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# Understanding national variations in reusable packaging: Commercial drivers, regulatory factors, and provisioning systems

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ABSTRACT

Given the global environmental impacts associated with single-use plastics, alternatives are being considered, including the reuse of product packaging, which aim to retain the functionality of products while reducing waste and broader environmental impacts. Drawing on the Multi-Level Perspective approach, we analyse three national examples of reuse in Denmark, Germany, and Mexico. While the success of reuse initiatives is often attributed to heightened levels of environmental consciousness, we argue that understanding national variations in levels of reuse requires greater attention to the commercial drivers, regulatory factors, and provisioning systems in which they arise. This argument is developed through case studies of the beverage sector in the three national contexts – specifically beer, mineral water, and soft drinks – as this sector is often regarded as a successful illustration of business-to-consumer reuse systems. To conclude, we consider what the implications might be for nations such as the UK where reuse levels remain comparatively low.

## 1. Introduction

There is growing international pressure to reduce the use of single-use plastic packaging, given its damaging environmental impact, with the encouragement of reuse now joining long-standing demands for increased recycling.[1] In the UK, for example, the UK Plastics Pact has four main targets including a commitment to eliminate problematic or unnecessary single-use packaging through redesign, innovation or alternative (reuse) delivery models, with 100% of plastic packaging to be reusable, recyclable or compostable by 2025 (WRAP, 2020). Reuse represents a significant opportunity for transitions to a more circular economy insofar as it retains the functionality of products whilst reducing waste and the broader environmental impacts of single-use packaging (see Simon et al., 2016; Błażejewski et al., 2021; Greenwood et al., 2021; UNEP 2021). There are, however, significant national variations in historical patterns and current levels of reuse. In the UK, reusable packaging has a long history, predominantly beverage based, including beer, soft drinks and milk (WRAP, 2008). Whilst reusable bottles for beer and soft drinks have been replaced with single-use, recyclable alternatives, reusable milk bottles have retained a nominal share of the milk sector as a result of its positive consumer association in terms of provenance, citizenship, sustainability and convenience (Greenwood et al., 2020; Vaughan et al., 2007). This paper explores the trajectories that Denmark, Germany, and Mexico have followed *vis-à-vis* reusable packaging in the beverage sector. In doing so, we draw on the wider sustainability transitions literature (for example Geels et al., 2015) to highlight different mechanisms and processes of reproduction and change.

Enabling transitions toward greater environmental sustainability and the achievement of the Circular Economy, often alludes to and requires the emergence of the 'circular consumer' (Hobson et al., 2021). An increasingly important analytical lens, recent research on niche 'package free' or 'zero-packaging' shopping spaces highlight the inconvenience of additional consumption work associated with reusable packaging systems as everyday impracticalities and barriers to citizen consumers (Fuentes et al., 2019; Beitzen-Heineke et al., 2017; Rapp et al., 2017). These conclusions are regularly reflected by mainstream actors trialling systems of reuse across food, drink and household item supply-chains, suggesting citizen focused barriers and enablers to facilitate the adoption of reusable packaging systems (see Tesco, 2022; WRAP, 2022). Whilst the suggestion of particular skills, knowledge and/or resources, alongside more personal attributes associated with

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[1] The waste hierarchy offers a set of waste management options, ranked according to their environmental costs and benefits (Defra, 2011). Waste prevention is the preferred option, followed by reuse, recycling and recovery (in that order), with disposal being the least preferable approach.

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confidence and willingness are required by consumers, it is apparent that all of which are not evenly distributed across society (Hobson et al., 2021). In a similar manner, observations in national variations in reuse are often explained in terms of different levels of 'environmental consciousness'. Notably, Scandinavian countries are often held up as global leaders in sustainability and corporate responsibility (Strand et al., 2015) with Denmark, Sweden, and Norway all in the top ten countries according to the 2020 Environmental Performance Index, with Germany in tenth place (SolAbility, 2020). This is frequently explained in terms of the heightened environmental consciousness that is said to prevail in these places (Burton, 2018). Comparing recycling rates in Sweden and England, for example, Wheeler (2013) describes England as 'environmentally lethargic' ("the dirty man of Europe"), compared to Sweden whose single, nation-wide system of recycling is described as 'embedded with the concerns of environmentalists', where citizen-consumers are 'enrolled into the collective environmental movement'.

In order to complement and extend these ideas, we suggest that other factors are also important in understanding the relative success of reuse and related pro-environmental initiatives in different countries. In the context of a wide-ranging and rapidly developing field of research that explores the overlapping phenomena of plastics, circular economy, packaging and reuse, we join a recent body of social science work that looks beyond cultural and environmental politics in order to emphasise the importance of business practices, technologies, markets and logistics (e.g., Hawkins, 2021; Sattlegger, 2021; and Evans et al., 2020). For example, recent work in this journal (Hirth et al. 2021) has focused on the challenges of reducing plastic packaging in the food-on-the-go sector. In contrast to the dominant perspective, where consumers' insistence on 'convenience' is held to be a key driver, Hirth et al. (2021) emphasise the role of corporate provisioning practices rather than (or as well as) consumer attitudes and behaviours. Hirth et al. use their evidence to criticise the over-emphasis on individual choice in explaining high levels of food waste, suggesting instead that these issues are driven by 'industrial socio-technical practices [and] neoliberal capitalism's development dynamics' (2021, p.122). Our argument follows a similar path, contrasting the role of consumer consciousness with the role of commercial interests, changing regulatory factors, and underlying provisioning systems.

By emphasising commercial drivers, regulatory factors, and provisioning systems, this paper responds to calls to better understand the organisational role of supply chains in the adoption of reuse systems (Coelho et al., 2020), and to move from the study of 'niche' retail environments - such as zero-waste stores - to analyse more 'mainstream and large-scale efforts' that involve 'less environmentally oriented consumers' (Fuentes et al., 2019). Our focus is on the beverage sector - specifically beer, mineral water, and soft drinks - insofar as this is an internationally well-established site of innovation that is often regarded as a successful illustration of business-to-consumer reuse systems (see, for example, Coelho et al., 2020). Our analysis is informed by the Multi-Level Perspective (MLP) approach to sustainability transition (for example Geels, 2002). MLP is a widely used framework (see, for example, Santos and Lane, 2017; Rut and Davies, 2018; Kirshner et al., 2019) for understanding processes of innovation and socio-technical change through reference to the interactions between niche, regime, and landscape scales. In this perspective, regimes refer to relatively stable configurations of institutions and technologies that constitute the prevailing organisation of particular sectors. When existing regimes are replaced by new socio-technical arrangements, a transition is said to have taken place. Innovations are typically developed at the niche level and are said to break through when changes at the landscape level (such as macro-economic trends, political belief systems and global shocks) put pressure on the dominant regime and create windows of opportunity. Whilst the MLP approach has been commonly utilised to understand socio-technical change and sustainability transitions across energy (Geels et al., 2016; Kern et al., 2015), mobility (Kotilainen et al., 2019), agri-food networks and food regimes (Rut and Davies, 2018; Bui et al., 2016), its use with respect to the circular economy and the packaging sector has been somewhat minimal (Hsu et al., 2022). Our view in this paper is that greater attention to interactions and dynamics at the regime scale are instructive for understanding the trajectories of reusable packaging in the beverage sector.

