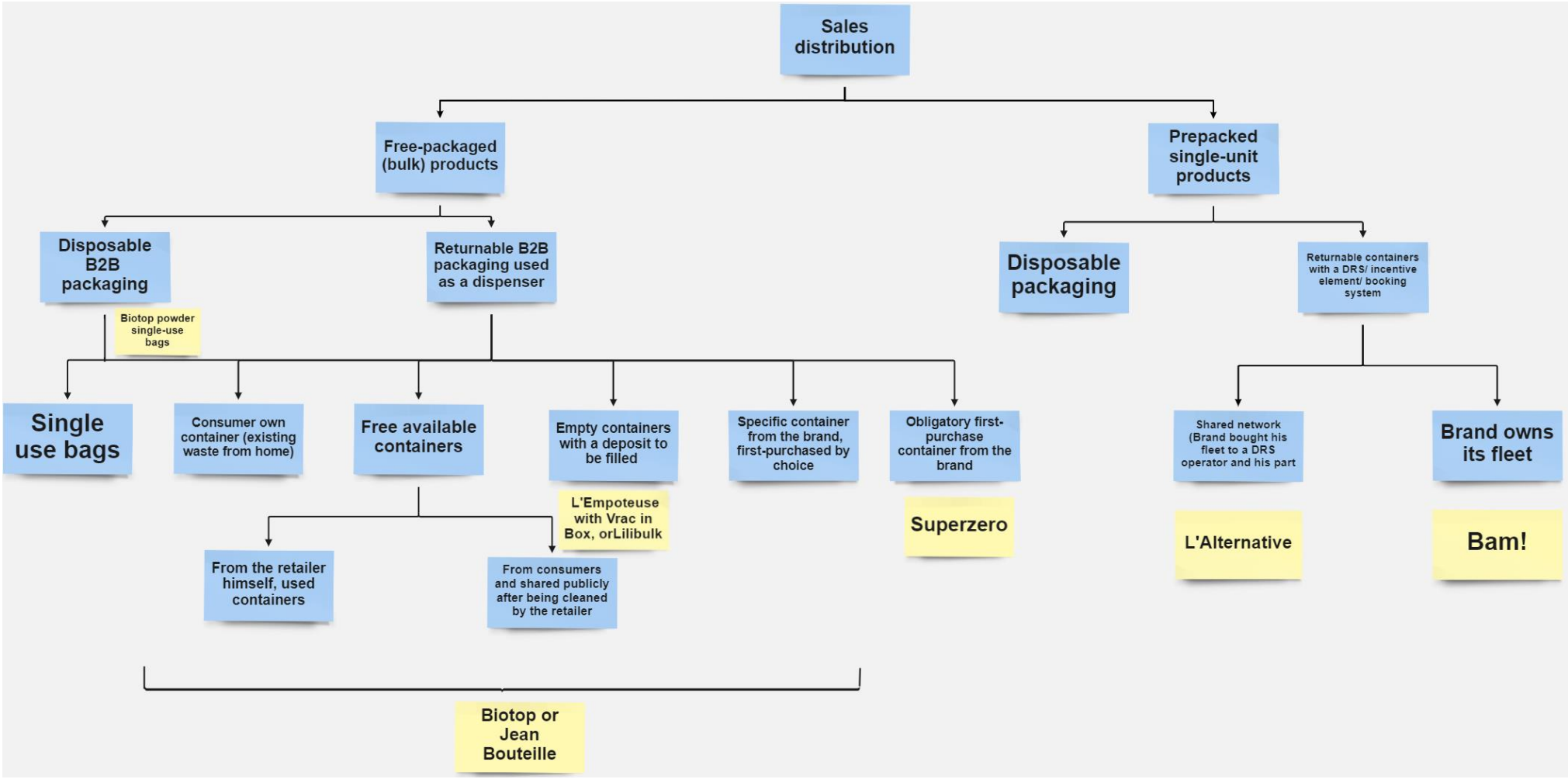


Figure 10: Framework of the different RPSs encountered

DISCUSSION

In this section, the results of our empirical research will be discussed and confronted to literature review to synthesize the answers of our research questions and determine how our work contributed to knowledge on reusable packaging systems. As a reminder the purpose of this thesis is to provide a better understanding on primary RPSs while identifying the interactions, roles and activities of the different organisations composing the RPS. The barriers and drivers of the different RPSs were also analysed through specific units of analysis.

The literature section enabled us to understand the importance of reusable packaging in this growing environmental concern context, while noting lacking measures and business practices towards reusable packaging compared to recycling practices. The review also helped to better define what was considered as a reusable packaging, and which type of packaging[66] (primary, secondary, tertiary) could be involved in RPS. We also had an overview of the different types of RPS thanks to existing typologies built by scholars. However, literature focused on consumer perspective and key behaviour while activities and roles of business actors necessary for the RPS success are just vaguely presented.

Each RPS is organised with different organisational elements (stakeholders with different responsibilities). All actors, relations, internal choice regarding design of the RPS put after each other constitute a unique model of RPS. Since systems are constituted with different actors, they also have different barriers and drivers toward reusable packaging.

We should note that scholars often categorize RPS between B2B or B2C market. (Coelho et al., 2020, p. 1) differentiates the packaging as follow:

- "B2B (Business-to-Business, including secondary or transport packaging, e.g. crates, pallets)
- B2C (Business-to-Consumer; also called primary packaging, e.g. beer bottles)"

However, through our research, this distinction quickly appeared not accurate or too simplified. The distinction between both market is not enough to separate type of RPS. It has to be more complex since the RPS may be composed with multiple intermediary actors and it depends on the sales channel chosen by the producer. Observing the case of L'Alternative and L'Empoteuse, we can even say that we are in a case of B2B2B2C RPS (if distribution chain with retailers). Furthermore, It is also reductor to call a primary packaging, a B2C packaging as the jerrycans, the intermediate packaging also directly containing the product can also be called primary packaging but are sold to a business actor, the retailer.

Principal type of actors caring specific activities could have been identified in our multiple case study. The roles, activities and responsibilities may be accumulated since it depends on the level of service outsourcing the organisations opted for the RPS:

- The reverse logistic operator (distributor)
- The brand (producer or sub-contracting a third-party)
- The cleaning operator
- The DRS operator - Supplier of the returnable containers with deposit/booking system

[66] If we did not decide to focus on primary packaging, we could also have analysed the choice regarding other packaging layers (primary, secondary, tertiary) to deliver a product in a RPS. We did so for the bulk, commercial packaging for Superzero and Biotop since it was still primary packaging, but we could also have taking in count the reusable transport racks used by Bam! and L'Empoteuse for the jars.

- The retailer (reseller or drop-off points) – Brands'business customer
- The "working" consumer

The responsibilities may be: designing the RPS, managing the collection at the retailers/drop-off points, the cleaning process, the storage of dirty returnable containers, the deposit cash flow, the hygiene and safety requirements for the consumer,…

An actor that seems the same at first sight may have other responsibilities and activities following the design of the RPS and the level of service outsourcing of activities. For example, Superzero, and L'Alternative are two brands that chose to offer reusable packaging, however Superzero is not the producer, the AJR is, similarly L'Alternative is not the creator of the RPS network, L'Empoteuse is.

To answer the second research question, we were able to identify different barriers and drivers following the type of RPS chosen by the brand and three level of analysis, namely design packaging, organisations and their relationships, and the external context. The lector can note that the different levels of analysis are not completely separated but interlinked, one barrier/driver may be a consequence or a factor of another barrier/driver presented and multiple actors may be affected by the same barrier/driver.

At the design packaging level, we identified critical factor success for RPS in relation to the choice of material and packaging form (standardised or not). Factors like weight, strength, lids reusability, eco-friendliness, and user-friendliness directly influence the barriers/drivers perceived by the organisations and consumers, either at the purchase, (re))use or end-of-life stage of the reusable packaging. As noted (Ellen MacArthur Foundation, 2019), refilling systems like Biotop (without first-purchase dedicated packaging) offers customisation freedom for consumers that can reuse existing waste, and therefore avoids additional production of packaging. We also saw the power of superior design packaging highlighted by EMF. Indeed, aesthetics characteristics influence the value perceived by the consumer which increases the willingness to extend its life through reuse**.**

For what concerns the **systemic level with organisations and their relationships (including the consumer),** we were able to detail better barriers and drivers for all stakeholders even third parties's not particularly taken in count in literature.

Consumer factor engagement towards RPSs defined by (Coelho et al., 2020; Lofthouse & Bhamra, 2006) were mostly focused on consumer convenience. This was confirmed in our case studies, but we should note as well that the convenience for retailers (brand's business customers) is important to widen RPSs adoption. Refilling systems (bulk sale) are more critical for this factor since it requires additional work (replenishment, organisation, assistance for consumers) from retailers and consumers (cleaning, organisation).

Compared to disposable options, consumers may definitely benefit from saving costs thanks to refillable schemes. However, since DRS requires more complex management and investments for professionals at the present, this benefit may not be found and on the contrary, consumers may pay more temporarily for this option.

Regarding business drivers, it is important to highlight that none of the central organisations (Superzero, Biotop, Bam!, or L'Alternative) directly talked about costs savings although this was mentioned by L'Empoteuse and (Lofthouse & Bhamra, 2006). Those savings are hidden behind all indirect costs linked to returnable packages besides that those savings may only be perceived in the

long run. Indeed, the package needs to be reused a certain number of time before it begins to be interesting compared to the cheap disposable option.

Regarding marketing elements, although literature highlighted this benefit, increased customer loyalty towards brands were not particularly observed in our cases. Potential additional sales may be noted for retailer collecting point like Piu Sanu with L'Alternative but not loyalty behaviour.

RPSs may improve the brand image and its attractivity since it reflects its corporate social responsibility (Coelho et al., 2020). The brand opting for those solutions attracts the growing group of consumers searching for ecological products as well as retailers (like Supermarket X for Superzero) looking for products with an added value to satisfy the demand. According L'Empoteuse, for returnable containers, since distant export chains are not relevant, the RPS clearly highlights the local and eco-friendly characteristics of the product.

The most important driver comes from the organisations themselves: the values of their management direction that believes in ecological benefits of RPS and really want to minimise their environmental footprint while educating and helping consumers not used to RPS to adopt zero-waste consumption. None of the businesses (retailers, third parties, brands) we encountered saw RPSs as something they are forced to adopt or provide. There are no external drivers strong enough to compel them to opt for RPS over disposable options. Currently, regulations, as seen in literature, are not enough constraining to encourage reusable practices and face the numerous challenges they entail, given our still well-established recycling and linear consumption styles of production and consumption. This explains the scarce number of brands offering their products in bulk or in DRS in Belgium (except for beverage sectors as stated by Coelho et al. (2020)).

As (Ellsworth-Krebs et al., 2022) stated, communication, coordination and collaboration is important since each stakeholders of the system influence each other. All of our case studies demonstrated this. Communication is essential with all RPss' stakeholders, intermediaries: anyone in contact with the reusable packaging should be aware of their responsibilities and know what has to be done to ensure the reuse (and smooth refilling process). Producers should inform their partners and customers on their followed RPS. This could be done through the packaging itself with labels, specific container design, or explanations on the dispenser for bulk distribution or orally (*"staff are the first ambassadors"(I2))*.

