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Circular Economy in corporate sustainability strategies: a review of corporate sustainability reports in the Fast-Moving Consumer Goods sector

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Abstract:

Despite the increasing interest of business and academic research towards Circular Economy, the investigation of its uptake by industry remains limited. To contribute filling this gap, we perform a systematic review of 46 corporate sustainability reports in the Fast-Moving Consumer Goods sector aiming to explore how companies incorporate the Circular Economy concept in their sustainability agenda. We focus on (i) the companies' uptake of Circular Economy, (ii) the relationship between Circular Economy and sustainability and (iii) the Circular Economy practices presented. Our results show that Circular Economy has started to be integrated into corporate sustainability agenda. Most reported activities are oriented towards the main product and packaging, focusing on end-of-life management and sourcing strategies, and to a lesser extent on circular product design and business model strategies. Most identified collaborations are with businesses, whereas initiatives addressing consumers are largely missing although considered critical for the transition towards Circular Economy.

Introduction

The concept of Circular Economy (CE) provides a central vision within the debate about how society may tackle the increasing resource scarcity and depletion of non-renewable resources. Blomsma & Brennan (2017) have defined CE under an “umbrella concept”, as “an emergent framing around waste and resource management that aims to offer an alternative to prevalent linear take-make-dispose practices by promoting the notion of waste and resource cycling”. Since its creation in 2010, the Ellen Mac Arthur Foundation (EMF) has played a key role in bringing CE on the agenda of decision makers, both in the private and public sectors. National and regional strategies for CE have been developed e.g. in China and the European Union (Jones and Comfort, 2017). The body of research around CE is also increasingly gaining ground in the academic literature, where a number of critical reviews have recently investigated the CE concept, but most studies focused on its origin or theoretical background (Ghisellini et al., 2016; Blomsma and Brennan, 2017; Winans et al., 2017, CIRAIG, 2015, Kirchherr et al. 2017).

The role of businesses in the development of the CE has been emphasized (Lewandowski, 2016) and the interest of companies towards CE has grown over the recent years (Linder and Williamder, 2017). Chinese companies took the lead in CE implementation as a response to the Chinese governmental policy, and applications of CE in business practice from Western countries are also increasing (Murray et al., 2015). However, only a few studies shed light on CE implementation at the company level, and the implementation of CE worldwide is in its early stages (Ghisellini et al., 2016). Based on a state-of-the-art review of academic insights into CE, Lieder and Rashid (2016) concluded that in the manufacturing industry CE development is to largest extent done from a resource scarcity and environmental impact perspective disregarding the economic implications. This attitude could be detrimental since the essential activities for a successful CE implementation, such as business models, product design, and choice of material, are in control and hence finally determined by manufacturing companies to gain economic benefits (Lieder and Rashid, 2016).

Recent work has focused on providing support for companies to implement CE at a micro level, i.e. product or organization (Aminoff et al., 2016; Lewandowski, 2016; Pauliuk et al., 2018) and shedding light on the barriers and challenges faced by companies in relation with CE implementation (Linden & Williander, 2017; Singh and Ordóñez, 2016; Ritzen and Sandström, 2017). Other studies deliver insights on best practices and enablers of CE implementation: De los Rios and Charnley (2017) performed an in-depth analysis on case studies from a limited set of multinational enterprises that are transforming their product strategies for closure of material loops, meanwhile Jones and Comfort (2017) presented and discussed the circular approaches of a limited set of companies. Bocken et al. (2017) recently explored the presence of CE thinking in a sample of corporate press releases from Standard & Poor’s 500 listed large capitalized firms. Yet, investigations of the uptake of CE in industry remain limited hitherto.

An increasing number of mainly large companies yearly release corporate sustainability (CS) reports which provide their external stakeholders with a description of their sustainability strategies and practices (Montabon et al., 2007; Borga et al., 2009; Siew 2015, Landrum and Ohsowski, 2017). When it comes to companies' approaches to corporate sustainability, CS reports are considered to be their most direct expression (Comas Martí and Seifert, 2013). Hence CS reports have been used as a data source by a growing number of scholars to investigate CS activities. For instance, Comas Martí and Seifert (2013) performed a content analysis of CS reports for a cross-sectoral sample of sustainability leaders to investigate the comprehensiveness of firms' environmental strategies throughout supply chains. Meckenstock et al. (2016) analyzed 142 CS reports across 12 industries to investigate how sustainability evolves from abstract ideas to operational practices across the supply chain. Sihvonen and Partanen (2017) conducted a review of CS reports in the Information and Communication Technology (ICT) sector, to identify, among others, CE-related activities present at companies. However, the overall role and influence of the CE concept in CS agenda were not addressed. The large pool of publicly available CS reports gives the opportunity to explore the role of CE in CS strategies and how companies have been incorporating the core ideas of CE within their main external communication tool.

A sector with large potential in applying CE principles is the Fast-Moving Consumer Goods (FMCG) industry, which includes products characterized by high throughput volumes, frequent purchases and large physical volumes available at relatively low prices (EMF, 2013). FMCG currently account for 35% of material inputs into the economy, a significant part of total consumer spending on tangible goods, and 75% of municipal solid waste (EMF, 2012). Within the FMCG sector, food, beverages, textiles, and packaging represent 80 % of the total market by value (EMF, 2013). To our knowledge, no previous study has reviewed the integration and implementation of CE in the FMCG sector. Therefore, this study aims to explore how the recently highly promoted concept of CE affects FMCG companies' sustainability agenda as reported in their CS reports. In this perspective, the study contributes to fill the gap on the missing link between academic research and business practice on CE.

The remainder of the article is structured as follows. In the next section, we provide a theoretical background on CE from which we derive three research questions. Further, the methodology to answer these research questions is introduced. Then, we present the results from the CS reports analysis for each research question and discuss our findings in the light of previous academic work. Finally, we shed light on the limitations of the present study and provide the theoretical and managerial implications of the results, before outlining our conclusions.