We begin by discussing our approach to data collection and analysis before presenting a summary comparison of the different trajectories of reuse in Denmark, Germany, and Mexico. With this in place, the analysis considers the detail of each case and explores how different relationships between commercial, regulatory, and provisioning elements help make sense of these trajectories. Crucially, we suggest that the actions, alignment and interrelated nature of these elements are key to understanding national variations in the technologies and practices of reuse. To conclude, we consider the theoretical and practical implications of our analysis.

## 2. Methodology

The research on which this paper is based was funded by the UK Natural Environment Research Council (NERC), award number NE/V010638/1, and aims to encourage the 'mainstreaming' of reusable packaging systems. This paper responds to a comment from one of the panel members who reviewed our proposal and expressed their disappointment at our lack of reference to 'other, very successful and long-term reuse schemes such as those operating in Germany and Scandinavia'. The analysis that follows therefore seeks explanations for national variations in levels of reuse, including the recommended examples of Germany and Scandinavia.

The research process involved three distinct phases of data collection. The first was to select cases via an initial review of reports and literature recommended by academic colleagues and project partners. At this stage, our focus was intentionally wide-ranging with the aim to developing a 'high-level' view of reusable packaging systems without focusing on any specific sector. Key themes in these reports include barriers and opportunities for the wider adoption of refillable containers (WRAP, 2008); the importance of effective policy (see Platt and Rowe 2002); alternative approaches to the circular economy such as deposit return systems (ERM, 2008); and the technical, organisational, and economical arrangements that are key to stabilising reuse systems (Golding, 1999). These reports draw on international cases - typically but not exclusively from Northern and Western Europe - with respect to learning best practices. In light of this review, we took the decision to focus on beverage packaging because it is an exemplar of reuse working at scale and across several international contexts (Coelho et al., 2020; Ellen MacArthur Foundation, 2019). We also selected three countries for further consideration. Denmark and Germany were selected because they are two well-documented examples of countries with high environmental consciousness, yet with contrasting experiences of reuse over the last c.20 years. Mexico was chosen for its comparative value because there is no evidence of high environmental consciousness but relatively high rates of reuse.

In the second phase of data collection, having taken the decision to focus on beverage packaging in Denmark, Germany, and Mexico, we reviewed a wider range of secondary sources including technical reports, online newspaper articles, annual reports, primary disclosure documents, market research data, business and NGO websites, and technical academic literature. Adopting a broadly inductive approach to data collection, we observed certain beverage sub-sectors contributing more insight into the role of reuse systems in each of the international contexts. At this point, we took the decision to focus on Denmark's beer industry, Germany's mineral water and beer industry, and Mexico's soft drink industry (including the role of Coca-Cola). It was not our intention to produce a direct case-by-case, point-by-point comparison across all sectors and countries. Rather, our aim was to use the available secondary data in conjunction with relevant literature to understand and to compare successful, long-term reuse schemes across the three national

cases.

The final phase of data collection involved engaging with key actors in Denmark, Germany, and Mexico with respect to the beverage sector, its notable sub-sectors, and competing systems. In total 7 interviews were conducted including representatives of the Danish Brewers' Association, Dansk Retursystem A/S, the Cooperative of German Mineral Water Companies (GDB), and the Association of German Beverage Retailers. The interviews served two main purposes: first, to clarify and verify the case descriptions, and second, to elicit new non-referenced material provided after these conversations.

The three case study countries demonstrate significant national variations in rates and trajectories of reuse (see Fig. 1). For Denmark, reusable packaging has declined to a point where it represents a relatively small proportion of the beverage market. Reusable packaging levels were consistently between 96% and 100% for beverages throughout the twentieth century (Fisher and Horton, 1979; Platt and Rowe, 2002). However, levels of reuse have declined from 96% in 2003 to 7% in 2022. For Germany, approximately 43% of the beverage market utilises reusable bottles (with some beverage sectors, for example beer, exhibiting higher levels of reuse than others, see Fig. 2). Germany exhibited similar levels to Denmark throughout the 1970s, with more than 90% of its beverages in reusable packaging (Fisher and Horton, 1979). By the 1990s, much of the beverage market (c.72%) still utilised reusable bottles. However, reuse levels have since declined - albeit not to the same extent when compared to Denmark – and stabilised at approximately 43% in 2020. Finally, Mexico and in particular, Coca-Cola Fomento Económico Mexicano, S.A.B. de C.V. (Coca-Cola FEMSA) exhibits how levels of reuse have been sustained despite the rapid expansion and growth of the business. The data conveys two distinct periods, the first is a decline of reuse between 1996 and 2008, where reuse levels decreased from 61.5% and 83.8% in the Valley of Mexico and Southeast Mexico respectively, to 27% in 2008. Since 2008 however, Coca-Cola FEMSA's use of returnable packaging has gradually recovered and increased its share to 43% in 2022.

Our analysis of these data reveals that national variations are not explained by heightened levels of environmental consciousness in isolation. Rather, it reveals that greater attention should be paid to commercial drivers, regulatory factors, and wider provisioning systems (cf. Bayliss and Fine, 2020). In the context of growing interest, within and beyond Economic Sociology, in the moral or institutional basis of economic activity and organisation, there is a potential wealth of theoretical perspectives that could be used to make sense of these findings. For example, Marion Fourcade has taken a comparative approach to the valuation of nature and the politics of wine regulation in France and the United States (Fourcade, 2012). Similarly, Viviana Zelizer (2010) has shown 'how culture shapes the economy' in a host of cases from life insurance to the economic and emotional value attached to children. Perhaps most notable is work that explores the role of 'non-economic' factors (such as conventions) in the governance of food systems or global value chains (e.g., Morgan and Murdoch, 2000; Ponte and Gibbon, 2005). We note, however, that our argument is not intended as a contribution to the wide-ranging literature that stresses either the Polanyian embeddedness of markets or the mutual constitution of 'market' and 'social' realities. Since the focus of this paper is a phenomenon - successful reuse initiatives - that is typically explained by cultural or moral considerations in isolation, our intention is to emphasise the continued relevance of instituted economic processes. Viewed as such, we are effectively confirming the same position on the fundamental inseparability of 'culture' and 'economy', but from a different starting point. Importantly, our arguments are developed through reference to the Multi-Level Perspective approach to (sustainability) transitions which we have chosen for two reasons. First, we suggest it is particularly well suited to the task of analysing configurations of heterogeneous elements (such as 'culture' and 'economy') without privileging any specific factor. Second, it is a processual theory that we suggest is adept at exploring shifts in configurations over time and as such, offers unique insight into how change (and by the same token, stasis) happens. We pay particular attention to the three interrelated analytic dimensions of actors, rules, and structures. Actors refer to individual human beings, businesses, and other organisations; rules refer to regulative, normative, and cognitive factors that facilitate the coordination of activities across actors; and structures relate to the material and technological aspects of society (Geels, 2004). We also draw specifically on MLP's concept of regime resistance (Smink et al., 2015; Geels, 2014; Unruh, 2000), to explain how actors, rules and structures align to maintain regime stability of reuse systems and/or defensively respond to transitions to single-use. This is instructive for exploring the tensions between process of innovation (Geels, 2002) and stability, which we suggest are germane to understandings trajectories of reuse in the beverage sector.

## 3. Denmark

Our first case study focuses on how the vested interests of the incumbent Danish beer brewing industry allied with national policy maintained the presence of refillable beverage containers, enabling the maintenance of a domestic monopoly. Our analysis shows how the eventual transformation from reuse to single-use bottles was a result of changes in the European policy context and domestic commercial interests which ultimately undermined the power of the national cartel of brewing firms.