The first barrier encountered to drive a successful RPS is the lack of consumer cooperation and engagement. This is translated in the threat of poor return/reuse rate for the four RPSs studied. Multiple reasons may explain it: consumer laziness to reuse and the ease to acquire new containers, a lack of financial incentive (setting the right deposit/first-purchase price imposed), the repurpose of the package for other functions (e.g. storing things at home) which force the brand to buy new containers,…

Additionally, the indirect expenses of returnable containers pose significant challenges for businesses. Bam!, L'Alternative and Biotop complained about the hidden costs and special management attention to recondition the container including the reverse logistics, labour for stock/collection management, reconditioning costs (special labelling, equipment, energy,…). However, those burdens and expenses for the producer may be shared with third-parties subcontractors or through shared networks.

Storing space is also critical, firstly at the level of retailers that should managed returned empty packaging (and also in-store dispenser usually bulky in case of refilling systems), then at the producer (stock of empty cleaned and dirty containers, and possible dishwasher) and/or eventually at the

cleaning operator facilities that must also sort the different type of containers according their original owner.

Our empirical research mostly uncovered new barriers and drivers regarding **external context** since they are period specific (Covid, Russian-Ukrainian conflict, …) and connected to the social, economic and legal particular context in Belgium (Europe) as well as specific industries (food and cleaning products).

Although there is a growing environmental concern, in practice, only few actors (producers, consumers, retailers,..) are ready to adopt radical change regarding their choice of packaging and abandon disposable solutions. This fact was emphasised in our multiple case-study and showed in grey literature.

Academic contributions

The thesis aimed to explore primary and B2C reusable packaging systems (RPS) to respond to a gap of knowledge mentioned by multiple authors (Long et al., 2020; Mahmoudi & Parviziomran, 2020; Coelho et al., 2020).

We also better analysed the role of third party providers, enabling share network, outsourcing key service related to reuse (reconditioning, reverse logistics,…) in primary RPSs, which was only done in few researches like (Kroon & Vrijens, 1995) for tertiary packaging, requiring less hygiene attention since not directly in contact with the product.

The exploratory qualitative research of this thesis, conducted through four case studies analysed thanks to semi-directive interviews with 1 actors, reinforce empirically the theoretical barriers and drivers found in literature while detailing, explaining, adding and nuancing specific points. Comparing and confronting two main RPS categories also helped us understand what the differences bring to the model. The analysis also helped us understanding why a producer decide to change from one RPS to another or abandon RPS because of lacking drivers or strong barriers identified. Similarly to Bam! and Biotop, who decided to begin a range of single-use form packaging, L'Alternative faced disillusion on the constraints to zero-waste, those barriers shaped the RPS he decided to adopt and forced him to choose which of his products will be available in reusable containers.

This work goes a little further in term of classification of the opportunities and challenges than what we can encounter in the literature. Indeed, the literature often stops itself to separate the role, and the barriers and opportunities between "businesses" and "consumers". This research able the lector to relate one barrier to one level of analysis (external context, organisational level, design packaging) taking in count the point of view of the different stakeholders in the RPS.

Managerial contributions

After analysing all those RPSs, and their characteristics, if any producer, DRS operator, cleaning operator, retailers would want to offer or play a role in the success of a RPS, this actor would be aware of those challenges and opportunities. The case studies presented with their local actors may inspire the creation of other start-ups or change in established companies.

Limitations

Although this research provided new insights on reusable packaging systems in the B2C market, some limitations should be mentioned and considered to interpret the results.

Even though it was interesting to focus on a specific geographical scope (Belgium and more specifically Wallonia) to identify specific macro context elements (policies, historical culture towards RPS, economy, etc.), the findings may differ with RPSs in other countries or regions (Flemish actors were not interviewed).

Moreover, our sample of case study may present a bias. We analysed two different industry sectors, but within one sector, we have two RPSs for bulk chemical products and two DRSs for food products. This could have limited our understanding of barriers and drivers. It would have been interesting to add case studies of bulk food or returnable household products, for example, assuming they exist.

We only analysed two sectors with four case studies. Additional case studies within the same sectors would have maybe brought other barriers and drivers, and we could have discovered more types of RPSs. Additionally, it could have been interesting to build a stronger theory (allowing generalisation) and define a better categorisation of RPSs.

Case studies of other primary packaging in other sectors (takeaway packaging in the HORECA, e-commerce shipping box, cosmetics or even IT packaging) would surely have brought other findings. Moreover, since some big FMCG brands began to explore RPSs (e.g. refilling scheme for Body Shop[67] or Yves Rocher[68], or DRS with Loop[69] for Nesquik, Dove, etc.), it would have been insightful to analyse the case of a multinational brand.

We poorly integrated quantitative data (return rate, sales volume, number of initial container stock, costs linked to reconditioning process, etc.) although it would have been interesting to assess barriers and drivers. This is also due to a lack of accurate quantitative data gathered by the actors interviewed.

Multiple lenses could have been chosen to analyse the roles and activities of the RPSs stakeholders as well as the barriers and drivers related to those RPSs. We decided to use the configuration theory, linked to the recommendations of articles (Mahmoudi & Parviziomran, 2020) (Ellsworth-Krebs et al., 2022) to take into account the whole system and its context. However, our research questions could also have been answered through the categories of a Circular Business Model Canvas, or a SWOT analysis for the barriers and drivers; the external context would have fit a PESTEL analysis.

Since we were not able to interview all types of actors in all our four case studies, we may have missed some useful elements to add in our research. Bam! Consumers' and Superzero consumers' point of view lack, as well as cleaning operators for Superzero and Bam!. However, we can assume the organisations interviewed included their perspectives, especially the consumers', since almost all interviewees automatically took into account their acceptance for the RPS and thus placed themselves as consumers, involving their own experience.

[67] https://www.thebodyshop.com/fr-be/about-us/brand-values/sustainability/refill-scheme/a/a00048
[68] https://www.beaute-test.com/mag/article-yves-rocher-lance-gels-douche-flacon-rechargeable-.php
[69] https://exploreloop.com/partners

Suggestion for Future Research

Following the previous limitations and the newness of the subject in literature, multiple paths can be taken to continue broadening the understanding on RPSs and promote their spread if relevant.

It would be interesting to realise quantitative research to have an overview[70] of all the RPSs present in Belgium, and different combinations of actors and activities that create a set of opportunities and barriers.

Since the practice in Belgium still seems timid according to L'Empoteuse and Axedis, further studies can analyse reusable transport packaging (used to wrap and fix high stackable products) as well as packaging for bulk products.

Future papers may also better analyse financial data (present and future possible cost savings) linked to RPSs to encourage more producers to opt for this sustainable option compared to recycling solutions or other single-use packaging options. Economic analysis and life cycle cost analysis are needed as states (Coelho et al., 2020). It would be interesting to test the viability of the RPSs (Bocken et al., 2022), determine the minimal number of reuse of the package to overcome investment costs, see who finally bears the costs of the reuse, how it is divided between the RPS stakeholders, how the current energy crisis and recycled material costs may influence the motivation of RPSs in Belgium, etc.

Exploration of other products that could adopt RPSs (bulk or DRS) could be relevant. We could extend the research to special attention products like dairy products, perishable products requiring refrigeration, for example. Other possible case studies may be chosen in our reviewed list of RPS in the **Appendix 15.**

Future research should be conducted to calculate the carbon footprint of the different types of RPSs while considering the different design parameters of the RPS (packaging material, location of actors, cleaning requirements, etc.). Indeed, there is a need for LCA studies to help the professionals make their choice regarding their ecological packaging, discern the limitations to deliver a better performance than single-use alternatives (compostable, craft bags, recycled plastic containers, etc.) and increase general environmental awareness while braking false perceptions. Those studies should be available and widely diffused.

We could also carry a study on the difference of barriers and drivers for established companies using single-use from the beginning, that have to switch to use reusable packaging, in opposition to start-ups. The change from single-use to reusable packaging (redesigning its business model, finding the right partners, etc.) implies costs and different management regarding the supply chain, communication, etc. We could follow the same idea and analyse possible shifts from one type of RPS to another, for example if a brand chose to offer bulk products but finally opts for returnable pre-packed products.

[70] This could end to a mapping of the different RPS such as in this map designed by the Zero Waste Living Lab https://zerowasteshowcase.enviu.org/solution/washcot/

Recommendations: Actions That Could Be Taken to Promote Reusable Packaging Practices

After analysing all the context, barriers, and drivers of our four case studies, the regulations in place regarding reusable packaging, and taking into account the opinion of our interviewees, a few recommendations may be presented.

For Authorities:
Regulators should harden policies to discourage the use of disposable packaging for professionals (not only in the beverage sector but for any packed product) and promote RPSs over recycling when environmentally justified. Recycling management may surely be used in complementarity, knowing that a reusable packaging will always finish as waste. The SUP Directive (EU) 2019/904 specifically targets plastic but as we saw with LCA from (Gueudet et al., 2021), single-use glass may have an even worse environmental impact than SUP packaging. Thus, it would be relevant to also ban or tax single-use glass containers.

The authorities can also help producers increase the number of collecting points for consumers (and therefore their convenience), using any place of storage possible for empty packaging (e.g. supermarkets, post offices, schools, public places, etc.). They can also act on the retailers' unwillingness to welcome products with RPS, imposing a certain percentage of those products in their shelves.

Fost Plus or another entitled new organisation may be asked to manage the cleaning and reverse logistics process for different brands. Therefore, instead of paying for the "Point vert" which is the cost paid by brands for recycling collection management, brands would finance cleaning facilities to recover their packages instead of only paying for recycling factories. To follow the same idea of recycling, installing special "reusable container" bubbles in public space as we can find for clothes or glass containers, for example, and imagining a special garbage truck collection at home may be interesting.

Authorities might financially (through subsidies, tax exoneration or loans) support actors integrating RPSs to change their supply chain, organise return logistics and reconditioning activities but also encourage third party cleaning operators to invest in industrial equipment in order to reach scales economy.

For Businesses:
As Bam! said: *"as long as there is no mutualisation of containers with all the actors who want to do this, it will remain difficult."* Brands should agree on standardised containers. This could be done by the industry or aggregated professionals selling similar characteristic products or type of product (jam, biscuits, etc.) as it was done for the brewery industry. Moreover, we encourage network collaboration between producers using reusable packaging to create economies of scale. This enables the share of cost and psychological burden between the members that will share washing facilities, reverse logistics, and reduced cost for high purchase volumes of standardised packages, etc. They could collaborate with distributors, transport companies, cleaning operators or DRS operators to create an entire system. This optimised system might attract more and more producers and grow the practice while forcing consumers to integrate RPS practices. Those collaboration initiatives may be launched by authorities that can play an intermediary role to connect all the members (e.g. organising group of discussions).

The design packaging analysis showed that there is still room for innovation regarding reusable packaging. Packaging suppliers[71] may develop other durable options combining the advantages of different materials (plastic, glass, textile, etc.), such as flexible plastic reusable containers instead of rigid jerrycans, screw-top jar with reusable lids,…

[71] New professionals already tough about some solutions in food sector for example PIZZycle (https://www.pizzycle.com/) , BWAT (https://bwatbox.be/en/elementor-2598/) , Flax& Stitch (https://www.flaxandstitch.com/index.html)

CONCLUSION

The current linear economic model promoting over consumption and production is no more sustainable regarding the environmental constraints: packaging pollution (and plastic threat) becomes a growing concern. Those elements force us to rethink our consumption and production patterns differently. Moreover, there is a growing pressure on companies coming from regulators and consumers (see zero waste trend, SUP directive, …) to ensure better ecological performance.

Current efforts regarding packaging were mostly focused on recycling although this solution is presented at lower level in the waste management preference, the Lansink's ladder comparing to reuse. Moreover, according to some studies (Landi et al., 2019) (ADEME, 2018), reusing glass containers generate lower carbon footprint than recycling them.