Theoretical background

The concept of Circular Economy

The CE concept is not new, yet the momentum recently created around the concept turned into a business approach is without precedent (Sauvé et al., 2016). In their recent analysis of 114 CE definitions both from academic and grey literature, Kirchherr et al. (2017) reveal that a variety of CE conceptualizations coexist. According to Stahel (2016), the objective of CE is “to maximize value at each point in a product’s life”. The French environment and energy management agency (ADEME) defines the CE as an economic model which values resource efficiency at every stage of the value chain, stating that “Circular economy aims at reducing the waste of natural resources and more generally aims at protecting the environment (climate change, preserving biodiversity). The transition towards this new economy require the development of new production and consumption models and the involvement of stakeholders at all levels” (ADEME, 2016). It emerged that some authors consider CE and recycling interchangeably, while practitioners tend to exclude “reduce” from the core principles of CE (Kirchherr et al., 2017). An alignment of the concept among scholars and practitioners is needed, if the CE is to “deliver on its promise of fundamental change” (Kirchherr et al., 2017).

CE is a concept into which many “Design for X” strategies promoted by the eco-design community (e.g. design for recyclability, design for reuse) and other long-lasting promoted environmental management practices (e.g. material efficiency) can fit in (Moreno et al., 2016). However, a “casual interpretation” of CE can lead practitioners to view it as a mere refreshing of recycling schemes and reverse supply chains rather than a true systemic change (Webster, 2013). CE requires a shift from current systems, rather than an “incremental twist” (Kirchherr et al., 2017). Kirchherr et al. (2017) suggest that the concept of CE is constructed on a set of R-principles (reduce, reuse, recycle, recover), in a systemic perspective, at all economic levels.

The transition towards CE as a new business paradigm is associated with critical challenges in terms of resource management, stakeholder management, financial and regulatory aspects, organizational barriers and consumer acceptance (Stewart et al., 2018; Ritzen and Sandström, 2017). Thus companies’ commitments towards CE might remain mainly aspirational (Jones and Comfort, 2017). In this context, there is a risk for business actors to symbolically uptake the concept for greenwashing purposes (Sauvé et al., 2016). CS reports have an important legitimacy role for companies, since through such communication tools they may seek to maintain their license to operate and reduce possible gaps between their stakeholders’ expectations in terms of sustainability and their own practices (Hahn and Kühnen, 2013). The risk for organizations to include CE in their CS rhetoric without anchoring CE in their actual practices is thus elevated. Knowledge about how companies understand and conceptualize the CE concept is limited in existing literature.

RQ1: How is companies’ uptake of CE in their CS reports?

Circular Economy and sustainability

The popularity of CE among both practitioners and scholars has been linked to its promise to attractively operationalize the concept of sustainable development (Kirchherr et al., 2017). Yet, in the definitions they reviewed, Kirchherr et al. (2017) found that in the academic literature CE is mostly linked to the aim of economic prosperity which contradicts some views from industry that CE is strongly related to environmental sustainability (e.g. Lieder and Rashid, 2016). The most circular option is not necessarily the environmentally preferable option when CE is applied on the micro-level (Haupt and Zschokke, 2017). Korhonen et al. (2018) outline that stronger links with environmental science need to be established to guarantee that CE effectively contributes to sustainability. Overall, different ways to position the CE concept in relation with sustainability coexist in literature. Geissdoerfer et al. (2017) suggest a typology of relationships between CE and sustainability to illustrate the variety of views: a *conditional relationship* means that CE is considered as a condition for reaching sustainability; a *beneficial relationship* means that CE is considered as one way to progress towards sustainability among others; a *trade-off relationship* means that CE is considered to lead to sustainability trade-offs (both benefits and negative outcomes). There are academic efforts to conceptually link circular business model and environmental value creation (Manninen et al., 2018). Nevertheless, scholars emphasize the need for methods to assess the environmental, social and economic sustainability performance of circular products and business models (Bocken et al., 2016; Elia et al., 2017; Pauliuk et al., 2018) and a lack of circularity indicators at the micro level (Linder et al., 2017). As far as the industry is concerned, little is known about how companies position CE in their sustainability agenda and measure the sustainability performance of circular approaches.

RQ2: How do companies link CE and sustainability in their CS reports?

Circular Economy practices

The well-known illustration of CE provided by the EMF distinguishes between the so-called technical and biological metabolisms (EMF, 2013). The technical metabolism illustrates how the value of technical materials should be kept through continuous loops aimed at strategies such as maintain, reuse/redistribute and refurbish/remanufacture, and recycle. The biological metabolism refers to a system where ‘nutrients’ are designed to re-enter the biosphere safely for decomposition to become valuable feedstock for a new cycle. CE principles can be applied to different application systems, namely packaging, main products or by-products.

According to Bocken et al. (2016), CE is about closing, slowing or narrowing resource loops. Closing loops refers to reuse of material through (postconsumer waste) recycling, slowing loops is about prolonged use and reuse of goods over time, through design of long life goods and product life extension, whereas narrowing loops is about reducing resource use associated with the product and production process, i.e. efficiency improvements (Bocken et al., 2016). Scholars identified three main categories of CE activities reported by companies, namely resource and waste management (Ghisellini

et al., 2016; Potting et al., 2016), product design stage (Bocken et al., 2016, Witjes and Lozano, 2016; Linder and Williander, 2017; De los Rios and Charnley, 2017) and development of new business models (Bocken et al., 2016; Lewandowski, 2016). Moreno et al. (2016) proposed a conceptual framework for circular product design by linking available Design for Sustainability approaches to the current literature on circular business models. Beyond design and business model, and as outlined by the CE principles (EMF, 2015), the general optimization of resources and use of renewable resources are also at the core of CE. Thus, sourcing strategies, e.g. the use of recycled content and renewable material, operation strategies, e.g. energy efficiency, use of renewable energy and recovery of operation waste and end-of-life strategies, e.g. actions supporting recycling/recovery infrastructure/initiatives, are also activities under CE. With regard to recycling, the CE agenda raises the issue of quality of recycling, first introduced in the context of the Cradle to Cradle® (C2C) design framework, through the term “upcycling” which refers to the redesign of ingredients or additives so they improve the quality of materials with respect to maintaining or improving value in continuous loops (McDonough and Braungart, 2002). Korhonen et al. (2018) argue that one specific contribution of CE is its focus on the importance of high value and high quality in material cycles.