While the use of refillable bottles in Denmark has declined since 2003, the preservation of a refillable bottle system up to the end of the twentieth century benefitted from a strong national cartel of the beer brewing industry. Founded in 1899, the Danish Brewers' Association introduced a nationwide price agreement, ensuring steady profit conditions, stable employee working conditions, and high entrance barriers to the market. These interests extended to the national authority, with the Danish state allowing industry to handle its own competition conditions, which in turn ensured stable tax returns. Within Scandinavia, free and uncontrolled competition was often viewed by businesses as unhealthy and dangerous, whilst 'cartelization' was supported (Aanstad, 2009; Iversen, 2009). This included protection from international competition by high transport costs, with domestic filling plants located near to the main markets, while distribution of small- and medium-sized breweries mostly produced for the regional or local markets (Golding, 1999; Sandberg, 2009). The domestic market was furthered protected by the long-term implementation of high taxation on beer, equivalent to 37% of its average retail price (Gourvish, 1998). Furthermore, the two major breweries, Carlsberg and Tuborg, benefitted from close co-operation with one another throughout the twentieth century, dominating the market and the interests of the Danish Brewers' Association and the closely related Association of Danish Soft-Drink Producers (Sorensen and Petersen, 2012). This commercial alignment also extended to maintaining close personal contact with leading political circles, with individuals combining roles across the beverage industry and the Conservative Party (Sorensen and Petersen, 2012).

Threatened by post-war deregulation and more liberal legislation, incumbent firms engaged in resistance strategies to maintain control of their domestic monopoly. A letter from The Danish Soft-Drink Producers to the Minister of Finance in November 1952 highlights the stabilising effects of the mutual dependency between industry and policy makers at the time. With the possible entrance of the American Coca-Cola Company (and other foreign producers) into the Danish beverage market, the letter suggested that they would start to produce cola drinks when sugar rationing ended, with the knowledge that soft drinks were taxed significantly lower than beer (Sorensen and Petersen, 2012). Countering this, the Ministry of Finance implemented a special tax on cola drinks. Throughout this period, the industry is best defined as having an 'internal non-competitive structure' (Sandberg, 2009), actively making agreements that ensured and maintained competitive advantage.

From the 1970s onwards, Denmark's national beverage monopoly

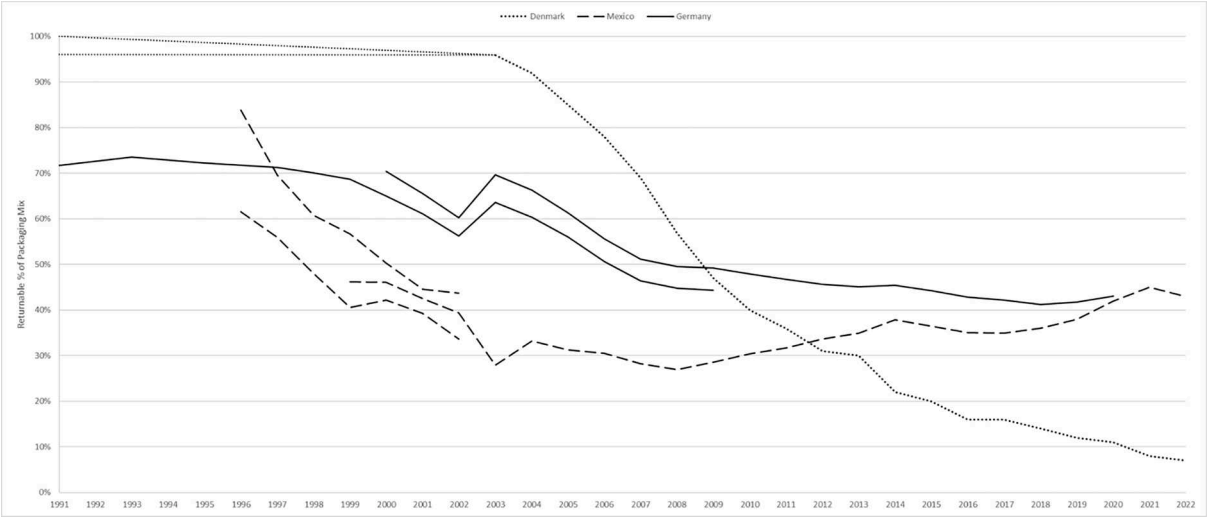


**Fig. 1.** Proportion of beverage sector consumed in reusable packaging.[21]

became increasingly vulnerable to growing international competition and by association, so was its refillable bottle. Since 1922 breweries had voluntarily used a common standardised beer bottle instead of their own branded bottles (Danish Brewers' Association, n.d.), and in 1942 members of the Brewers' Association and 80 mineral water factories entered into a nationwide and contractual deposit and return system for reusable bottles (Loftlund, 2007). The introduction of single-use cans - as a disruptive innovation - and different shaped glass bottles in the 1970s posed a serious threat to the role of refillable bottles. Denmark was particularly vulnerable to growing international competition in Western Europe and the role of canned beverages given that Sweden packaged 63% of its beer in cans, the Bergues plant in Northern France canned Coca-Cola products for the entire European Market, and the softening of Germany's beverage container laws placed more cans closer to the Danish border (Platt and Rowe, 2002).

The Danish government began to regulate the packaging market in 1977, banning one-way packaging for carbonated soft drinks and beer due to the environmental burdens of cans and one-way glass bottles (Golding, 1999). As such, reusable packaging was required for domestic products whilst the policy allowed non-refillable glass and plastic containers for imported beer and other drinks on the requirement it was sold under a deposit return system and with a limit of 3,000 hectolitres. The 1978 Packaging Tax and the infamous 1982 'Can Ban' conveyed further protectionist tendencies, with private interests reflected and reframed into societal goals (Smink et al., 2015) - in this case, as an anti-pollution measure (Sexton, 1991). The taxation measure, levied on new packaging, gave refillable packaging a significant price advantage (Golding, 1999). For the 'Can Ban', beer and soft drinks were required to be marketed in returnable packaging approved by the Danish Environmental Protection Agency (DEPA). Order 297 limited the type of material used for beer and soft drink containers to glass and prohibited the use of metals and plastics, given their limited ability to be used in either a reuse or recycling system (Anon, 1997). With the ban in place, the Danish wholesale monopoly effectively prohibited imports (Gourvish, 1998; Sandberg, 2009). Soft drinks marketed by foreign producers were often sold under license, or at least bottled in Denmark (Sexton 1991), whilst discount retailers such as Aldi, who generally implemented a one-way packaging strategy, adopted a reuse system with no logistical or economic disadvantages (Golding, 1999). The reproduction of the incumbent regime benefitted from the continued alignment between the Danish brewing industry and the Danish state, reflecting mutual dependencies between industry and policy makers (Geels, 2010).