Reusable packaging solutions should therefore be more at the heart of discussion to tackle pollution. A first review of literature helped us better define a reusable packaging, and discover the different layers of packaging that may be implied in RPS (primary, secondary, tertiary). We decided to focus on primary packaging since there is a gap ok knowledge (Long et al., 2020; Mahmoudi & Parviziomran, 2020).

However, to adopt RPSs, it is necessary to have a better understanding on the different option of RPSs it exists and how it works practically. Applying the Ellen MacArthur Foundation (2013) advice to "think in 'systems'" and the organization configuration theory, we believed it would be interesting to analyse and describe the interactions, roles and activities of the different actors composing the RPS within their environment context. We built in this sense those two questions research:

- **What are the role and activities of the different stakeholders in their related reusable packaging system?**
- **What kind of barriers and drivers do these different systems face?**

To answers those questions, we carried out a multiple case study with four case study in Belgium and interviewed the different stakeholders within each RPSs studied. Our scope is focused on FMCG products and therefore in the B2C market. Two specific industries, food products and cleaning products, are analysed.

Our empirical research enables us to uncover and better understand the business perspective (often overseen by the consumer perspective), with all the business stakeholders that may be implicated in RPS. Analysing the whole system helped us uncovering different actors entitled with different activities that could be accumulated: The reverse logistic operator (distributor), The brand (producer or sub-contracting a third-party), The cleaning operator, The DRS operator - Supplier of the returnable containers with deposit/booking system, The retailer (reseller or drop-off points) – Brands'business customer, The "working" consumer.

The study also highlights several elements concerning the different barriers and drivers that fluctuated according the type of RPS studied (bulk sale or returnable containers), the design of the reusable packaging itself, the different combinations of organizations within RPSs and their environmental context.

The sustainable values carried by brands and their managers are the first drivers for adoption of RPSs. Indeed, although there is a growing demand for ecological solutions regarding packaging, those are still a niche market. Future costs savings were not really highlighted since they may appear in the long run and overcome the important indirect costs linked to the reuse of the package (reconditioning, reverse logistics,…). Shared networks with third parties subcontractors may help to decrease costs and burden.

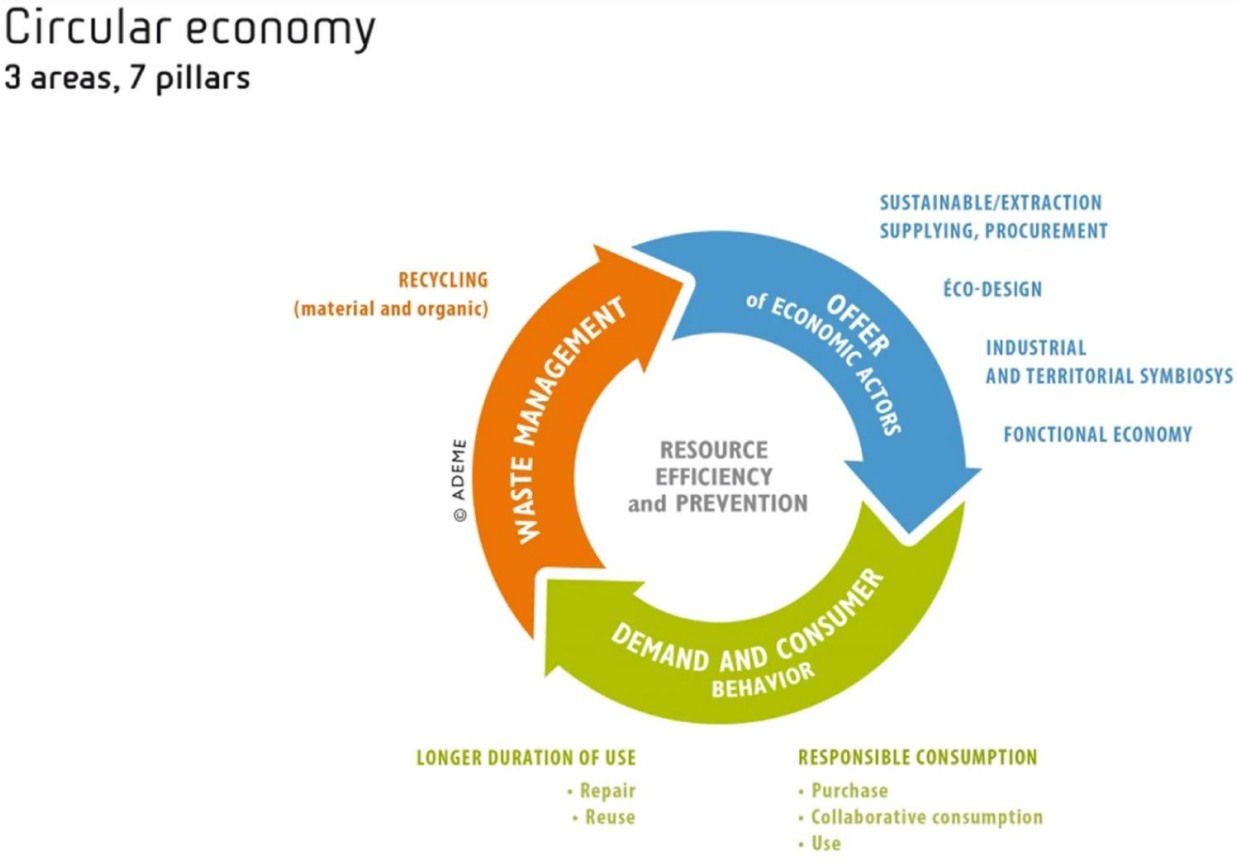
Collaboration between all the stakeholders of a RPS is necessary to optimize environmental and commercial benefits. Poor reuse/return rate damages the RPS: information and convenience are key to increase it.

The current low cost of disposable containers, the health and safety requirements to ensure in RPSs and the COVID and current energy crisis are strong external barriers for RPSs. The changing behaviour and cultural habits anchored in Belgium towards DRS for the brewery sector may help practice expansion for other types of products.

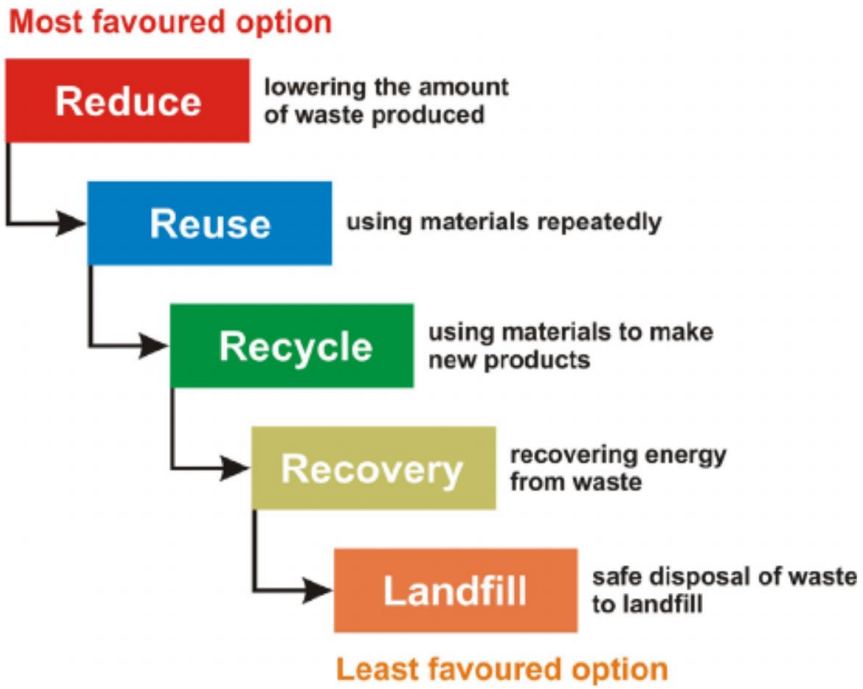
Since, the subject is still a new area in literature, there are multiple additional research that could be carried out to contribute to the knowledge on RPSs and promote the practice in our changing macro-context. For instance, face to the numerous ecological option that raise regarding packaging, what are the best option environmentally speaking taking in count the whole life cycle of the package? How a brand can choose the right RPS for its business model while being financially and environmentally viable?

Appendices

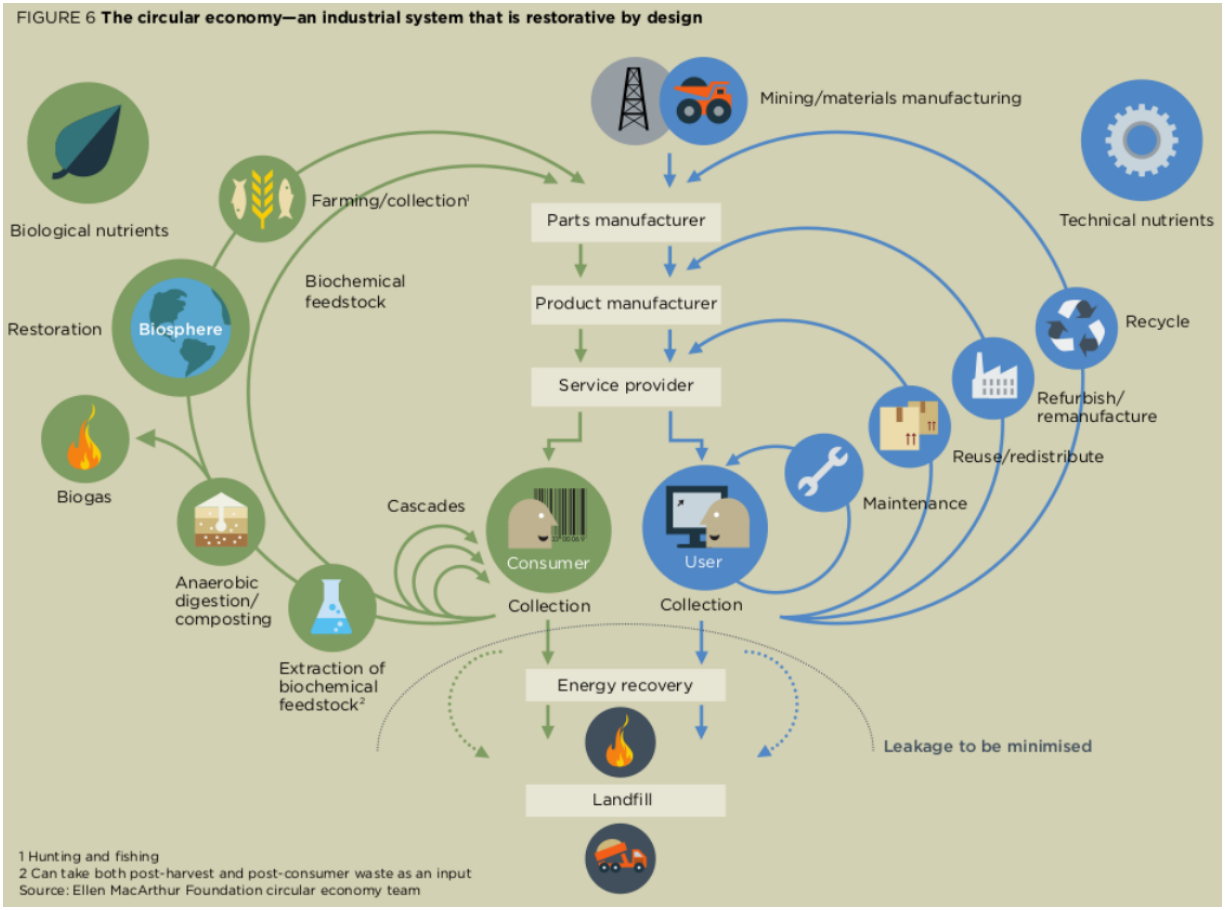
Appendix 1: ***The principles of a circular economy according to (ADEME, 2013) adapted by (Héry & Malenfer, 2020)***