Another key area of CE practice is collaboration in business ecosystems which is outlined as one pillar of a transition towards a well-functioning CE (Witjes and Lozano; 2016). Collaboration is also closely related to the system perspective which is another fundamental aspect of CE practice (Webster, 2013). There has been limited attempts to explore CE practice in the industry (De los Rios and Charnley, 2017; Jones and Comfort, 2017), and broader investigations are recommended by scholars (Moreno et al., 2016).

RQ3: Which CE practices do companies present in their CS reports?

Methodology

Sample definition

The sample of companies to be included in this study was systematically built using the Corporate Register database. It is the largest online database of CS reports with possibility of doing content searches (CR, 2017), previously used by Bjørn et al. (2016) in a similar context, i.e. to perform a comprehensive review of references made to ecological limits in CS reports in 2000-2014. Corporate Register seeks to include all sustainability reports “without limitations of country or company size and across all sectors, public and private” and it estimates that more than 90% of all reporting companies and other organizations are covered in the database which is updated daily (CR, 2017). The database includes any type of sustainability reports in Latin-script, e.g. integrated report, sustainability and environmental reports (CR, 2017). In January 2017, we identified all sustainability reports of companies (i.e. excluding other organizations) listed in the above-mentioned database released until

203 2016 and mentioning at least once the term “circular economy”. The term “circular economy” was
204 specifically searched for, rather than including other entries connected to the topic such as “closed-
205 loop” and “close the loop”. Indeed, the focus of this study is to explore the influence of the recently
206 highly promoted concept of CE on corporate sustainability strategies. We do not aim to explore the
207 extent to which CE-related practices are already used in the industry at large, e.g. reuse and recycling
208 of production waste or use of recycled material, but we focus on how companies uptake the CE concept
209 as a source of inspiration or even a new framework for their sustainability work.

210 The temporal evolution of the resulting CS reports is illustrated in Figure 1, showing that the popularity
211 of the CE term drastically increased in 2015 and 2016. Such increase could be correlated with the
212 release of the first EMF report in 2012 (EMF, 2012) and the first European Communication on CE
213 (EC, 2014). A total of 630 CS reports were retrieved, among which we selected those published in
214 2016 (representing more than half of all CS reports mentioning “circular economy”) by companies in
215 the FMCG sector, i.e. Food & Beverage, Household Goods & Textiles, Packaging, and Personal Care
216 & Household Products. Additionally, we included the CS reports of the FMCG companies listed in the
217 CE100 directory and founders of the EMF (EMF, 2017a), provided that they contained information
218 about CE, since these companies are expected to be engaged with CE.

219 The final sample contains 46 CS reports released by 46 companies (See Table A1) whose geographical
220 and sectoral distributions are shown in Figure A1. Most companies included in the sample belong to
221 the Household Goods & Textiles (39% of the sample) and Food & Beverage (37%) sectors, meanwhile
222 a limited set represents the Personal Care & Household Products (11%) and Packaging (13%) sectors.
223 In terms of geographical distribution, the majority of the companies included in the analysis are based
224 in Europe (i.e. 65% of the sample) and North America (26%). Companies from Africa, Asia and
225 Oceania are represented to a very limited extent, i.e. 2%, 4% and 2% of the sample, respectively. This
226 differentiated distribution may be partially explained by the relative representation of sectors and
227 regions in the Corporate Register database, i.e. the database contains fewer reports in the Packaging
228 sector than in the Household Goods & Textiles sector and European reports represent almost half of all
229 reports while South America and Africa only a few percentages. Considering the explorative nature of
230 the present study, no statistical tests were used to search for differences between sectors and regions.
231 Nevertheless, similarly to the study by Comas-Martí and Seifert (2013) also performed on a rather
232 limited set of CS reports, the main differences found in our results are qualitatively indicated in the
233 results when relevant, between North America and Europe, and between Food & Beverage &
234 Household Goods & Textiles which concentrate most of the sample.

235 **Analysis methodology**

236 In order to answer the research questions previously formulated, we systematically analyzed the
237 content of the CS reports using (i) a content analysis approach (RQ1 and RQ2) and (ii) a mapping
238 approach (RQ3). The stepwise procedure adopted for the analysis is displayed in Figure 2.

239 *Content analysis*

240 RQ1 and RQ2 are both directly related to how companies present the CE concept in their CS reports.
241 Thus, an analysis of meaning (or recording) units where CS reports introduce and discuss CE seemed
242 best suited to address these questions. Meaning units are defined as sets of sentences “containing
243 aspects related to each other through their content and context” (Graneheim and Lundman, 2004). As
244 first step, all extracts where companies make explicit reference to CE were systematically collected
245 from reports and stored as recording units in an excel sheet, similarly to the approach adopted by
246 Hrasky (2011) to study the topic of “carbon footprint” in CS reports. We identified as explicit reference
247 to CE where the company makes reference to “circular economy”, but also more broadly to “circular”,
248 e.g. “circular model”, “circular business”, “circular development”, “circularity”, “circular thinking”, to
249 account for slightly different terminology. The second step consisted in coding the recording units,
250 using a combined deductive and inductive approach (Hsieh and Shannon, 2005), as shown in Figure 2.

251 For RQ1 we first coded the recording units against the list of “R” principles adapted from the work by
252 Kirchherr et al. (2017). The coding of “R” principles was assisted with keyword searches taken from
253 Kirchherr et al. (2017) and complemented with keywords inductively derived from the data (see the list
254 of keywords used in Table A2). Occurrences were checked for relevance with the principles of CE, e.g.
255 in the case of a reference to “reduce” as “reduction of greenhouse gases”, the occurrence was ignored.
256 Second, we coded the recording units for references to the systemic dimension of CE (see Table A3).
257 Third, we coded the recording units against the categories “general statement”, i.e. general statements
258 or aspirations about CE, versus “concrete activities”, i.e. concrete activities undertaken by companies
259 in relation with CE (see Table A3).

260 For RQ2, we first coded meaning units against sustainability aspects they mention (environmental,
261 economic, and social). Second, we used a deductive approach based on the first-level typology of
262 relationships between sustainability and CE suggested (conditional, beneficial and trade-off) by
263 Geissdoerfer et al. (2017), see Table A3. If distinct relationships could be retrieved from different
264 meaning units in the same report, an unclear relationship was indicated. Last, we inductively noted for
265 each CS report if sustainability performance indicators or assessment methodologies were indicated in
266 relation to the CE approach at the company.