However, actors outside of Denmark, most notably in Germany, argued that establishing a collection system would be administratively difficult and expensive, prohibiting firms from entering the market (Sexton, 1991; Anon, 1997). Similarly, the Association of European Producers of Steel for Packaging criticised the standards for being discriminatory and subjectively prioritising one environmental impact factor over another (edie newsroom, 2001). Domestically, the national price agreement also came under pressure from the Monopolies Commission in 1984. Fundamental changes were also occurring across the retail sector with the introduction and growth of supermarket chains and discount retailers who gained a foothold in the Danish beer market throughout the 1970s and 1980s (Iversen, 2009). With this came the introduction of retail branded beers, which were often discounted and not included in the price agreement. Smaller breweries subsequently broke away from the agreement to produce for the discount beer market, whilst also introducing new packaging formats to expand their distribution nationwide. As a result, avoiding competition became untenable and with this the contracting agreement between breweries was abolished in 1988 (Iversen, 2009). Additionally, the 'Can Ban' came under scrutiny from retailers, the packaging industry, importers, and even producers themselves who became keen on removing the ban on one-way packaging for domestic production (Loftlund, 2003a). The growing variety of bottle designs approved under the directive during the 1990′s led to a growing complexity in sorting and returning bottles to beverage manufacturers, with retailers calling for a handling fee to be applied to compensate for this (Loftlund, 2003a). The culmination of these international and domestic factors highlights the transformation of the regime to privilege recycling of beverage containers over reuse.

Further pressure for this transition came from the European Commission who raised concerns about the 'Can Ban' violating the EU Directive on Packaging and Packaging Waste, contravening measures to harmonise the management of packaging across the EU. Laws such as the packaging tax and the 'Can Ban' were interpreted as favouring local businesses, restricting internal markets, and acting as a trade barrier (WRAP, 2008). Against the backdrop of continued threats by the European Commission and two pending joint cases in the European Court of Justice against the 'Can Ban', a proposed deposit return system by the beverage and retail industries received political guarantee from the Minister for Environment in 2000 (Loftlund, 2003b). This alignment between the beverage industry, retailers and the political system allowed for a new Danish company, 'Dansk Retursystem', to be set up to provide a deposit return system for both refillable and single-use packaging. The 'Can Ban' was subsequently repealed in 2002 by a new Liberal-led government to halt the two pending cases. This enabled a free choice of packaging for beer and soft drinks provided the packaging was recovered by Dansk Retursystem or another deposit return system

(Danish Brewers' Association, n.d.). Once these policies were removed and alternative markets and infrastructures established, a period of transformation ensued. The beverage industry and retailers were subsequently prepared with a recycling infrastructure to cater for the anticipated influx of single-use products, particularly those in cans (Bettelheim, 2004). Beer imports into Denmark significantly increased from 4 million litres in 2002, to 13 million litres in 2006, and 77 million litres in 2019 (Anker Andersen, n.d.; The Brewers of Europe, 2020). As for the beverage packaging mix, as of 2022, 58% of beverage containers collected by Dansk Retursystem were metal cans, while reuse beverage containers equate to 7%, down from 96% in 2003 (Dansk Retursystem, 2023).

To summarise, the Danish case shows that, despite formal political justifications emphasising environmental consideration in overriding market forces and preventing one-way packaging entering the market, vested commercial interests within the incumbent regime were key to maintaining high levels of reuse. With the domestic market vulnerable to growing international competition, the formation of political coalitions between firms and policymakers established a core alliance for regime level resistance and the stabilisation of existing structures (Geels, 2014; Unruh, 2000). Despite commercial interests being reframed into societal goals and rules implemented by the Danish Government, monopolistic practices and economic protectionism were eventually challenged by supra-national (EU) forces and commercial actors rather than by any radical change in environmental consciousness.

## 4. Germany

Our second case study considers Germany's maintenance of a reuse system, particularly in relation to its beer and mineral water sectors. Here we emphasise how regional scale production, bottling (including cooperative approaches) and wholesale created strategic inertia on small- to medium-sized commercial actors in favour of the reuse system. We also explore the role of regulatory action and the importance of coalition building in attempting to manage changes in the retail sector that might destabilise the regime of reuse.

In Germany, producers of beverages sold in refillable bottles mostly operate at a regional level, with short transport distances (Deutsche Umwelthilfe e.V. (DUH), 2019a). The decentralised structure of beer and mineral water production in Germany is reflected in brands often being regional, with a small minority operating at national level, albeit still reliant on a strong regionalised presence (GDB, personal communication). Like mineral water, beer is geographically rooted to a region, with place-based beer preferences and deeply entrenched local drinking cultures (Keenan, 2020). In addition, the regionality of brewery production and the experience of consuming beer from a glass bottle is a strong semiotic marker of tradition and heritage (Association of German Beverage Retailers, personal communication). Despite a decentralised beverage market, both the beer and mineral water sectors have benefitted from cooperative approaches with respect to bottling and distribution (DUH, 2019a). With c.90% of mineral water companies a member of the Cooperative of German Mineral Water Companies (Genossenschaft Deutscher Brunnen eG (GDB)), a nationwide reusable pool bottle management system, the standardised refillable 'pearl bottle' enables economic and ecological efficiency, allowing them to be returned and transported to the closest filler (GDB, personal communication; DUH, 2019a). The sharing of infrastructure and costs has often made it more economical for small- to medium-sized mineral water suppliers to use refillable bottles over that of a standard single-use PET bottle (GDB, personal communication). Allied to this is the logistical role of the 'wholesaler' in the distribution, sale, and collection of reusable beverage bottles. Since the 1970s the wholesale sector has expanded its commercial interests by investing in beverage-specific retail stores. Given the alignment between regional scales of production by small businesses, bottling cooperatives and the role of the wholesaler, bottling processes are often considered path dependent through 'a combination of self-interest, experience, and established traditional structures' (GDB, 2021). For producers with a single filling line, the associated high costs of investing in a PET single-use line offers few economic gains when compared to the incumbent refillable line (GDB, personal communication). Unruh (2000) considers this as a source of inertia and strategic 'lock-in' to the existing dominant socio-technical regime by incumbent firms.

While this depicts a stable regime, actors may also have different interests and views, leading to contestation, tension, and power struggles (Geels, 2004). For example, Coca-Cola announced its intention of replacing its 1-litre returnable bottle with a non-returnable alternative in 1987 (DUH, n.d.). Subsequent regulatory intervention by the Environment Minister introduced a high mandatory deposit on one-way bottles to dissuade Coca-Cola (Fishbein, 1994). This highlights a period when the Federal Government engaged in several regulatory threats in order to maintain levels of reuse reflecting an increasing concern about pollution from landfills and the consequent restructuring of the waste regime favouring processes of recycling and energy recovery (Calice and Weber, 2012; Plastic Zero, 2014). This dynamic interaction *between* groups in the regime (in this case between industry actors and the public authority), acknowledges that the regime was far from harmonious (Geels, 2004).