*Appendix 2**: The Waste Hierarchy adapted from EU Waste Framework Directive 2008/98/EC** (Cole et al., 2014)*



*Appendix 3: **The butterfly diagram (Ellen MacArthur Foundation, 2013)***



Appendix 4: ***Overview of the reuse share categorised by market sector*** *(Jansen, n.d., p. 2)*

1.1 Products in reuse packaging

Reuse share >50%
- Beer
  draught, glass bottle

Reuse share >20%
- Soft drinks
  Glass bottle, (very little REF-PET-bottles)
- Mineral-, spring-, soda water
  Glass bottle, (very little REF-PET-bottles)

Reuse share <10%
- Milk and diary products
  Glass bottle, jars with screw cap
- Wine
  Glass bottle,
  Refill in retail stores
- Fruit juices
  Glass bottle
- Washing agents and detergents
  Plastic bottles for refill retail stores

Appendix 5: ***Characteristics of the three types of systems (Pålsson, 2018, p. 94)***

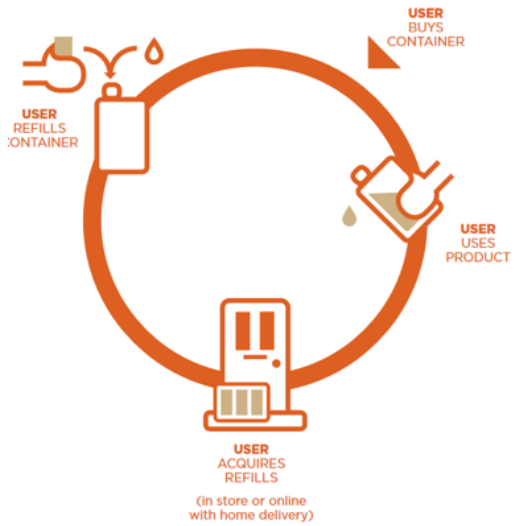
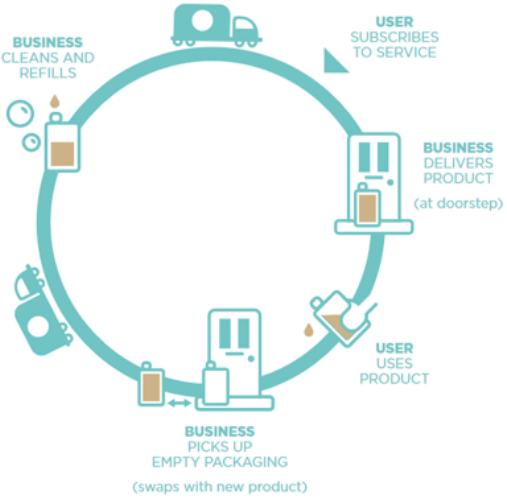
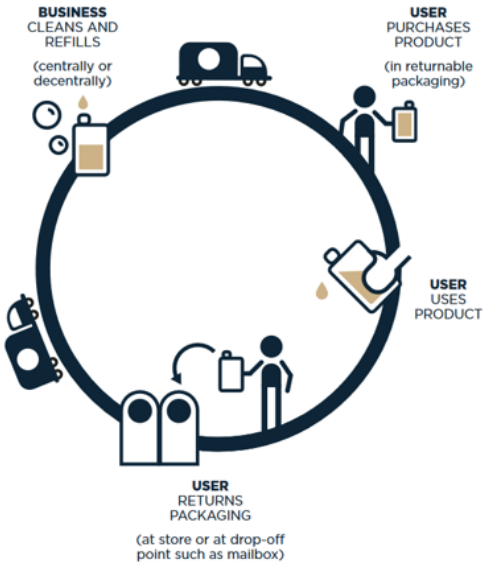
	Switch pool		With reverse logistics			Without reverse logistics
Basic principle	Every partner has an allotment		Reverse logistics by agency			Rental of the containers
Responsibility	Every partner is responsible for his own allotment		Agency			Sender, also for the reverse logistics
Investment	Shared among users		Agency			Agency
Partners	Sender, receiver	Sender, transport provider, receiver	Agency, sender, transport provider, receiver			Agency, sender
Control system	Direct switch	Exchange-per-exchange switch	Transfer system	Depot system with booking	Depot system with deposit	Rental of the containers
Benefits	Simple administration	Simple administration Control of packages in the system	The sender has good control of own packages	Minimal administration for packaging users Economies of scale for cleaning and maintenance Cost-efficient return transport	Cost-efficient return transport Track & trace system is not needed Short cycle time Deposit covers lost packages	No investment for users Low economic risk for users Easy-to-handle flexible packaging volumes
Drawbacks	Risk of long cycle times Risk of lost packages	Extra packaging inventory at the transport provider	Internal resources for administration for the sender No economies of scale for cleaning and maintenance	Advanced IT structure Frequent reporting	Advanced IT structure Frequent monetary transactions	Rental fee to the agency No economies of scale for cleaning and maintenance Senders need own cleaning and maintenance facilities

SOURCE Developed from Lützebauer, 1993 and Kroon and Vrijens, 1995

Appendix 6: ***Refill models (Lofthouse et al., 2009)***

	Refill Example	Refill Approach	Description	Reflection on inclusion in main study
1		Lightweight self contained refill delivered through dispenser	Customer buys a self contained refill which they take home and put into their durable dispenser. Applications include Wipes, face creams, razors, cosmetics, fabric conditioner & air fresheners.	INCLUDED
2		Lighter weight refill through part reuse	Customer buys a new bottle of product and reuses the spray pump. Applications include cleaning products.	NOT INCLUDED Not innovative enough an approach
3		Self dispense	Customer takes reusable container back to the store where they refill it with the same product. Applications include dry goods, personal care products and fabric conditioner.	INCLUDED
4		Original packaging swapped for new product	Customer returns empty packaging to a unit where they leave it and pick up a new product. The old packaging is refilled for future use by someone else. Applications include toner cartridges and single use cameras.	INCLUDED
5		Door to door delivery – packaging replaced	On demand the customer receives full packaging and leaves empty packaging for supplier to collect, when they are finished. Returned packaging is refilled for other customers. Applications include milk bottles and vegetable box system.	NOT INCLUDED Did not fit into Boots business model
6		Deposit system	Customer returns empty packaging to supplier for a financial incentive. Applications include soft drinks bottles and beer bottles.	INCLUDED
7		Top up card	Customer pays for a service which is delivered on the production of the payment card. Applications include downloadable music and payment systems for services such as mobile phones.	INCLUDED
8		Creation	Customer buys the constituent parts to make the product themselves. They buy refills to allow them to repeat the process. Applications include soft drink makers and orange juicers.	NOT INCLUDED Not obviously a refill
9		Door to door delivery – packaging refilled	Customer dispenses quantity required from a delivery van, using special containers and only paying for the quantity taken. Applications include detergent products.	NOT INCLUDED Did not fit into Boots business model
10		Refilled with different product	Once original packaging has been used it is refilled with a different product. Applications include toys filled with sweets or durable packaging used to store other products in.	NOT INCLUDED Did not fit into Boots business model - trying to establish a closed loop system
11		Dispensed concentrate	Customer buys a dispensing unit. They also purchase refills containing concentrated product which are delivered through the dispenser. Applications include coffee machines.	INCLUDED
12		Dispensed product	Customer buys a dispensing unit. They also purchase refills which are delivered through the dispenser. Applications include personal care products in showers.	INCLUDED
13		Concentrate mixed in original packaging	Customer buys a concentrated refill which they dilute with water and mix using the old packaging. Applications include laundry products.	INCLUDED
14		Fill your own packaging	Customers fill their own packaging with product in shop.	NOT INCLUDED Did not fit into Boots business model
15		Bulk purchase	Customer buys in bulk and refills a sampler package at home. Applications include cooking ingredients (such as oil, vinegar, peppercorns) and household cleaning products.	NOT INCLUDED Did not fit into Boots business model - wholesale not high street

Appendix 7: ***The four reuse models*** *(Ellen MacArthur Foundation, 2019)* ***adapted in table***

	REFILL	RETURN
AT HOME		
ON THE GO		

Appendix 8: ***Product-service systems in FMCG*** *(Zeeuw van der Laan & Aurisicchio, 2019)*

Table 2. PSSs of FMCGs with revalorisation services.
(F) : facilitating components; (C) : consumable components

	PSSs	FMCG *(components)*		Revalorisation service *(B2C)*			
		Consumable (C)	*Facilitating (F)*	*Service*	*Collect-and-return*	*Location*	*Close loops of*
Food and beverages	**Dopper**	Water	Reusable bottle	App locates water points		Refill point	Components (F)
	Drinkfinity	Concentrated flavourings	Pods	Take-back	Terracycle post label	Post box (or Terracycle drop-off point at retailer)	Materials
	Grolsch	Beer	Glass bottle and crown cap	Take-back	Grolsch crate	Retailer's reverse vending machine	Components (F)
	Jacob's	Biscuits	Wrapper	Take-back	Terracycle post label	Post box (or Terracycle drop-off point at retailer)	Materials
	Milk&More	Milk	Glass bottle and foil cap	Take-back		Doorstep	Components (F)
	Nespresso	Coffee grounds	Single-use capsules	Take-back	Nespresso envelop or post label	Nespresso in-store drop-off point (or post box)	Materials
Home care	**Ecover**	Detergent	Reusable bottle	Refill station		Refill station at retailer	Components (F)
	Splosh	Detergent	Reusable bottle	Refill delivery		Home	Components (F)
Office	**BIC (pen)**	Ink	Pen components	Take-back	Terracycle post label	Terracycle drop-off point at schools	Materials
	Fuji (dispo camera)	Film	Camera components	Photo development		Photo developing shop	Components (F)
	HP	Ink	Cartridge components	Take-back	HP envelope	Post box	Materials
	Repack	Various e-commerce	Reusable envelope	Take-back	Repack address label (part of envelope)	Post box	Components (F)
Outdoor	**Kartent**	Cardboard tent		Collection		Music festival site	Materials
Personal care	**Boldking**	Metal blades	Cartridge components	Take-back	Boldking envelope	Post box	Materials
	Garnier	Cosmetic	Plastic bottles	Take-back	Terracycle post label	Post box (or Terracycle drop-off point at retailer)	Materials
	Lush	Cosmetic	Plastic pots	Take-back		Lush store	Materials
	MAC	Cosmetic	Plastic pots	Take-back		Mac store (or post box)	Materials
	Preserve	Bristles	Handle	Take-back	Preserve post label	Post box	Materials