267 *Mapping*

268 In order to answer RQ3, we adopted a mapping approach, similarly to Roca and Searcy (2012) and
269 Kozlowski et al. (2015) in their investigation of sustainability indicators in CS reports. Contrarily to
270 RQ1 and RQ2, which address explicit references of CE in CS reports, RQ3 focuses on CE practices
271 whether they are labeled under CE by companies or not. Thus, full reports had to be considered and a
272 mapping approach was deemed better suited than the coding of full CS reports.

273 With regard to the activities, we adapted the framework developed by Moreno et al. (2016), including
274 circular design strategies, i.e. design for closing resource loops, design for reducing resource
275 consumption, design for reliability & durability, design for product attachment & trust, design for
276 extending product life, design for dematerialization of products, design for resource recovery, design to
277 reduce environmental backpacks (terms used by the authors to refer to design for the entire value chain
278 and for local value chains) and design for regenerative systems and circular business model archetypes
279 (circular supplies, resource value, product life extension, extending product value, and sharing
280 platform), by adding sourcing, operations and end-of-life activities. The full mapping framework of CE
281 activities is displayed in Table A4. With regard to the application systems, we distinguished between
282 “main product”, “packaging” and “by-products”, further classified into technical and biological
283 systems. For collaboration practices, inductive categories were formed based on collaboration aspects
284 mentioned both in the meaning units collected in the content analysis and in relation with CE activities.
285 The inductive categories are: research/innovation/technology development project; support of local
286 recycling system; working group/forum/dialogue; system for circulating goods; partnership for
287 reprocessing; and campaign/education.

288 Validity and reliability are two important criteria to be addressed in any research design and were
289 enhanced through researcher triangulation throughout the study. Each researcher reviewed half the
290 sample of CS reports. The analysis for each research question was first performed by a single author
291 and second checked for consistency with the second author. Both authors discussed each critical case
292 until consensus could be obtained (Bengtsson, 2016). On the other hand, an important aspect to
293 increase reliability is to ensure a clear-cut definition of coding categories: basing categories on
294 concepts established in literature for most RQ facilitated differentiation between categories
295 (Kohlbacher, 2005).

296 **Results and discussion**

297 **How is companies' uptake of Circular Economy in their corporate sustainability reports?**

298 In most CS reports, no clear-cut definition for CE is provided by companies, yet defining elements can
299 be retrieved in extracts where CE is introduced by most companies. Several companies make reference
300 to the EMF (Amcor, Luigi Lavazza, Tetra Pak, H&M, CCE, Sealed Air Corp, Groupe SEB, IKEA,
301 Tarkett) and the EU Action plan (Karl Fazer, Heineken, CCE, SCA, IKEA) when mentioning CE.
302 Figure 3 shows the respective presence of the “R” principles in extracts where CE is referred to in CS
303 reports. “Recycle” is mentioned in almost two third of reports, and to a lesser extent, “reuse” (40%),
304 reduce (35%) and “recover” (20%) also appear in CE extracts. The Food & Beverage sector contains
305 more reference to “recover”, and less to “recycle” which can be related to the importance of by-
306 products recovery in this sector (see Table A7).

307 Around one third of the sample (17 CS reports) contains references to a systemic change related to CE
308 (see Table A5). These CS reports mention e.g. the will to “lead the fashion industry away from the

309 make, use, dispose economy to one that allows us to keep resources in use for as long as possible”
310 (C&A, 2016), the idea that “resources and products should be designed and used in continuous loops”
311 (Carlsberg, 2016) or reference to a “future society based on a circular economy” (Åhlens, 2016).

312 One fourth of the sample (11 CS reports) contains only extracts referring to CE coded as “general
313 statement” as shown on Figure 3. For instance, Åhlens (2016) simply mentions its ongoing reflection
314 about the role that the company can play “in a future society based on a circular economy”; Mayr-
315 Melnhof Karton (2016) states that “circular economy is thus an immanent part of our business activity”
316 and Ball (2016) argues that its “[metal] cans represent a perfect example of truly recyclable packaging
317 and a product that fits a circular economy model very well”. All other CS reports contain at least one
318 extract where CE is mentioned in relation with concrete activities, e.g. joining the New Plastics
319 Economy initiative “for a more effective plastics system based on circular economy principles - a new
320 plastics economy” (Amcor, 2016), creating a hub to incubate circular technologies (C&A, 2016),
321 launching a rental service system of kitchen appliance (Groupe SEB, 2016) or valorizing operations’
322 by-products (Pernod Ricard, 2016).

323 All in all, our findings show that in reviewed CS reports, CE is mostly associated with the idea of
324 recycling and reusing, its systemic dimension is referred to in one-third of the sample and in most CS
325 reports it is associated to concrete activities, as opposed to sole general statements. With regard to the
326 presence of “R” principles in CE definitions, our results are aligned with the findings of Kirchherr et al.
327 (2017). The lesser presence of “reduce” (in comparison with “recycle” and “reuse”) in our results
328 echoes their findings for practitioner definitions in comparison with academic definitions, which they
329 argue can be explained by the negative connotation of this principle for economic growth. Furthermore,
330 Kirchherr et al. (2017) found that definitions of CE rarely contain a reference to the systemic
331 dimension of CE, which seems to hold true as well in our sample of CS reports. Our results show that
332 overall the discussion about CE in CS reports is articulated around concrete activities and does not
333 remain solely on an aspirational level, although symbolic references to CE in CS reports could have
334 been expected considering the strong traction of CE in the industry (Jones and Comfort, 2017).

335 **How do companies link Circular Economy and sustainability in their CS reports?**

336 Different aspects of sustainability, i.e. environmental, economic and social aspects, are mentioned in
337 CS reports in relation with CE as show in Figure 4. The most mentioned aspects are environmental
338 ones (around 50%), either in relation with resource scarcity, climate change or more generally
339 environmental pressures, followed by economic aspects (around 30%). Social aspects are largely
340 ignored in references to CE in CS reports.