An informal agreement in 1978 between industry and government actors sought to maintain refill levels, with regulations to follow if industry failed to fulfil their obligation. The subsequent failure led to the Federal Government imposing a mandatory deposit (0.50 Deutsche Mark) on one-way PET bottles placed on the market in 1988 (Fishbein, 1994). This was replaced by the 1991 German Packaging Ordinance to prevent retaliatory action by the European Community for its perceived restrictive trade policy (as highlighted in the Danish case, above). Under the German Packaging Ordinance, the implementation of the 'Duales System Deutschland' (DSD) established a system for the collection, sorting, and treatment of household packaging waste with producers and distributors responsible for paying a fee to the Producer Responsibility Organisation (OECD, 1998). This ran in parallel to the existing waste management system by local authorities, hence the name 'dual system' (Spasova, 2019). A mandatory deposit on one-way beverage containers was only prevented through an agreement to maintain a national market share of refillable drinks packaging above the 1991 level of 72%. A clear regulatory threat for non-compliance, the mandatory deposit acted as a strong incentive to prevent refill rates from falling. Beverage manufacturers such as Coca-Cola opposed the implementation of the 72% quota, and discount retailers often boycotted it – placing pressure on other beverage manufacturers to meet the quota – in the anticipation of industry-friendly policies and weak countermeasures (DUH, n.d.; DUH, 2019b). As a result, the refillable rate for beverages fell below the 72% quota for the first time in 1997 leading to Germany's Social Democrat/Green coalition Government introducing the Deutsche

[2] Reported levels of reuse for Denmark refer to the annual reports published by Dansk Retursystem, between 2003 and 2023. Figures between 1991 and 2003 refer to the broad consensus that reuse levels were regularly between 96% and 100% (Fisher and Horton, 1979; Platt and Rowe, 2002). Germany's levels of reuse relate to two datasets, the first, published by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety reporting between 1991 and 2009 (BMU, 2010); the second, published by the Federal Environment Agency reporting between 2000 and 2020 (FEA, 2022). The discrepancy between the datasets during 2000–2009 is largely explained by minor changes to the beverage categories used to calculate the average. Mexico's dataset refers to Coca-Cola FEMSA's annual reports and primary disclosure documents (Form 20-F reports) between 1996 and 2023. Figures between 1996 and 2002 refer to separate reporting of its Southeast Mexico (higher figure) and Valley of Mexico (lower figure) territories. Combined reporting commenced in 1999, with data points for 2008 and 2009 an estimate based on a comparison of the graphical share of reuse between Mexico and Argentina and the reported figure for the latter nation.

Pfandsystem (or 'Pfand') deposit return system in 2003.

Despite regulatory intervention, the socio-technical regime of reusable beverage containers continued to be undermined. While the introduction of a mandatory deposit on non-refillable bottles resulted in an uplift in the use of reusable beverage packaging, the effect was brief and un-sustained (see Fig. 2). The failure of the political intervention can be attributed to several perceived benefits for actors on both the supply-side and demand-side. These include one-way packaging being somewhat easier and simpler to transport (not requiring back haul distribution networks); the return and refunding of single-use packaging being no less convenient for consumers compared to handling reusable drinks packaging; and consumers receiving new one-way drinks packaging without the unavoidable signs of use from a reusable drinks packaging (Groth, 2008).

Throughout the late twentieth century, discount retailers such as Aldi and Lidl asserted a single-use mantra as an intentional market displacement strategy. These large retailers boycotted refillable beverage bottles and refused to sell products in reusable packaging, citing the labour, space and general management requirements associated with having to take them back. The importance of mineral water as a strategic product in retailing has not helped, with discounters being able to strategically displace competitors and subsequently control large portions of the beverage sector, including 52% of mineral water sales (DUH, 2019a; DUH, 2019b). This has been aided by retailers (Lidl) purchasing mineral water suppliers, making them one of the largest mineral water companies today (GDB, personal communication).

Against the backdrop of a destabilising reuse system, several actors and organisations embedded in interdependent networks of reuse established 'Pro Mehrweg' to lobby on their behalf. With actors from the beverage industry, beverage wholesalers, beverage retailers, supplier industries, and environmental associations, Pro Mehrweg positioned reuse in pro-environmental terms as climate protection and saving the planet. By aligning economic and environmental aspects of the refillable system through an emphasis on resource and logistical efficiency, this exemplifies the 'ecological modernization' of the retail sector (cf. Hajer, 1995; Mol et al., 2009). With incumbent actors committed to the reuse regime, it was clearly in their interests to form a strategic alliance through which to actively shape public opinion or directly lobby for further regulatory changes (Geels, 2010). For example, in 2019, a new Packaging Act replaced the Packaging Ordinance, providing more ambitious recycling rates and an aim for 70% of beverage packaging to be reusable by 2022. Members of 'The Reusable Alliance' (a further association of Pro Mehrweg, Deutsche Umwelthilfe e.V., and the Association of Private Breweries Germany) have lobbied for an additional 20 eurocents charge per one-way plastic bottle and can, and for the 70% reuse quota to be binding and implemented by every bottler and dealer (Schulz, 2019; Pro Mehrweg, 2020). The establishment of these industrial associations reflects the recognition of collective interests around the reuse system and the formation of political alliances that can lobby on behalf of the incumbent socio-technical regime (Unruh, 2000).

To summarise, the German case shows how the historically contingent elements of provisioning systems, particularly the cooperative model of wholesale and pool bottle management, are aligned with the commercial interests of regional beverage producers. This has created a level of reproduction or 'lock-in', due to vested interests and mutual role expectations between small- to medium-sized businesses and reuse infrastructures, representing a level of 'organisational capital' that reaffirms the regime (Geels and Kemp, 2006). The decline in reuse rates can be attributed to a particular retail sector transferring to single-use because of the perceived economic and structural advantages associated with the centralisation of production. Despite regulatory interventions that attempted to resist regime transformation, the lack of regulatory policy impact can be evidenced through the need to establish organisations to push for stricter and more binding rules for systems of reuse.

## 5. Mexico

Our final case focuses on the use of the refillable bottle by Coca-Cola FEMSA (hereafter referred to as CCF) in the Mexican beverage market. We highlight CCF's adoption of reuse in making Coca-Cola soft-drinks products more affordable, thus widening their consumer market, maintaining strategic advantage over their competitors, enabling CCF to manipulate national retail infrastructures to their advantage. Crucially, we suggest that the reproduction of a reuse system in Mexico is a result of a strategic game in the beverage market, defending the vested interests of a powerful incumbent actor (Geels, 2014; Geels and Kemp, 2006).

CCF represents approximately two-thirds of the Mexican carbonate market (Euromonitor, 2020) and is the largest Coca-Cola franchise bottler in the world by sales volume (CCF, 2023). Mexico is CCF's largest market representing more than half of its total volume of beverages, formed of sparkling (~71%), water (~21%) and still (~7%) products (CCF, 2023). Since the late twentieth century, sales of single-use bottled products have significantly increased. This is a result of CCF's capacity rationalisation programme (integrating manufacturing processes, streamlining bottling operations, reducing costs, and improving productivity) and their market strategy of expanding and enhancing brand portfolios to meet and stimulate consumer demand. Despite this, CCF has committed to reuse through modernisation and investment in 'swing line' bottling infrastructure that provides operational flexibility between single-use and reuse bottling lines (CCF, 2001; CCF, 2010). Importantly, CCF charges less in remote rural areas, where its products in returnable packaging are often cheaper than bottled water, with many people turning to soft drinks for basic hydration (Tuckman and Bagnoli, 2019). In 2000, the 2-litre returnable package cost 18% less than its non-returnable counterpart, whilst in 2003, the price of a 2.5-litre returnable package was ~30% less than its non-returnable equivalent (CCF, 2001; CCF, 2004). In addition, multi-serving bottles (bottles of more than 1-litre) have grown in importance, representing 66% of CCF's product mix in 2019. This can be attributed to the lower price per ounce of product that multi-serve bottles offer (CCF, 2001; CCF, 2020). Consequently, in 2000, CCF's most popular soft drink by sales volume was the 2.0-liter returnable plastic bottle, accounting for 33.3% of its sales (CCF, 2001).