Appendix 9: Type of ***reusable packaging (Coelho et al., 2020, p. 3)***

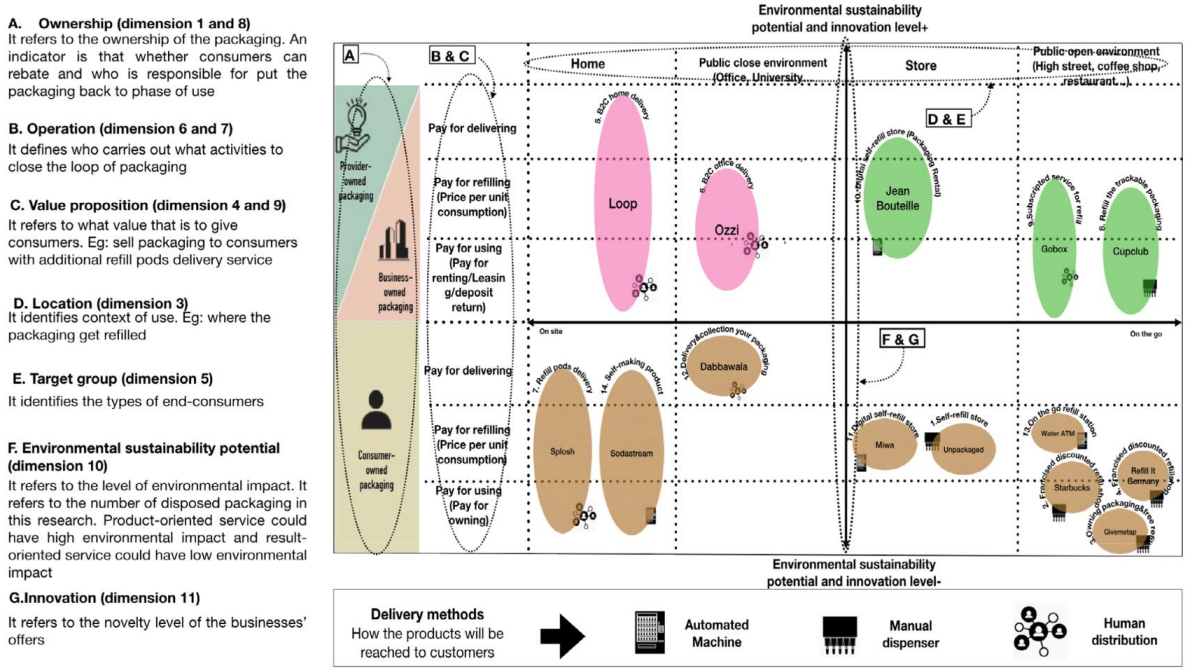
Type of packaging	Packaging description	Product examples
Refillable by Bulk Dispenser	Customers use their packaging or brand's refillable packaging in-store or at a mobile truck, making the use of further packaging unnecessary.	Cereals, grains, candy, wine, juice, mineral water, beer, olive oil, vinegar, detergent, soap, hair care products, perfume, body and face lotion
Refillable Parent Packaging	**Bottle, container, pouch, pod, tablet, powder**The refill packaging is made with less material than parent packaging. Parent packaging can be refilled by: - pouring product inside parent packaging; - placing container inside of parent packaging; - diluting concentrated product in water inside parent packaging.	Makeup, dental floss, tooth and mouth wash tabs, deodorant, perfume, cosmetics, cleaning products, hair care products, flavoured water
Returnable Packaging	**Container, bottle, cup, plate, bowl,…** Customers return empty packaging which will be cleaned and refilled for future use by the retailer/producer (can be combined with a deposit system to provide a financial incentive).	Beer, soft drinks, mineral water, perishables, detergent, soap, cosmetics, hair care products. Reusable cups, containers, plates. (for events, cafes, restaurants)
Transit Packaging	**Boxes, containers, soft packages** Customers receive the product in reusable packaging which is returned by door delivery/pick up, or through the post office. **Crates, pallets, wrappers** Customer reuses packaging multiple times before being returned to the producer or disposed of.	Reusable packaging for transport or shipping of perishables or non-perishables. B2C: for moving home or office location or e-commerce delivery of apparel, furniture or perishables. B2B transport from producer-warehouse-store.

Appendix 10: ***Reuse and recycling models and behaviours framework*** *(Tassell & Aurisicchio, 2020)*

Reuse model	Recycle model	Key enabling behaviour
(a) Consumer replenishes/ reconditions		Keep & Replenish/ Recondition
(b) Consumer replenishes at home via service		Keep, Receive (home) & Replenish
(c) Consumer replenishes on-the-go via service		Keep, Bring (shop) & Replenish
(d) Consumer brings and company replenishes/ reconditions via service	(f) Take-back scheme	Bring (post office/ post box, shop, street) & Dispose
	(g) Bring site	Bring (shop, street) & Dispose
(e) Company replenishes for consumer via service	(h) Kerbside collection	Bring (doorstep) & Dispose

Design tool use to classify the current RPS (Long et al., 2020, p. 25)

Appendix 11: ***Design tool classifying RPSs (Long et al., 2020)***



1. Defining PSSs+RPSs dimensions following the theory-building approach

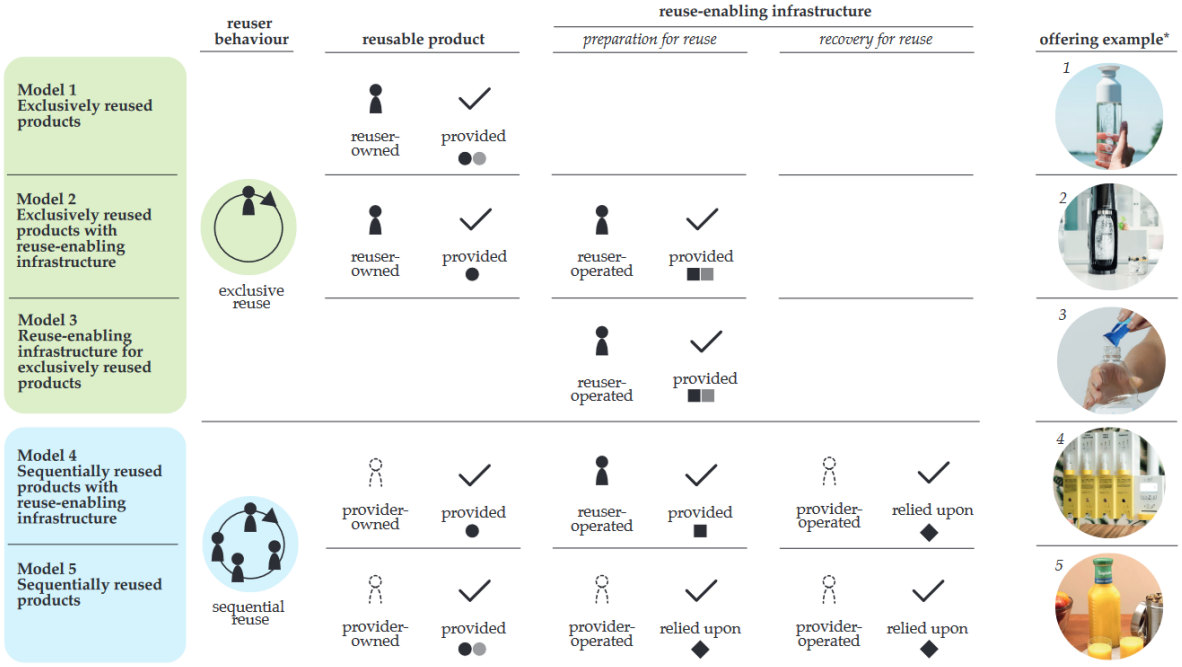
2. Identifying the compatible dimensions. X-axis includes D&E dimensions. Y-axis includes A, B, C, F&G dimensions. Crossing them to develop the classification.

3.Populating the classification with the collected cases which led to an identification of 14 archetypal models.

Appendix 12: ***Archetypal models (Long et al., 2020)***

No.	Archetypal models	Value proposition
1	Self-refill store	Offering products through manual dispensers to consumer-owned packaging (e.g., Unpackaged).
2	Franchised discounted refill shop	Offering products in the packaging through manual dispensers (e.g., Starbucks).
3	Owning packaging and free refilling	Offering branded packaging to consumers who can have free products in the participating organizations (restaurants, coffee shops, and so forth) (e.g., Givemetap).
4	Owning packaging and discounted refill	Offering branded packaging to consumers who can have discounted products in the participating organizations (restaurants, coffee shops and so forth) (e.g., Refill it Germany).
5	Free refill station	Consumers can have free water in the participating organizations. Location is the public open space (e.g., Oneless).
6	B2C home delivery and collection	Offering products in the business-owned packaging to consumers. Products in the packaging are delivered to customers' homes through human distribution (e.g., Milk&More/Spring health/Loop).
7	Canteen returnable packaging	Offering products in the business-owned packaging in the public close environment through human distribution. Businesses will refund the deposit to consumers once the packaging is returned (e.g., Ozzi).
8	Concentrated refill pods delivery	Offering products in the packaging through human distribution to consumers' homes. Consumers pay for owning, refilling, and delivering the product. Consumers are able to only pay for refilling and delivering the packaging after consumers finish the previous packaging (e.g., Splosh).
9	Refill the trackable packaging	Offering products in the provider-owned packaging in public open environment through the manual dispenser. Businesses instruct consumers to put empty packaging in the certain places where providers will collect them (e.g., Cupclub).
10	Subscripted service for refill	Offering products in the provider-owned packaging in public open environment through human distribution. Consumers will pay subscription fees for providers (e.g., Gobox).
11	Digital self-refill store	Offering products to refill consumer-owned packaging at the store via automated machine (e.g., Miwa).
12	Digital self-refill store (packaging rental)	Offering products to refill provider-owned packaging at the store via automated machine (e.g., Algramo/ Jean bouteille/Miwa).
13	Delivery and collection of your packaging	Offering delivery and collection service of consumer-owned packaging from their homes to public close space. Consumers pay for delivery service only, and content of the packaging will be delivered through human distribution (e.g., Dabbawala).
14	On-the-go refill station	Offering products to refill consumers' owned packaging at public open space through the automated machine (e.g., Water ATM).
15	Self-making product	Offering the packaging and automated machine for consumers to self-make the products. The packaging and automated machine will be delivered to the homes of consumers (e.g., Sodastream).