341 The analysis on the linkage between CE and sustainability reported in Figure 4 suggests that for around
342 75% of CS reports there is an unclear linkage, and CE seems to be considered as a purpose to be
343 pursued *per se* in many CS reports. What is most interesting to note is that no company outlines the
344 existence of trade-offs between CE and sustainability, therefore suggesting that CE inherently

345 contributes to the sustainability agenda. On the other hand, companies might be aware of trade-offs, but
346 decide not to expand on them in CS reports, which are targeted to a non-technical audience. A few
347 examples of beneficial (Barilla, Growmark, Inditex, Luigi Lavazza, Tarkett) and conditional
348 (Carlsberg, CCE, Colgate, Davines, H&M, IKEA) relationships could be inferred from companies'
349 narratives about CE in 2016 (See Table A6 for the details of coding results). For instance, IKEA (2016)
350 states its aim to “converting to a circular economy” in order to address the Sustainable Development
351 Goal 12, “ensure sustainable consumption and production patterns”, which expresses a conditional
352 relationship. Luigi Lavazza (2016) is “developing sustainable solutions that are inspired by the
353 philosophy of a circular economy”, thus outlining a beneficial relationship.

354 References to sustainability performance indicators or assessment methodologies were lacking in most
355 CS reports which elaborate on CE. Only a minority of companies presents a dedicated set of Key
356 Performance Indicators (KPIs) for their CE approach. CCE (2016) uses a set of KPIs to achieve their
357 goal to “support the development of the circular economy, use recycled and renewable materials and
358 recycle more packaging than [they] use” and which includes among others percentage of recycled
359 material used, percentage of renewable material used, percentage of weight reduction, percentage of
360 recyclable products and amount of items collected or recycled. Fromageries Bel (2016) reports on its
361 recovered byproducts in the section “circular economy”. We also found that Carlsberg’s and SCA’s
362 2016 CS reports, mention their use of the life cycle assessment (LCA) methodology in parts where CE
363 is discussed. Similarly, CCE (2016) explicitly mentions reducing its carbon footprint in relation with
364 CE. On the other hand, most companies do mention footprint methodologies (LCA, carbon footprint or
365 water footprint) elsewhere in their reports, with no link with CE. Furthermore, we found three
366 companies mentioning the C2C design framework and C2C certification program as a performance
367 indicator (Carlsberg, 2016, Tarkett, 2016, and Shaw Industries Group, 2016).

368 Interestingly, our results show that environmental challenges are present in companies’ narratives about
369 CE, which contrasts the findings of Kirchherr et al. (2017) who found economic prosperity to be the
370 mostly mentioned aim in CE definitions. On the other hand, our findings confirm that the social aspects
371 are barely mentioned in relation with CE (Kirchherr et al., 2017). Most examples found in academic
372 literature describing the link between CE and sustainability refer to a beneficial relationship,
373 meanwhile only a limited set of authors refer to the possibility of trade-offs (Geissdoerfer et al, 2017).
374 This is consistent with the absence of tradeoffs relationship in our analysis. In addition, the high
375 presence of unclear linkage suggests that companies regard CE as inherently contributing to the
376 sustainability agenda. Our results further show that most companies do not link CE with sustainability
377 assessment which stress the need for performance indicators and assessment methodologies outlined in
378 academic literature (Linder et al., 2017; Pauliuk, 2018). The references to LCA and other footprint
379 methodologies in companies’ CS reports show potential for them to explore the environmental
380 sustainability relevance of CE-related activities. LCA has been explored in several studies as a tool to
381 evaluate the environmental sustainability potential of CE approaches (Niero et al., 2016; Haupt and
382 Zschokke, 2017; Niero et al., 2017) and is outlined as a promising tool (Elia et al., 2017), meanwhile

383 the C2C certification program should be used with caution as a way to monitor environmental
384 performance (Niero et al., 2016).

385 **Which Circular Economy practices do companies present in their CS reports?**
386 **Which systems do companies apply Circular Economy activities to?**

387 As illustrated in Figure 5a, most of CE-related activities are oriented towards the main product and
388 packaging. Particularly in the Food & Beverage sector, efforts are aiming at implementing CE
389 strategies to packaging (see Table A7). This trend is confirmed by analyzing the type of nutrient cycle
390 which CE-related activities are applied to. As shown on Figure 5b, almost all companies refer to CE-
391 related activities with regard to the technical cycle and around one-third of the sample report actions in
392 both cycles.

393 Our findings can be explained by the prominent role that has been given to packaging both in the
394 business agenda, particularly plastic packaging e.g. in the EMF reports (EMF, 2017b, 2013) and in the
395 political agenda, e.g. the recycling targets for packaging waste included in the EU Action Plan for CE
396 (EC, 2015). Both plastic and food waste are included as focus areas in the EU Action Plan for CE (EC,
397 2015), but from our analysis little emphasis has emerged on food waste reduction in the Food &
398 Beverage sector.

399 **Which Circular Economy activities do companies apply?**

400 As illustrated in Figure 6, among CE-related activities, most companies report initiatives addressing
401 improvement in their operations, such as energy efficiency, increased share of renewable energy and
402 recovery of production waste. The second most spread activities in the ranking are connected with raw
403 material sourcing and with promoting the use of recycled content or renewable material. Almost half of
404 the companies report engagement in supporting recycling and resource recovery infrastructure through
405 recycling campaign or initiatives with suppliers.

406 Our findings show that activities addressing circular product design and circular business models are
407 reported to a lesser extent, except for design for reduce resource consumption and design for resource
408 recovery. Within the former category, most of the reported activities aim at design for light weighting,
409 e.g. Barilla (2016), Bonduelle (2016), and Diageo (2016), and design for reducing material/resource
410 use (e.g. Marimekko, 2016, Mohawk Industries, 2016 and P&G, 2016). In terms of design for resource
411 recovery, the emphasis is on the recyclability of the products or packaging, e.g. SCA (2016), Groupe
412 SEB (2016) and Nike (2016). The Household Goods & Textiles sector is the only one with examples in
413 extending product life both in the design stage (mainly through design for easy maintenance, reuse,
414 repair) and circular business models, by primarily setting take back systems for reuse, e.g. H&M
415 (2016), KappAhl (2016), for repair (e.g. IKEA, 2016) and to a lesser extent by extending product value
416 through rental service (e.g. Tarkett, 2016) (see also Table A7).