Reusable packaging has nevertheless experienced a significant decrease between 1996 and 2003, resulting in single-use becoming CCF's predominant form of beverage packaging. This was not a simple matter of CCF transitioning from one packaging format to another, rather, it signalled the refocusing of their packaging mix strategy. CCF's multi-segmentation strategy offers an array of affordable single-serve and returnable packaging alternatives 'at the right price for every consumer' (CCF, 2014, p.10). In utilising these commercial tactics, distinct national approaches to selling Coca-Cola products are evident with consequences for reuse. For example, whilst products in Brazil were often presented in single-serve, single-use packaging, Mexico's packaging options relate specifically to returnable products (CCF, 2014, p.10).

Amongst other international companies and brands, Coca-Cola has become part of popular culture and everyday life in Mexico (Mungaray-Lagarda, 1992). In 2019, Mexico had the world's largest annual soft drink consumption per capita with on average 150 litres consumed per person (Statista, 2021). The growth of soft drinks is deeply ingrained into Mexican culture especially in more rural areas (Jenatton and Morales, 2019). Throughout the 1960s, local indigenous leaders, with state backing, began to accumulate power in religious, social, and economic spheres, including taking control of concessions for the distribution of Coca-Cola. Evangelical churches pressurised indigenous communities to

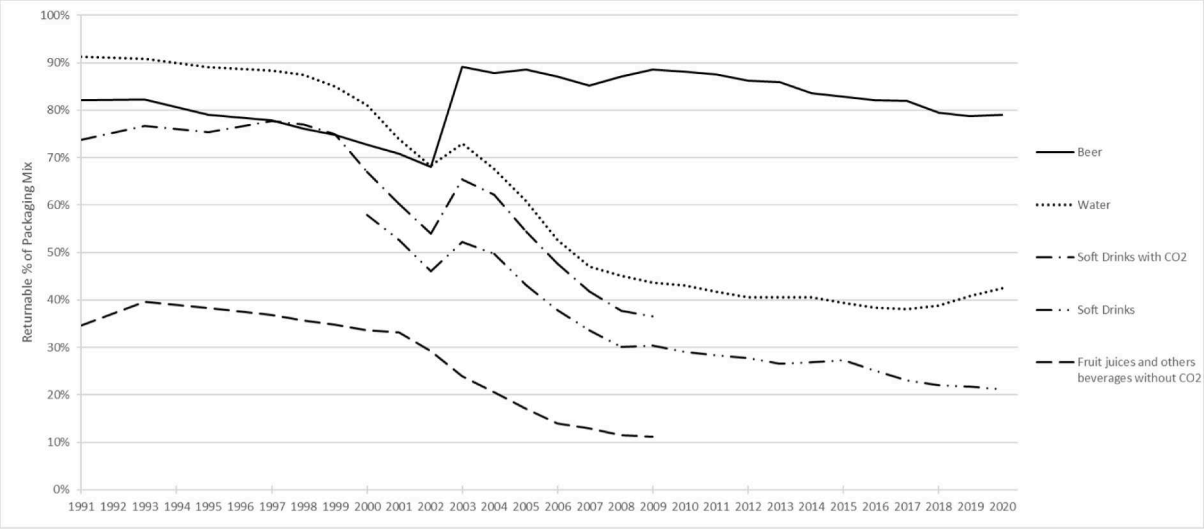


**Fig. 2.** Proportion of beverages consumed in reusable packaging. Sources: BMU, 2010; FEA, 2022.

stop drinking alcohol (local firewater 'pox') in rituals, replacing it with Coca-Cola and other soft drinks (Tuckman and Bagnoli, 2019). It also became the go-to drink, replacing more traditional fermented drinks (pozol) that were often linked to rural peasant farming practices (Tuckman and Bagnoli, 2019; Jenatton and Morales, 2019). Further symbolisation of social status and a sign of good hospitality has cemented Coca-Cola's place in Mexican society (Tuckman and Bagnoli, 2019).

As well as attracting 'price-sensitive consumers' (CCF, 2003), CCF's use of reusable bottles also enabled manufacturers to maintain strategic advantage over market competitors and manipulate national shopping infrastructures to their advantage (CCF, 2001). Refocusing their packaging mix was a reaction to the broader movement away from reusable bottles in Mexico's soft drink industry and the entrance of low-price brands focusing on multi-serving bottles (CCF, 2004). Currently, small-scale family-owned 'mom and pop' retail outlets make up the majority (65%) of Mexico's carbonates retail distribution (Euromonitor, 2020) and are CCF's primary sales channel (CCF, 1998). These small independent grocers benefit from the returnable bottles' lower price per ounce of product, enabling them to compete on price with larger modern grocery retailers. At the same time, this allows CCF to compete on price with low-price product entrants to the Mexican soft drink market (CCF, 2001; CCF, 2005). This highlights a strategic game which CCF plays in the soft drink market and draws attention to a strategic coalition between CCF (the manufacturer) and 'mom and pop' retail stores. In this context, CCF is a significant and powerful actor in the beverage market who seek to maintain the structures which they reproduce. They acknowledge this in their own risk management strategy, highlighting that they package their products in returnable bottles in order to undermine its competition and maintain a 'barrier to entry' for non-branded products (CCF, 2002; CCF, 2018).

Turning now to the role of regulatory factors and trade rules, we highlight a lack of national regulatory intervention. With Mexico noted for having weak governmental commitment and a lack of environmental policies, tax relief and resources allocated to services in the recovery of materials, market forces dominate with opportunities relying on the producer's, in this case CCF's, good will (Schwanse, 2011). For example, as part of the nation's effort to reduce plastic litter, the federal initiative known as the Management Plan for PET Packaging Waste (2002), implemented PET bottle taxation to initiate a response from soft drink bottlers and producers. The formation of ECOCE A.C., a consortium representing 59% of the Mexican PET packaging and bottling industry, introduced a similar trademark to the Green Dot in Germany to distinguish those PET bottles participating in the nationwide recovery programme. ECOCE A.C. has however been critiqued as merely complying with a recovery rate, with little concern in either meeting an agreed recycling rate or creating other opportunities to enhance the domestic recycling industry (Schwanse, 2011). Beyond this regulatory context, CCF emphasises several other initiatives with respect to their extended responsibility and aims of becoming a more sustainable, environmentally friendly manufacturer. This includes increasing the percentage of clean and renewable sources of energy, increasing the percentage of recycled resin, and reducing watershed risk (CCF, 2016). Prior to the identification of these areas, CCF had referred to the light weighting of single-serve bottles (CCF, 2007) and the development of the 'Plant Bottle', a PET bottle comprising of 30% renewable material and a carbon footprint 15% less than its conventional counterpart (CCF, 2011). What is pertinent to note here is that, despite a reference to reusable bottles 'preserving the environment' in CCF's 2011 annual report, the reusable bottling system is rarely recognised nor promoted as providing a positive environmental impact and fostering sustainability. Rather, as we have suggested above, the role of reusable packaging is closely aligned to maintaining CCF's commercial success.[3]

In summary, the Mexican case demonstrates that in the absence of significant regulatory intervention, reuse plays a key role in maintaining CCF's commercial competitiveness. Following a decline in reuse levels between 1996 and 2003, reuse has increased and entered a period of stability. We highlight a strategic coalition between beverage manufacturers (CCF) and retailers (independent 'mom and pop' stores) in facilitating the growth of soft drink products in Mexico, with reuse offering a price point advantage and access to poorer consumers. Acknowledging that different actors have differential capabilities to (re) configure regime level activities (Geels, 2004), we highlight CCF's power not only in relation to other beverage manufacturers and retailers, but also within their own strategic coalition with 'mom and pop' stores, through which the reuse systems is reproduced.