Appendix 13: ***"Reuse models framework" (Muranko et al., 2021, p. 12)***



Appendix 14: ***Types of repurposing/reuse practices for packaging (Guiot et al., 2021, p. 9)***

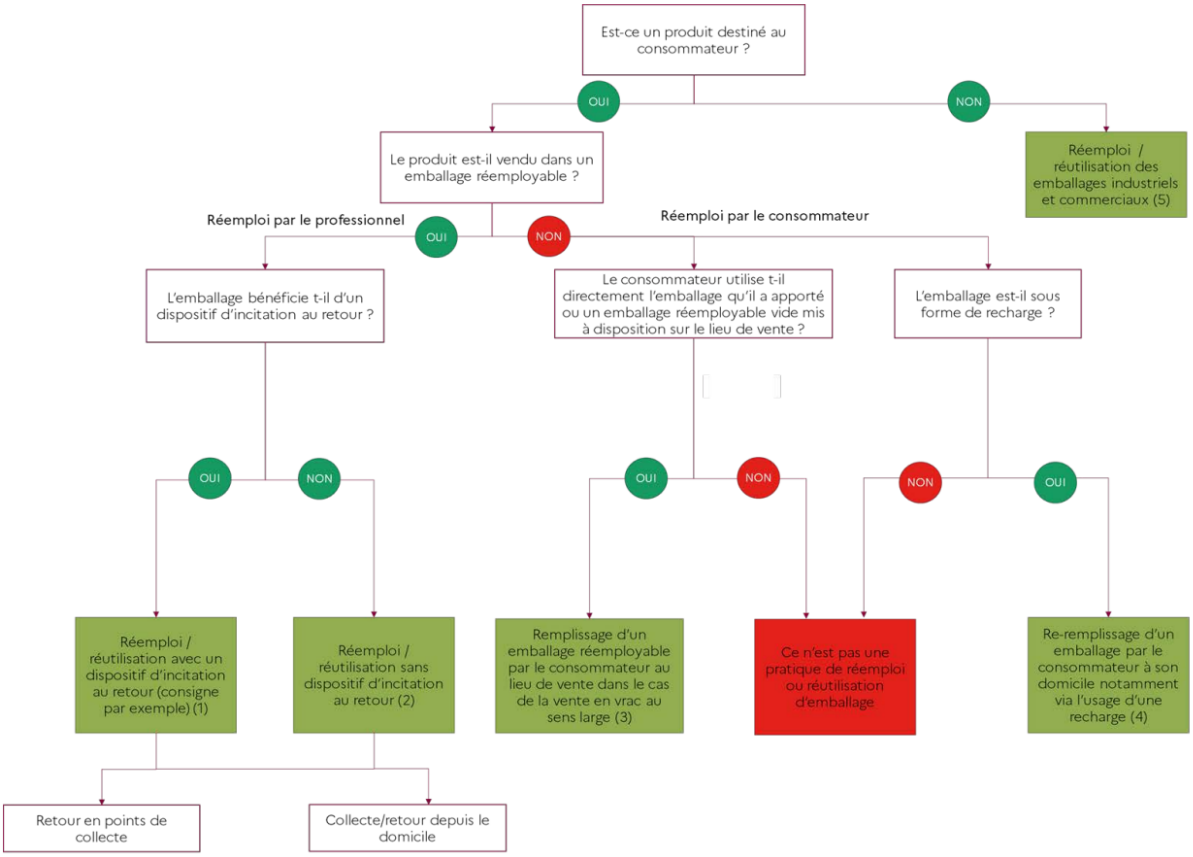


Figure 1 : Logigramme pour déterminer le type de réemploi ou réutilisation d'un emballage

Appendix 15: ***List of possible RPS to analyse in case studies***

RPS/BRANDS/STORE TO CHECK	**WEBSITE**
Loop FR	https://exploreloop.com/Carrefour https://exploreloop.com/shop/us
COZIE FR	https://www.cozie-bio.com/ https://www.cozybee.be/marques/
Endro cosmétiques FR	https://www.bretagne-economique.com/actualites/endro-cosmetiques-22-creee-en-juin-2019-la-jeune-marque-bretonne-enregistre-une Vendu chez Tarh
Jadys cosmétiques	https://www.jadys.be/pages/lhistoire-de-jadys
The naked shop FR	https://thenakedshop.fr/pages/le-concept
OOlution FR	https://www.oolution.com/blogs/eco-responsabilite-ecologie/oolution-lance-consigne-de-flacons
Brâam FR	https://atelierbraam.com/snacking-sain-au-bureau/
Bledina FR	https://www.bledina.com/vos-bocaux-en-consigne/
Body shop	https://www.thebodyshop.com/fr-be/about-us/brand-values/sustainability/refill-scheme/a/a00048
Yves Rocher	https://www.beaute-test.com/mag/article-yves-rocher-lance-gels-douche-flacon-rechargeable-.php
Lili Bulk Bam ! BE	https://bamfood.bio/fr/content/14-revendeurs https://bamfood.bio/fr/blog/communique-de-presse-lili-bulk-laureat-be-circular-2017-2018-n22
Superzero BE	https://superzero.eu/en/ https://www.rtbf.be/tendance/green/detail_les-produits-menagers-en-vrac-bio-ecolo-et-belge-avec-superzero?id=10724852
Biotop	https://www.biotopeco.be/products/
Ecover BE	https://www.ecover.com/be-nl/navulstations/
Les boudines BE	https://www.elle.be/fr/316295-saint-nicolas-les-boudines-biscuit.html
Autentic BE	https://www.autentic.be/
Alternative parfum BE	https://sosoir.lesoir.be/alternative-parfum-une-adresse-pour-shopper-des-parfums-en-vrac
Tarh BE	Raw products such as flour, sugar, seeds, but also almond, sesame, nut puree & https://www.tarh.be/products/bonbons-ourson
L'Alternative BE	https://boulangerielalternative.be/produit/granola-framboise/
Jean bouteille FR	https://jeanbouteille.fr/accompagnements-des-marques/
Magasins acceptant que les consommateurs amènent leurs propres contenants	https://www.zerowastebelgium.org/fr/autocollant-contenants-bienvenus-2/ https://www.ecoconso.be/fr/content/magasins-de-vrac-et-zero-dechet-de-wallonie-et-bruxelles#carteZW
Magasins vrac et zero déchet	https://www.ecoconso.be/fr/content/magasins-de-vrac-et-zero-dechet-de-wallonie-et-bruxelles#carteZW
L'empoteuse BE	https://lempoteuse.be/qui-suis-je
Omonbopo BE	https://omonbopo.be/pages/le-choix-de-nos-recipients
Uzaje FR	https://uzaje.com/fr/businesscase/uzaje-accompagne-les-industriels-de-lagro-alimentaire-dans-leur-passage-au-reemploi/

Lemon Tri	https://lemontri.fr/category/nos-actus/
Vrac and roll (FR mais livre en BE)	https://vracnroll.com/
Vrac and Ride BE	https://vracandride.be/about.php
Root store BE	Français | roots-store Roots Store- Vers le Zéro Déchet et au-delà ! | Bruxelles Environnement
Happy vrac.be	https://happy-vrac.be/
Oxfam juste pour certaines bouteilles jus d'orange	https://www.oxfamfairtrade.be/fr/2020/02/emballage-durable-pour-le-jus-de-fruit-et-les-autres-produits-equitables/
EFarmz	https://intercom.help/efarmz/fr/articles/4341762-comment-vous-rendre-les-vidanges-et-recuperer-la-caution
Le potiquet	https://le-potiquet.business.site/
Chango	https://www.chango.be/
Färm	Bokal Lokal pour Färm — Mingle Food
Inex	https://www.inex.be/fr/inex_product_category/foodservice-lait/
Pajottenlander	https://www.pajottenlander.be/?FR/home
Qui lait cru à Visé	https://www.bringback.be/_customer

Appendix 16: ***Interview guides***

COMMON BASE

	Guidelines for interview and questions
	Name of the company: **Interlocutor:** **Role of the interlocutor:** **Date of the interview (duration):**
Presentation and introduction	**Introduction:** Bonjour, je m'appelle Victoria … Je vous remercie pour… **Aim of the interview, my thesis:** Juste pour recontextualiser cet entretien. L'objectif de mon mémoire est d'apporter une meilleure compréhension systèmes d'emballages réutilisables. Et donc d'analyser les rôles de chaque maillon de la chaine qui permet de rendre cette réutilisation possible, passant par le producteur, le commerce, client consommateur. J'aimerai également identifier les contraintes et opportunités de ces systèmes. *Et comme je réalise une étude de cas sur…., j'aimerais beaucoup avoir votre avis en tant que partenaire.* **Confidentiality :** Est-ce que cela vous dérange si j'enregistre notre conversation ? Pour rappel, cet enregistrement ne sera utilisé que dans le cadre de mon mémoire et sera supprimé une fois terminé.
Drivers	*1.* Quels points positifs, avantages tirez-vous de ce système d'emballage réutilisable ? ⇨ *Economique (réduction de coûts ?)* ⇨ *Environnemental* ⇨ *Loyauté clients*
Barriers	2. Pourriez-vous me décrire les contraintes, challenges liés à ce système d'emballage ? ⇨ *Logistique (gestion des stocks d'emballage,..)* ⇨ *Economique (investissement conséquent au début ?)* ⇨ *Produit (problème de standardisation des pots, forme, conservation, …)* ⇨ *Légal (lois encore contraignantes par rapport à la réutilisation, vente en vrac)* ⇨ *Client (taux de retour bas des bocaux, temps d'attente long pour les récupérer,..)* ⇨ *Manque de communication/organisation avec/entre vos partenaires (commerce, station de lavage, vous-même)…* **3.** Comment gérez- vous ces challenges ? *Quelle solution avez-vous mis en place pour résoudre ces problèmes ?*

1. INTERVIEW GUIDE FOR THE "BRAND"

General question about the company	1. Quelle est la vision et la mission de votre entreprise ? 2. Pouvez-vous me raconter brièvement l'évolution de votre activité ? *Comment ce modèle de réutilisation d'emballage a-t-il évolué pour en arriver là aujourd'hui ?*
Description of the whole reusable system/supply chain	3. Quelle était la motivation qui vous a poussé à faire ce choix au niveau de vos emballage ? (Consigne, vente en vrac,..) 4. Comment en êtes-vous arrivé à faire ce choix d'emballage, cette proposition de valeur ? 5. Pourriez-vous me décrire le chemin de vos produits ? Comment se passe l'achat de ceux-ci ? *De l'achat de vos emballages, conditionnement, vente, logistique retour, lavage, tri possible …*

	6. Quels sont les parties prenantes intervenant dans le système ? Et leurs responsabilités respectives ? 7. Au final, quelles activités sont sous votre responsabilité dans ce système ? ⇨ *Production produit ?* ⇨ *Qui reconditionne (lave, tri, étiquette..) les emballages ?* ⇨ *Qui est responsable du transport/ la collecte de ces emballages auprès des points de dépôts ?* ⇨ *Qui gère la fréquence où les contenants sont récupérés auprès des points de vente/dépôt?* 8. Pourquoi (ne pas) avoir choisi de faire appel à DRS ? Pourquoi ce DRS operator et pas un autre ? 9. Comment êtes-vous arrivé à ce choix de partenaires quant au reconditionnement, distribution de vos produits ? *Quels étaient vos critères (distance avec les commerces, épicerie durable,…)? Qui est à l'origine du partenariat ?* **Choix de la matière/forme de l'emballage :** 10. D'où viennent vos emballages (qui les fabriquent) ? 11. Comment avez-vous choisi la matière de vos récipients ? *Qu'est-ce qui vous a amené à choisir du…. à la place de … par exemple ?*
Drivers	
Barriers	
Market information	12. Quels sont vos coûts ? Internalisez-vous tous les services que vous proposez (lavage bidons, transport, étiquetage) ou collaborez-vous également avec d'autres sociétés? 13. Quels sont les coûts générés par ce choix d'emballage réutilisable ? Transport, lavage, … 14. Comment est défini le prix de vente des produits (prix de la consigne)? Internalise-t-il tous les coûts permettant de réutiliser les bocaux (lavage, collecte,…) ? 15. Comment vous rémunérez-vous ? 16. Quel genre de clients attirez-vous le plus ? *Plutôt une clientèle loyale, attirée par l'environnement ou juste curieuse de votre concept?* Au final avez-vous plus de clients B2B que B2C ? 17. Quel est le taux de retour/réutilisation des emballages ? Comment gérez-vous ce taux ? 18. Que pensez-vous de votre rentabilité avec ce choix de système d'emballage réutilisable ?
Autres	19. Quel part de chiffres d'affaires représente votre vente sous cette forme d'emballage réutilisable (vrac, consigne)? 20. Sur quelle base choisissez-vous les produits que vous allez proposer sous forme d'emballage réutilisable ?

	21. Qui sont vos concurrents directs/indirects?
	Pourriez-vous me recommander un de vos partenaires, clients (commerces, ..) que je pourrais contacter pour continuer ma recherche, avoir le point de vue d'un autre maillon du système ?