417 Most activities reported by companies with regard to recycling focus on the quantitative aspect of
418 recycling. Some reports tackle the importance of maintaining the quality of material, therefore
419 highlighting a more advanced analysis of the CE challenges (Carlsberg Breweries, 2016, H&M, 2016,
420 Inditex, 2016). Some companies even recognize the challenges inherent in keeping material quality.
421 Pepsico (2016) highlights the need to “eliminating materials in Pepsico designed packaging that
422 impact recycling sorting or contaminate recovery stream” in order to achieve their 2025 goal of
423 designing 100% of their packaging “to be recoverable or recyclable”. Nike (2016) sees “chemistry as
424 an important tool to unlock some of the key innovations for the future, including performance-
425 maximizing material, component improvements and overcoming roadblocks to closed-loop
426 processing”.

427 Based on Bocken et al.’s (2016) categorization it can overall be concluded that the reviewed companies
428 primarily report the implementation of activities aiming at narrowing loops, somehow already in place
429 in linear economic system, secondly closing loops and only to a limited extent slowing loops. No
430 examples were found for design for dematerialization of products and design for trust & attachment,
431 which are circular design strategies more strongly connected to consumer behaviors. Circular business
432 model strategies are also very limited in the sample. Although the activities considered in this mapping
433 were included whether labeled under the CE or not by the company, the results reveal that among the
434 activities at the core of a CE, the reviewed companies seem to be very involved in resource-efficiency
435 measures in their operations and sourcing, but less active when it comes to circular offers through
436 design or business model initiatives. These outcomes confirm the findings of Kirchherr et al (2017), i.e.
437 that circular business models are mentioned only marginally within CE conceptualizations. Blomsma
438 and Brennan (2017) outline that the value of CE in the broader debate around resource and waste is to
439 put forth a set of “strategies to extend resource life as a means to facilitate additional value extraction
440 and reduce value loss and destruction”. Yet our results indicate that only a limited set of the latter
441 strategies seem to be implemented by the reviewed companies. Interestingly, this lack of a larger set of
442 circular strategies in current activities is coupled with limited references to maintaining material
443 quality, although it is one main strength of the CE concept in comparison with other sustainability
444 initiatives (Korhonen et al., 2018; Webster, 2013).

445 **Which CE-related collaboration practices do companies have?**

446 More than half of CS reports indicate collaboration(s) with external players in a CE-related context. As
447 shown in Figure 7, the most common collaboration types are working group/forum/dialogue identified
448 in nearly a third of CS reports and research/innovation/technology development project identified in
449 nearly a fourth of CS reports. Working group/forum/dialogue collaborations reveal that several
450 companies have initiated or engaged in active dialogue with e.g. peers, knowledge partners, value chain
451 partners and regulators, to explore the role of CE in their specific business. For instance, Carlsberg
452 (2016) has established the Carlsberg Circular Community as a forum for the beverage value chain to
453 explore future circular packaging options. IKEA (2016) is part of a coalition of companies with

454 Michelin, Phillips, Unilever, DSM, Suez, Tetra Pak and Umicore to advocate changes to the EU CE
455 Package.

456 Research/innovation/technology development project collaborations reveal that concrete projects are
457 already happening in several companies to implement CE principles concretely in their technologies
458 and products together with relevant players such as innovation consultancy, knowledge partners,
459 competitors, technology developer. For instance, H&M (2016) in partnership with Kering and Worn
460 Again works on developing a textile-to-textile recycling technology. Amcor (2016) participates in the
461 Project Reflex, which is a “UK-based program evaluating the recyclability of films and multilayer
462 laminates through innovative product designs and recycling technologies”, meanwhile C&A’s
463 Foundation hosts a technology innovation incubator to boost CE initiatives (C&A, 2016). These
464 collaborations mainly focus on technological innovation and to a lesser extent on consumer-based
465 research and design. One notable exception is CCE’s (2016) research on recycling behavior of 20
466 households in Great Britain and France together with the University of Exeter.

467 Partnership for reprocessing and system to circulate goods can be directly related to the respective
468 circular business model strategies resource value and product life extension. They respectively involve
469 joint ventures with recycling factories or cooperation with secondary raw material suppliers on the one
470 hand; and on the other hand collaboration with online platforms, retailers, charities or reprocessors. For
471 instance, Shaw Industries Group (2016) has a joint venture with the company DAK Americas which is
472 a manufacturer of monomers, resins and fibers, to run a recycling facility (resource value) and H&M
473 (2016) collaborates with the online platform Sellpy to support sales of items that are not used anymore
474 by consumers (product life extension). For such circular business model strategies to thrive, more
475 collaboration with external players will be needed in the future.

476 Our results reveal that part of the companies already engage at different levels with their business
477 ecosystem in relation with the CE, which goes in the direction of academics outlining the importance of
478 business ecosystem interactions for a transition towards the CE (Witjes and Lozano, 2016, Linder and
479 Williander, 2017). Yet, interestingly most identified collaborations are with businesses, and few
480 initiatives focus on consumers apart from some campaigns and education initiatives. This seems to
481 confirm trends outlined in literature (Young et al., 2017, Kirchherr et al. 2017; Jones and Comfort,
482 2017; Hazen et al., 2017) that consumer involvement and acceptance are largely missing although
483 considered critical for a transition towards the CE.

484 **Limitations, implications and future research**

485 **Limitations of the study**

486 Our study presents some limitations which should be highlighted before deriving theoretical and
487 managerial implications. First, the data set only contains FMCG companies that publish CS reports in
488 English. This implies that the sample excludes most small and medium companies which often do not

publish such reports (Borga et al., 2009) and is under-representative of countries where it is not common to publish CS reports or to communicate in English. For example, Chinese companies are reported to implement CE in literature, but their experience and views were very limitedly addressed in the present study since only one Chinese company was identified as fulfilling the sample criteria. The sample also excludes companies that use the CE concept, but did not communicate about it in their 2016 CS reports. For instance, Unilever has a full section dedicated to CE on its website (Unilever, 2017), but does not address the topic in its CS report published in 2016 (Unilever, 2016). In this perspective, the sample included in this study cannot be considered fully representative of the FMCG sector at large. Future work is needed to appraise CE uptake in the sector more comprehensively and to statistically account for differences across sub-sectors and regions, which was outside the scope of this study. Moreover, the role of institutional factors, e.g. laws, norms or beliefs in specific regional contexts, on CE uptake in the industry could be particularly interesting to explore (Ranta et al., 2017).