[3] Since data collection and analysis, CCF's subsequent annual reports have refered to the importance of its returnable/reusable bottling system - alongside other recycling commitments - in transitioning to a circular economy (see CCF, 2022; CCF, 2023).

**Table 1**
Key dimensions in the stabilising and destabilising of reusable beverage packaging systems.

| | | Denmark | Germany | Mexico |
|---|---|---|---|---|
| **Actors** | Stabilising | Strong national cartel.<br>Monopolistic practices and self-regulation by incumbent firms.<br>Voluntary use of common standardised bottles by breweries and mineral water factories. | Regional production with mutual expectations between small- to medium-sized businesses.<br>Risk-averse business practices, few economic gains switching to single-use versus incumbent refillable lines.<br>Actors and organisations across supply-chain forming political alliance to lobby for stronger, more binding regulatory measures. | Returnable packaging offering a price advantage and access to poorer consumers.<br>Strategic coalition between beverage manufacturer and trade channels to undermine competition and maintain a barrier to entry for market competitors. |
| | Destabilising | International actors critical of discriminatory and prohibitive policy environment.<br>Actors across the supply chain advocating transition to single-use due to changes in retail sector and growing complexity of handling reusable bottles. | Beverage manufacturers and discount retailers boycotting quotas, anticipating weak countermeasures. | Single-use an opportunity by incumbents to expand and enhance their brand portfolio to meet and stimulate consumer demand. |
| **Rules** | Stabilising | Government implementing high taxation and responding to commercial threats to maintain domestic monopoly.<br>Policy framework protecting government fiscal interests, reframed as anti-pollution measures.<br>Regulation of packaging material due to environmental burden. Required use of reusable packaging for domestic products. | Voluntary and informal agreements between industry and government.<br>Regulatory threats and subsequent implementation of quotas in attempt to maintain high levels of reuse. | |
| | Destabilising | Domestic policies challenged by supra-national EU forces. | Lack of regulatory impact evidenced by industrial associations lobbying for stricter and more binding rules for systems of reuse. | Absence of national regulatory intervention with market forces dominating and reliance on the producer's good will. |
| **Structures** | Stabilising | High transport costs and domestic filling plants located near to main markets.<br>Small- and medium-sized breweries mostly producing for regional/local markets.<br>Voluntary use of common standardised beer and mineral water bottles and contractual deposit and return systems for reusable bottles. | Mature provisioning systems and cooperative arrangements resulting in material lock-in.<br>Decentralised regional scale structure of beer and mineral water by small- to medium-sized commercial actors.<br>Logistical role of wholesaler in distribution, sale, and collection or reusable standardised bottles. | Continued investment in provisioning systems through the development of hybrid production of bottling plants (swing lines). |
| | Destabilising | Smaller breweries expanding distribution nationwide.<br>New packaging formats led to growing complexity of handling/backhauling infrastructure. | Discount retailers and beverage manufacturers favouring single-use and centralisation of beverage production due to perceived economic and structural advantages. | |

## 6. Discussion

The case studies have revealed that national variations of reuse are not explained by heightened levels of environmental consciousness in isolation. Rather, with reference to the MLP approach, we highlight the role commercial drivers, regulatory factors, and provisioning systems play in maintaining regime stability of reuse systems and/or defensively respond to transitions to single-use. Table 1 compares the key dimensions (actors, rules, and structures) that together interact to produce distinct reusable beverage packaging regimes in Denmark, Germany, and Mexico. To finish the paper, we consider the interrelated nature of these analytic dimensions in generating diverse socio-technical regimes, before considering our contribution to MLP studies.

We have shown how the combined actions of incumbent actors and provisioning systems contribute to the reinforcement of existing socio-technical regimes. For Germany, commercial actors benefitted from mutual role expectations, leading to a level of 'organisational capital' and reaffirming the reuse regime (Geels and Kemp, 2006). Whilst this might be viewed as strategic lock-in and inertia to an outdated system, we echo Kotilainen et al. (2019), arguing that this reflects a positive spatial lock-in through the clustering and agglomeration of actors and infrastructures, resulting in a core rigidity to the system. For commercial actors to transform their packaging system to single-use, requires significant investment, alternative supply-chain models, and production scale. Here we highlight how *material* aspects that result from these commercial relationships reflect sunken investments and vested interests in the stability of the current socio-technical regime. With these material networks in place, they acquire a logic of their own and become more difficult to abandon (Geels and Kemp, 2006). Mexico also shares strategic coalitions amongst actors, to some extent, between beverage manufacturing and traditional trade channels. This technological association and inter-relatedness creates a lasting barrier to competing technology (single-use systems) with material networks acquiring an economic and ecological logic of their own.

Like most sustainable innovations, the cases of Germany and more so Denmark have shown how commercial actors and the regulatory factors can form a core alliance that is oriented towards maintenance of the status quo (Geels, 2014). Concerns of waste and resource protection at a landscape level by respective national governments enabled regime rules to be tightened, offered formal justification for overriding market forces, and created a policy context where the 'rules of the game' afforded preferential treatment to the existing technological system of reuse. For Denmark, the interests of incumbent actors supported general policy goals. Consequently, this enabled a translation of private interests into socially legitimate goals, a key framing approach for firms which aim to influence policy makers (Smink et al., 2015). When the regime was threatened, key actors engaged in strategic defensive institutional work to maintain existing practices. With this alignment, the regulatory context supported and shaped the actions of commercial actors, providing a level of 'structural power' with which to influence the market (Newell and Paterson, 1998) and ensure an extended period of stability and system lock-in to reuse (Unruh, 2000). The case of Mexico, however, provides an anomaly to this argument, highlighting the lack of an alliance between both Coca-Cola FEMSA and the regulatory context with respect to reuse. Arguably, any compliance or coalition between Coca-Cola FEMSA and the national government relates to the

development of recycling infrastructure. Despite this, Coca-Cola FEMSA engaged in strategic behaviour that maximised reuse systems, but only to the extent that it safeguarded their commercial interests in the soft-drink market.

We have also shown that regime stability is not an easily coordinated process nor a guaranteed outcome. The emergence of new socio-technical regimes is possible with the support and involvement of actors stimulating transformation and transition (Geels and Kemp, 2006). This was evident across all cases with actors attempting to destabilise reuse. In Denmark this related to both domestic and international actors across the manufacturing and retail industry, including those who were incumbent actors. Whilst incumbents may attempt to defensively respond to transitions in the short run, they can foresee business opportunities for such innovations in the long term (Smink et al., 2015). The Danish case highlights that with the incumbent regime increasingly destabilised, the long-term maintenance of a market structure where reuse was the dominant packaging format was no longer tenable. With the regulatory context supporting the innovation of a recycling infrastructure, actors quit their defensive tactics and subsequently prepared for the transition. In Germany, and in opposition to risk adverse firms (small- and medium-sized beverage manufacturers), discount retailers who handled single-use bottles, and beverage manufacturers (e.g., Coca-Cola) who actively sought to discontinue reuse lines, were more willing to gamble on the new technology with the confidence of it becoming the new dominant design over time (Unruh, 2000). Whilst in Mexico modern grocery retailers (supermarkets and hypermarkets), and non-branded, low-price product beverage manufacturers were in direct competition with CCF and its strategic marketing of reuseable beverage bottles. As shown in each case, these misalignments with the socio-technical regime create 'windows of opportunity' for change and transition to happen (van Mossel et al., 2018), resulting in systems of reuse currently 'co-existing' with systems of single-use to varying extents. This is important to consider as these are often considered 'successful' examples of reuse systems from which other nations can learn. But as we have shown here, their success has not been without struggle, nor does their current socio-technical regime dictate or guarantee stability for its reuse system.