2. INTERVIEW GUIDE FOR THE « RETAILER »

General question about the company	1. Quelle est la vision et la mission de votre magasin ? 2. Comment a commencé votre partenariat avec PRODUCTEUR ? Qui est à l'origine du partenariat ? 3. Quelle est la motivation qui vous a poussé à choisir cette marque et pas une autre ? 4. Quels étaient vos critères *(facilité, prix, renommée) ?*
Description of the whole reusable system/supply chain	5. Quelles activités sont sous votre responsabilité dans la solution proposée par PRODUCTEUR ? ⇨ *Recharge distributeur, maintenance* ⇨ *Stockage* 6. Comment se passe l'achat de ces produits concrètement ? *(location distributeur, achat bouteilles séparées, retour des emballages par le consommateur, retour au producteur …)*
Market information	7. Quels sont les coûts engendrés par cette solution réutilisable/vrac ? *(contribution dans transport, gestion logistique inverse,…) ?* 8. Comment fixez-vous votre prix de revente ? Tenez-vous compte de ces taches, la logistique ? *9.* Comment cela se passe au niveau comptable avec la consigne ?
Drivers	
Barriers	
Market information	10. Quels contenants utilisent les consommateurs ? Les clients ont-ils l'habitude de réutiliser leurs contenants ? 11. Que pensez-vous de la rentabilité de cette solution ? **Documents : Contrat, factures client** ?

12. INTERVIEW GUIDE FOR THE "THIRD PARTIES"

General question about the company	1. Quelle est la vision et la mission de votre entreprise ? 2. Pouvez-vous me raconter brièvement l'évolution de votre service? 3. Comment a commencé votre partenariat avec PRODUCTEUR ?
Description of the whole reusable system/supply chain	4. Quels sont les services, les activités sous votre responsabilité (prévues dans le contrat avec PRODUCTEUR) ? *(Fourniture pots, Production produits, conditionnement, stockage, Logistique, Lavage)* 5. Comment se passe la préparation d'une commande de PRODUCTEUR concrètement ? Pouvez-vous me décrire le chemin des contenants, avec les différentes activités ? **Choix de la matière forme de l'emballage**
Drivers	

Barriers	
Market information	6. Comment vous rémunérez-vous ? 7. Quels sont vos coûts dans ce genre de service ? Internalisez-vous tous les services que vous proposez ou collaborez-vous également avec des sociétés de lavage ? 8. Comment évaluez-vous le risque que vos clients professionnels arrêtent de passer par vous ? Internalise le service ? 9. Qui sont vos concurrents directs/indirects pour ce genre de service ? 10. Quel autre type de clients avez-vous dans ce service ?
Autres	11. Que pensez-vous de la rentabilité de cette activité ?

Appendix 17: Comparison of the main RPS

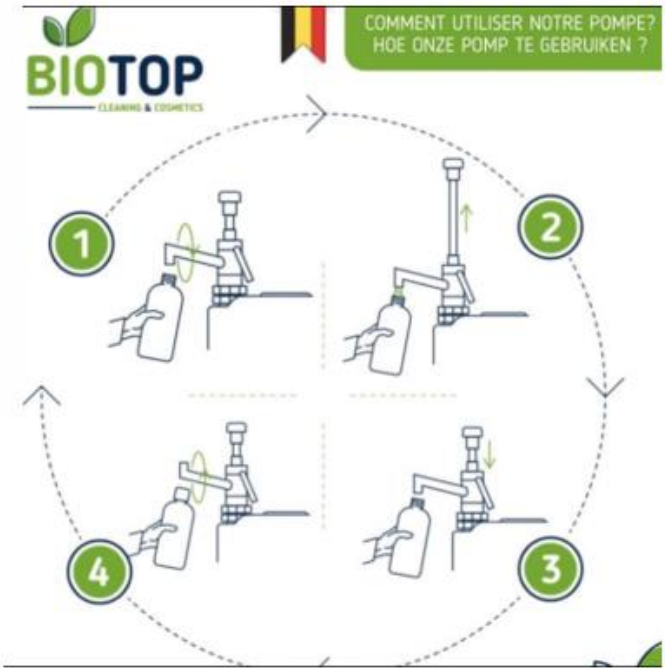
	Alternative	**Lilibulk - Bam!**	**Ecotap- Superzero**	**Biotop**
Date of creation	2019	2017	2019	1996 (2012 acquisition)
Adoption of reusable packaging since the beginning?	V	V	V	V
Evolution of the RPS	1. Tried bulk sale 2. Creating his own DRS system 3. Joined L'Empoteuse network with her pots but single-use paper bags for some products in 2020	1. Online bulk store with home delivery in returnable containers 2. Bulk store supplier with returnable containers 3. Bam! with dried mix in returnable containers 4. Expansion in compostable packaging	Bulk refilling automatic dispenser with specific pre-labelled packaging bought at the first purchase. Returnable jerrycans	1. Pre-packed in single-unit form sold and possibility to refill it. Deposit system for jerrycans 2. Bulk sale without pre-packed. No more deposit for jerrycans from 2012
Size of the company	Start-up, 3ETP, low volume https://www.companyweb.be/fr/0785458290/boulangerie-l-alternative	Bigger, high volume https://www.companyweb.be/fr/0672953138/lili-bulk	Start-up https://www.companyweb.be/fr/0735482308/zero-waste-solutions	7 ETP, high volume https://www.companyweb.be/fr/0458756352/biotop
Geographical presence	Belgium	Belgium and intention to explore international with compostable packaging	Belgium (and Luxembourg very recently, beginning in mid-2022)	Belgium
Mission and vision	Make people who have celiac disease, or who suffer from food intolerance, forget about their intolerance by offering qualitative food substitutes	Providing delicious bio ready-to-cook solutions - salty and sweet - in a zero waste mode !	To accelerate consumers' transition towards zero-waste distribution for liquids consumption by ensuring the best user-friendliness for both shops and consumers	Providing hygiene and cleaning product eco-labelled, ecologic, biodegradable, efficient and affordable for all interested
Type of product sold in this RPS	Solid products (Madeleines, biscuits, snickers, tiramisu) Semi-liquid (Spread humous, chocolate spread, ,…)	Solid volatile product (Dried ready-to-cook mixture with possible flour)	Liquid cleaning product (Powder cleaning products in single-use paper bag)	Liquid cleaning products

Direct sale distribution (B2C) ?	V 80% in which it is directly in the store and a part online through collecting point + 20% B2B	X before online service for compostable packaging	X	X
Presence of the RPS in traditional supermarket ?	X	X tried with TOMRA system but too expensive	V	X
Material of the end reusable packaging	Glass (+ Possible first-purchase textile bags sold by L'Alternative)	Glass	Recycled and recyclable plastic	Unpredictable, it depends on the consumer (Glass/ Plastic/…)
Characteristics of the reusable packaging	Wecks with plastic reusable lids and a deposit of 1€ permanently labelled with L'Empoteuse icon and removable label for L'Alternative	Screw-top jars with disposable metallic lids and a deposit of 0,25€	End packaging: Plastic pre-labelled reusable bottle at 1,5€ for the first purchase Intermediary packaging: Plastic returnable jerrycans without deposit	End packaging: Depend on the consumer, plastic bottles not pre-labelled may be furnished by the producer in the shop Intermediary packaging: Plastic returnable jerrycans without deposit
Number of reusable packaging type (format)	Different volumes and shape available from L'Empoteuse depending on the products in it (spread, biscuits,…)	1 unique jar for all their products	1 unique bottle of 1L for 4 products. And one 500ml bottle for a specific product	All consumer choice
Permanent label ?	X but L'Empoteuse's label should stay to ensure the reuse for another network member	X	V but removable for recycling	X The one furnished by the producer and proposed by the retailer is removable
Whole range of products sold following this RPS?	Part	Part	Whole	Part
Single-use prepacked product for the same products	X	V	X	V
Collection management: Delivery at the same time of the collection?	V Through a personal delivery man or a distributor	V Through a distributor or a carrier	V for the jerrycans	X collection tour for the jerrycans organised by them, delivery by a distributor or carrier

Internalisation of the washing of the returnable containers	V	X by their producer partner Travie	X by a cleaning operator	V
Coherence with the rest of the packaging system (layers)	V using the reusable plastic transport. But not in the case of products sent by post (packed in cardboard in plus)	V using the reusable plastic transport	V implicit reuse of the end-packaging + Reuse of the intermediate packaging, the jerrycans	V implicit reuse of the end-packaging + Reuse of the intermediate packaging, the jerrycans
Main barriers	1. Hidden costs 2. Poor return rate	1. Hidden costs 2. Poor return rate	1. Poor reuse rate of consumers 2. Storing space for the dispenser	1. Reverse logistics for the jerrycans 2. Storing space at the retailer
Main drivers	1. Environmental impact 2. Raising awareness	1. Environmental impact 2. Zero waste consumption	1. Environmental impact 2. Wider adoption of bulk distribution through convenience	1. Environmental impact 2. Direct contact with customer

Appendix 18: Superzero automatic dispenser

Appendix 19: ***Biotop jerrycans (and rest of their range) and their dispenser system (pump)***