Furthermore, the source of information used to analyze each company is limited to its CS report published in 2016. The latter only gives selected insights of the company's sustainability work, since it outlines key topics of that year, filtered by the company's communication team and according to stakeholders' concerns. The time scope in this study did not allow any longitudinal exploration of companies' activities that is, through comparing reports across years (Hrasky, 2011). Thus it was not possible to investigate further a possible symbolic uptake of CE in CS reports. Moreover, CS reports are concise documents presenting practices that may have reached a certain maturity in the organization, thus the information communicated in CS reports might be too thin to appreciate actual ongoing efforts towards CE. Results based on CS reports provide a partial picture and must be taken with caution when drawing conclusions at the level of the companies that publish these reports. Hence, future work based on longitudinal and primary data is needed. Yet, we consider that what companies provide about CE in their CS reports delivers relevant information about business thinking around the concept and allows for providing insights and trends about the business uptake of CE.

Theoretical implications

Our study contributes to the academic knowledge of CE uptake at a micro-level and sheds light on several aspects particularly relevant for the CE research community. First, only limited symbolic references to CE could be elicited, whereas most of the CS reports considered report concrete actions on CE implementation. Second, the systemic dimension of CE is not systematically acknowledged in CS reports and rather poorly represented in practices, i.e. limited focus on business model changes, consumer engagement and material quality. The "reduce" principle is under-represented in companies' narratives about CE. These findings are consistent with previous observations in the academic literature (Kirchherr et al., 2017) and indicate the need for research to further inspire and support business players towards systemic changes and more radical innovations in their businesses if the CE is to deliver on its promises (Kirchherr et al., 2017). Although we found that most companies envision CE as a way of addressing their environmental challenges, their understanding of the linkage between

sustainability and CE remains implicit or absent and CE-related practices are rarely associated to sustainability assessments or performance indicators. These results show that CE remains primarily regarded by companies as a vision (Goedkoop et al., 2015) and strengthen the existing call in academia for more methods which allow evaluating how good a CE strategy is from a sustainability perspective, i.e. including environmental, economic and social aspects (Niero and Hauschild, 2017). If not assessed, the relevance of CE approaches could be challenged due to overlooked burden shifting. Based on these considerations, we strongly recommend an increased focus on the systemic dimension and sustainability relevance of CE in future academic work on the implementation of CE in business sustainability strategies.

Managerial implications

Although our study reveals that the CE concept has started being implemented in corporate sustainability agendas of the reviewed FMCG companies, our findings highlight that its concrete application can be strengthened in different ways. We encourage practitioners to reflect on the meaning of CE for their business activities, beyond sourcing, operations efficiency and end-of-life initiatives, e.g. by taking a multiple life cycle perspective, i.e. considering material quality and limitations to recycling (Grosso et al., 2017) and rethinking their product design and business models, in collaboration with consumers and other business partners. If CE is “casually interpreted” (Webster, 2013) and its application remains constrained to narrowing loops (Bocken et al., 2016) while failing to challenge our production and consumption models more broadly (ADEME, 2016), there is a risk to miss out opportunities to drastically reduce pressures on earth’s resources. Our results further reveal that CS reports seem to convey a strong faith in the CE as an approach to solve environmental challenges in the industry, which is consistent with its key role as a clear vision to move away from the throw-away society. However, practitioners are encouraged to clarify their objectives to engage in CE activities and perform quantitative sustainability assessment or hotspot analysis to avoid burden shifting between life cycle stages.

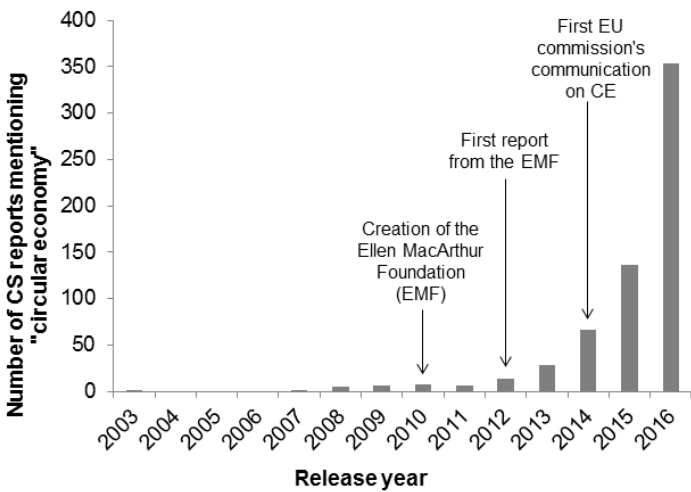
Conclusions

This explorative study aimed to contribute to fill the gap on the missing link between academic research and business practice on CE by investigating how the CE concept affects FMCG companies’ sustainability agenda as reported in their CS reports. The 2016 CS reports of the 46 companies in the FMCG sector identified as referring to “circular economy” were systematically analyzed to unearth (i) their uptake of the CE concept, (ii) the linkage established between CE and sustainability and (iii) the breadth of CE-related practices undertaken by these companies. A fair share of CS reports indicate concrete activities in relation to the concept of CE, mainly oriented towards the main product and packaging, which reveals that companies have started a journey towards CE implementation. However, our analysis revealed that the breadth of CE-related activities remains to be explored and the systemic dimension of CE is rarely present in companies’ narratives about CE, as well as poorly rooted in CE-

562 related activities (i.e. limited focus on consumer engagement, material quality, and business models).
563 Furthermore, the results show that the linkage between CE and sustainability remains largely implicit
564 both conceptually and practically due to limited use of performance indicators or quantitative
565 sustainability assessments. Based on these findings, we outlined the need for researchers and
566 practitioners to respectively further explore and support the systemic dimension of CE and its link with
567 quantification of sustainability performance. Our findings are a first attempt to systematically explore
568 CE conceptualization and related practices in a business context for FMCG, but cannot be generalized
569 to the whole sector, and neither can give a direct account for the actual practices of the reviewed
570 companies. Future work should thus expand our analysis by exploring other periods of time and sectors
571 to test the statistical significance of differences among sub-sectors and regions, as well as focusing on
572 in-depth investigations of companies' approaches to CE based on interviews and field studies.