These insights extend the empirical application of MLP to a new substantive topic area on reusable packaging. Our analysis confirms the value of MLP, showing how regime resistance, in the interest of reuse, are a result of the alignment, and interrelated nature of actors, rules, and structures. Adopting the language of MLP theorists, we have reviewed the interactions between commercial actors, regulatory factors, and provisioning systems across the three cases. While MLP research often considers the role of incumbent actors keeping sustainable innovations and low-carbon transitions (which threaten existing regimes) 'on a leash' (Unruh, 2000; Geels, 2014; Smink et al., 2015), this paper has presented an alternative storyline whereby these 'environmentally friendly' systems remain as the incumbent socio-technical regime. Answering Geels' (2014) call to go beyond the normal 'David versus Goliath' storyline, in which heroic green innovations overthrow the giant, we suggest that these 'green' alternatives exhibit and engage in similar strategic practices to resist destabilisation and to maintain the competitive advantage of the existing regime. In doing so, this paper suggests the value in considering the actions of sustainable systems from a regime perspective rather than from a niche perspective (Rut and Davies, 2018; Kirshner et al., 2019).

## 7. Conclusion

To summarise our argument, significant national variations in rates of reuse in Denmark, Germany and Mexico cannot be understood purely in terms of contrasting levels of environmental consciousness. Attention to a range of commercial drivers, regulatory factors, and provisioning systems is also required. As Wheeler (2013) argued in reference to variations in recycling across Europe, national differences can be related to different welfare regimes and institutional provisioning systems, similar to the arguments we have advanced here in terms of national variations in reuse. Specifically, we have shown that the refillable beverage container maintained its presence in Denmark largely due to the vested interests of the incumbent national beer brewing industry, which was supported by and maintained through the implementation of national policy. The declining levels of reuse since 2003 can be related to changing commercial interests and changes in the policy environment. The German case shows the importance of scale (regional beverage production) and infrastructure (the role of wholesalers and standardised bottles) in aligning commercial interests, within a supportive regulatory context. The decline in reuse levels to a new 'normal' (~40%) is attributed to the changes in both the retail and beverage sector, which benefitted from a softening of regulatory rules. The Mexican case highlights high levels of reuse by the largest commercial actor in beverage manufacturing as a way of maintaining strategic advantage over both beverage manufacturers and national retail infrastructure. This is achieved despite the lack of any regulatory directive that supports reuse. We have shown therefore that the reproduction of reuse systems in the beverage sector are not the result of any one single analytic dimension (actors, rules, and structures), but the interrelated nature with which they engage with one another.

Viewed as such, the paper contributes new insights that help address the sustainability challenge of reducing plastic waste by furthering our understanding of returnable business-to-consumer packaging systems which are currently limited in extent (Coelho et al., 2020). We also wish to emphasise the significance of taking a geographical perspective on these issues. This ranges from the comparative dimension of our research, focusing on the commonalities and differences between our three national case studies; the significance of scale (ranging from the regional nature of beer and brewing in Germany to the supra-national (European) regulation of the Danish bottling industry); and the spatialities associated with the different 'levels' (landscape, regime, and niche) in the MLP. Indeed, it could be said that these 'levels' are generally approached as theoretical abstractions in MLP with 'landscape' referring to global forces, 'regimes' operating mostly at a national scale and 'niches' being found in specific localities. As an extension of our work, there might be value in formalising these ideas with a stronger theorisation of space in MLP. At the very least, the preceding discussion gestures towards the importance of comparative analysis for the purposes of theory building. We contribute to a growing MLP literature that moves beyond a singular descriptive pathway in specific national contexts (Roberts and Geels, 2019; Lepoutre and Oguntoye, 2018; Kern et al., 2015). By taking a comparative approach, our analysis shows that commonly assumed barriers in moving from single-use to reuse (increased logistical complexity, the reorganisation of the supply chain, and upfront investments for new packaging systems) (Coelho et al., 2020) are not necessarily context-specific, but reflective of the reproduction of socio-technical systems against alternative possibilities which relate to processes of transformation and transition (Geels and Kemp 2006). In following this path, we underscore the significance of MLP for understanding the plurality of processes of resistance and inertia.

Finally, we consider the implications of our argument for nations such as the UK, where regime actors are progressively exploring the role of reuse systems, for example, the UK Plastics Pact (as reported in the Introduction to this paper).[4] First and foremost, we suggest that we cannot take direct learnings from these case studies given reuse's

[4] Responding to environmental concerns, the UK Government's Resources and Waste Strategy (2018) issued several consultations on tackling the negative environmental impacts of plastic packaging. They included consultations on reforming the UK packaging producer responsibility system; improving the consistency in household and business recycling collections in England; the introduction of a plastic packaging tax; and the establishment of a Deposit Return Scheme in England, Wales and Northern Ireland.

difference of positioning in the socio-technical system. While the cases of reusable packaging in Denmark, Germany, and Mexico were already institutionalised - and actions involved maintaining stability through its practices - reuse in the UK context is currently a niche activity and at a point of experimentation. This is evident by the somewhat fragmented and dispersed nature of trials by regime actors and pioneering activities by entrepreneurs and start-ups on the periphery (Geels, 2019). We do suggest however, that current understandings of 'environmental consciousness' are a 'landscape' factor from a MLP perspective and, while it will not dictate transition or transformation in isolation, we emphasise that it may put pressure on existing regimes to move towards a circular economy. It can provide deep-structural gradients of force that make some actions more readily easy than others (Geels and Schot, 2007). Given MLPs emphasis on understanding (or not) of transitions and regime shifts, and not to necessarily identify or dictate these transitions (Geels and Kemp, 2006) we stop short of identifying what is required from actors, rules, and structures to 'make reuse mainstream' in the UK. Rather, we enhance existing research calls to learn from 'the (failed or successful) introduction of reusable packaging systems' (Coelho et al., 2020), suggesting that this should be analysed in conjunction with MLP, noting that for transition to occur dynamics at different levels (landscape, regime, and niche) should come together to reinforce one another (Geels and Kemp, 2006). For example, while we acknowledge the necessary emergence of circular consumer practices, and despite the emergence of niche commercial actors with reusable packaging innovations, we recommend analytical attention should be expanded to the growing prevalence of reuse 'trials' by incumbent regime actors (most often supermarket retailers) in the UK, due to their importance and involvement in change processes of reproduction, transformation, and transition (Geels and Kemp, 2006). As a result of this, we would expect further understanding of how and why technologies and practices of reuse may or may not take hold.

## CRediT authorship contribution statement

**Rorie Beswick-Parsons:** Conceptualization, Methodology, Investigation, Writing – original draft, Writing – review & editing, Funding acquisition. **Peter Jackson:** Conceptualization, Writing – original draft, Writing – review & editing, Supervision, Funding acquisition. **David M. Evans:** Conceptualization, Writing – original draft, Writing – review & editing, Supervision, Funding acquisition.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

No data was used for the research described in the article.

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