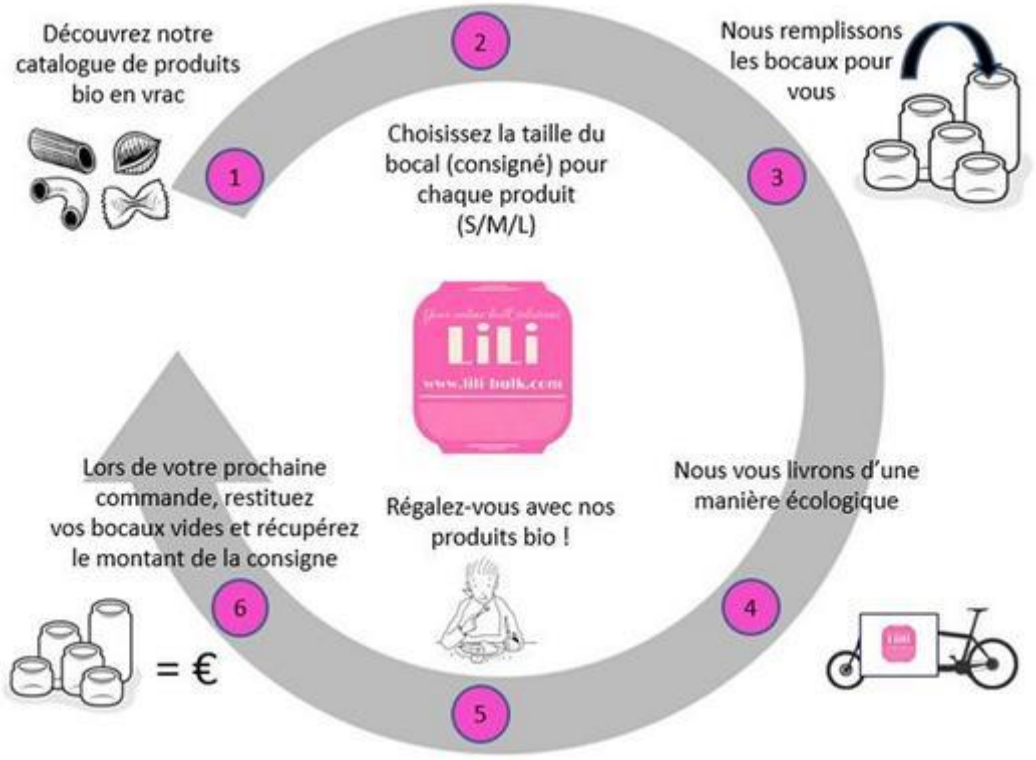


Appendix 20: ***Order from a customer to L'Empoteuse***

	L'Empoteuse		Prix		Votre commande			
			Consigne (0% TVA)	Service HT (21% TVA)	Qté souhaitée	Arrondie par cond.	Total HTVA	Total TVAC
Boîte fraîcheur		Boîte fraîcheur 1150 ml avec couvercle vert 17*17 cm	2,50 €	€		0	0,00 €	0,00 €
Boîte fraîcheur		Boîte fraîcheur 2000 ml avec couvercle vert 20*20 cm	2,50 €	€		0	0,00 €	0,00 €
Boîte fraîcheur		Plat pyrex 800 ml avec couvercle plastique blanc, 19*14*4 cm	2,50 €	€		0	0,00 €	0,00 €
Boîte fraîcheur		Plat pyrex 1500 ml avec couvercle plastique blanc, 22*17*6 cm	2,50 €	€		0	0,00 €	0,00 €
Stockage		Bac pliant réutilisable 60*40*27 cm	12,00 €	€		0	0,00 €	0,00 €
Bouteille		Bouteille 500 ml avec bouchon mécanique	1,00 €	€		0	0,00 €	0,00 €
Bouteille		Bouteille 1000 ml avec bouchon mécanique	1,00 €	€		0	0,00 €	0,00 €
Bocal		Bocal à vinaigrette 53 ml non consigné	0,00 €	€		0	0,00 €	0,00 €
Weck		Weck **200 ml cylindrique** avec couvercle plastique ou verre	1,00 €	€		0	0,00 €	0,00 €
Weck		Weck **220 ml arrondi** avec couvercle plastique ou verre	1,00 €	€		0	0,00 €	0,00 €
Weck		Weck **290 ml empilable** avec couvercle plastique ou verre	1,00 €	€		0	0,00 €	0,00 €
Weck		Weck **370 ml empilable** avec couvercle plastique ou verre	1,00 €	€		0	0,00 €	0,00 €
Weck		Weck **580 ml empilable** avec couvercle plastique ou verre	1,00 €	€		0	0,00 €	0,00 €
Weck		Weck **850 ml droit** avec couvercle plastique ou verre	1,00 €	€		0	0,00 €	0,00 €
Weck		Weck **1000 ml arrondi** avec couvercle plastique ou verre	1,00 €	€		0	0,00 €	0,00 €
Weck		**Clips** réutilisables (à la pièce)	0,00 €	€		0	0,00 €	0,00 €
Weck		**Joints** (non inclus dans le prix du couvercle verre)	0,00 €	€		0	0,00 €	0,00 €
Stockage		Casier lavable 16 compartiments	13,00 €	€		0	0,00 €	0,00 €
Stockage		Rehausse pour casier lavable 16 c.	10,00 €	€		0	0,00 €	0,00 €
Stockage		Casier lavable 25 compartiments	13,00 €	€		0	0,00 €	0,00 €
Stockage		Rehausse pour casier lavable 25 c.	10,00 €	€		0	0,00 €	0,00 €
Textile		Pochette couverts de récup cousue en Belgique	5,00 €	€		0	0,00 €	0,00 €
Textile		Wrap à Sandwich en PUL cousu en Belgique	5,00 €	€		0	0,00 €	0,00 €
Textile		Sac à vrac 35*35 cm cousu en Belgique	5,00 €	€		0	0,00 €	0,00 €

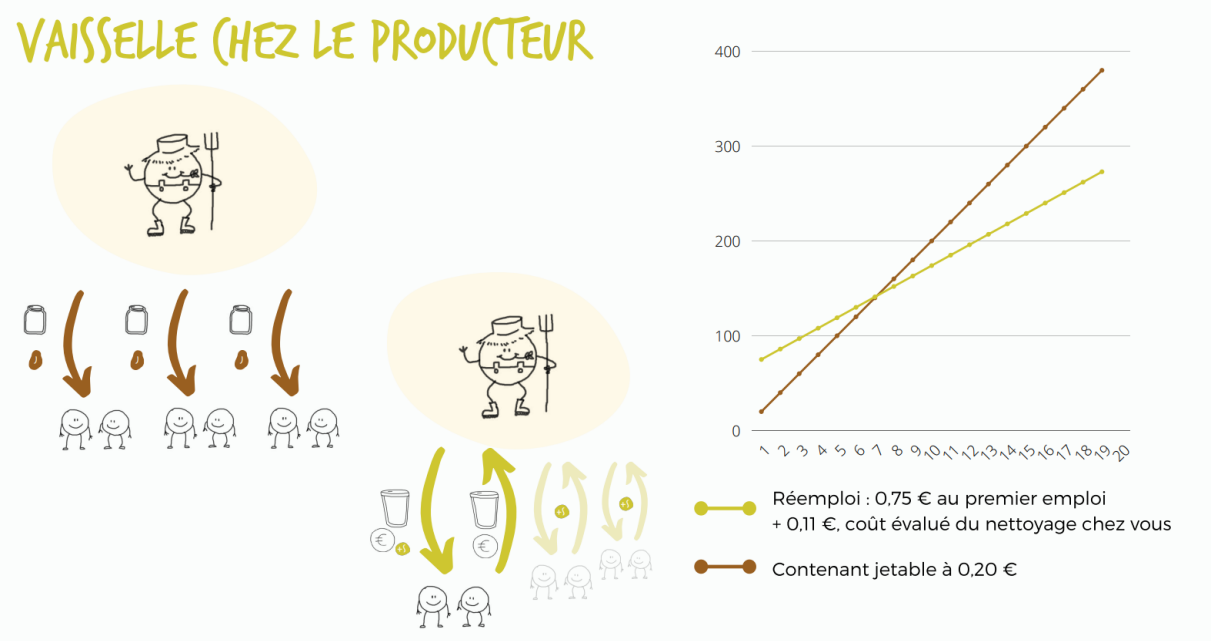
The service numbers were araised for confidentiality reasons. Personal communication, L'Empoteuse

Appendix 21: ***Mode of operation of the online bulk store of Lilibulk***



https://www.ucmmagazine.be/portraits/lili-bulk-lepicerie-bio-zero-dechet-en-ligne/

Appendix 22: Number of reuse before costs savings (Personal communication, L'Empoteuse),



NB from L'Empoteuse:

- The y-axis is the cost in cents, the x-axis is the number of dishes sold/used.
- The cost of the deposit (1€) is not indicated as it is a financial flow between the producer and his customer.
- The price of the disposable container with lid is an average between different prices charged by her customers manufacturers in 2020.
- The estimated cost of cleaning on site is taken from the report submitted by the Rayon Bio to Brussels Environment in 2020.

La grande variété des manquements constatés

De nombreux types d'anomalies ont été relevés par les enquêteurs de la DGCCRF dans les établissements contrôlés. Les manquements concernaient notamment :

- les modalités de nettoyage des équipements,
- la gestion des contaminations croisées par des allergènes,
- les modalités de stockage des denrées,
- la lutte contre les nuisibles,
- la conformité des matériaux utilisés comme contenants,
- le tarage des balances et autres instruments de mesure,
- l'information du consommateur,
- la nature des denrées vendues en vrac.

Appendix: List of the https://www.economie.gouv.fr/dgccrf/denrees-alimentaires-la-vente-en-vrac-besoin-dun-peu-dordre

Appendix 23: Comparison between two main category of RPS (bulk sale and DRS for prepackage products)

	Free-packaged (Bulk)	**Returnable pre-packaged products (DRS)**
Efforts for the consumer	High (cleaning, organising the shopping to reuse directly the container,…)	Medium mental burden transferred to the producer
Efforts for the retailer	High (Replenishment, support for the consumer to fill his container, understand the dispenser enabler system, eventual maintenance of the dispenser enabler, storage of the products and empty jerrycans, respect of hygiene requirement)	Medium (storage of the empty containers and respect of hygiene requirement, managing the deposit cashflow)
Efforts for the producer, the brand	Medium	High (cleaning, reverse logistics,…but possibility to externalise, collaborate with other actors)
Risk of product waste during the process	High. Depends on the use (dirty filling) and the choice of the filling system (bags or rigid container)	Low (filling by the producer)
Incentive to reuse the package	Low. Depends on the number of alternatives if the consumer is not forced to buy the first purchase, or take a container with a deposit	High. Depends on the deposit and consumer efforts and perception of the container as valuable
Space needed	Medium (depends if the intermediate packaging is returnable) Returnable jerrycans (stock + in-store displayed)	High At the retailer (dirty containers) At the producer (dishwasher + dirty and clean stock) At the cleaning operator (separating dirty and clean, wet and dry containers and possible different stockage per business customer)
Regulations challenges	High, market not so well ruled. Products that require special attention, gluten-free products, hygiene and household products. Risk of product contamination,	Medium, well-known regulations (labelling). Ensuring a right cleaning to avoid contamination risks.
Brand image visibility	Low, less visible, only in store. Except for first purchase pre-labelled bottle system.	High, possibility for the producer to choose its container, and label it
Customisation for the consumer	High, they can choose their preferred package, volume. Except for automatic calibrated filling option (Superzero)	Low

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Executive summary

Context: We cannot live infinitely in a "take-make-waste" model since pollution and environmental constraints are growing concerns. Using plastic containers for few days or weeks seems senseless given that they can take over hundred years to disintegrate in the ocean while endangering human health, marine ecosystems and biodiversity (Herrmann et al., 2022).

Authorities are aware of the problem and are working to improve garbage management. However, efforts are currently concentrated on recycling solutions (European Environment Agency, 2019) although reuse solutions should be preferred according the treatment order process in CE (Gouvernement wallon, 2018; Ellen MacArthur Foundation, 2013) and the LCA analyses we discovered.

Purpose: Better understand primary reusable packaging systems, how they work, how they are structured and what are the barriers and drivers encountered that influence their success and scaling.

Methodology: Multiple case study research representing four reusable packaging systems (RPS) in Belgium, with food and chemical cleaning products. 15 interviews to gather the different perspectives of stakeholders in each RPS. Analyse the whole system including all stakeholders enabling the reuse of the package as well as the external context in which the RPS exists to uncover particular barriers and drivers.

Findings: Literature offered us an overview of typologies of RPSs (including deposit reuse systems and bulk purchase) that helped understand the multiple settings and spotting lack of perspectives in analysis that drove our reflexion. We reviewed the barriers and drivers under different levels of analysis (the design of the reusable packaging, the organisations, and the internal relations, and the external context). Convenience for all actors in the supply chain is important to encourage the adoption and a smooth running RPS: Customer experience, burden for the retailer and employees directly managing the reusable container, burden for the producer. Bulk sale may present simple logistic supply chain for everyone but burden for retailers and consumers. The DRS may be the closest solution to traditional prepacked product but involve a number of barriers in this niche market environment towards RPS and for sectors with less historical experience with DRS (food sector compared to brewery sector). The values of zero-waste shared with business partners are the strongest driver for RPS currently since barriers are numerous (safety hygiene requirements, work burden for reverse logistics, storing space reconditioning management, deposit cash flow management, financial costs,…).

Practical implications: The authorities still have a number of ways to encourage reusable packaging practices (tax, subsidies, prohibitions, awareness-raising,…) since currently, except for the beverage sector, not enough attention was given to the solution. Regarding the business side, cooperation through shared networks and outsourcing activities with dedicated third-parties may help optimise deposit-return systems (the most convenient option of RPS for consumers)**.**

Key words: Reusable packaging system, bulk sale, deposit-return system, food and cleaning industry, reverse logistics, reconditioning.

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