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578 reviewers for their constructive suggestions on how to improve the paper.



579
580 **Figure 1.** Temporal evolution of corporate sustainability (CS) reports included in the Corporate
581 Register database mentioning the term “circular economy” (CE). EMF: Ellen MacArthur Foundation.

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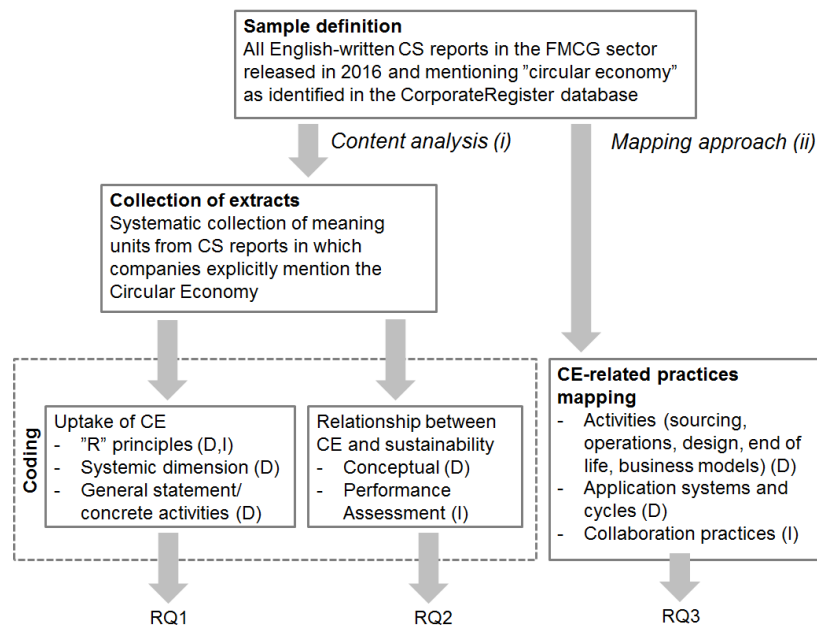


Figure 2. Stepwise procedure used to answer the three research questions (RQ), with indication of the methodological approach adopted. CE= Circular Economy, CS= Corporate Sustainability, FMCG = Fast Moving Consumer Goods. I= inductive approach. D= deductive approach.

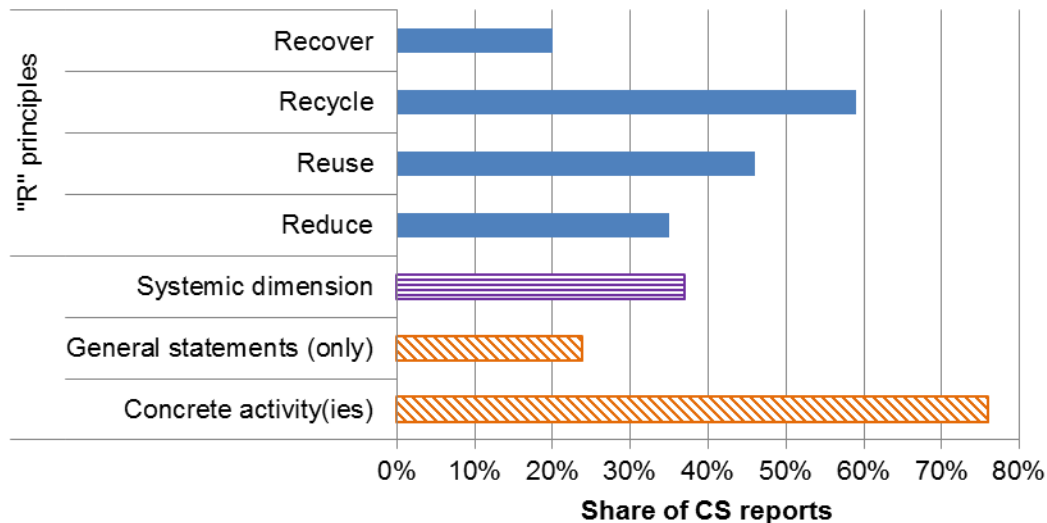


Figure 3. Main conceptual elements used by companies to introduce and/or define Circular Economy in their corporate sustainability (CS) reports, with regard to the "R" principles introduced by Kirchherr et al. (2017), link to systemic dimension and presence of either general statement (only) or concrete activities in relation to CE.

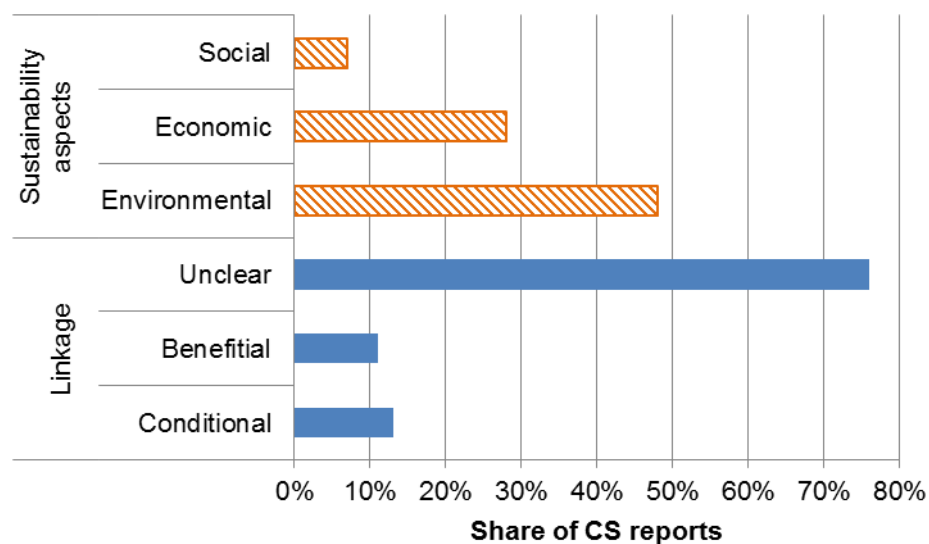


Figure 4. Share of corporate sustainability (CS) reports for (i) sustainability aspects associated to Circular Economy (CE) and (ii) different linkages between CE and sustainability based on the categories introduced by Geissdoerfer et al. (2017).

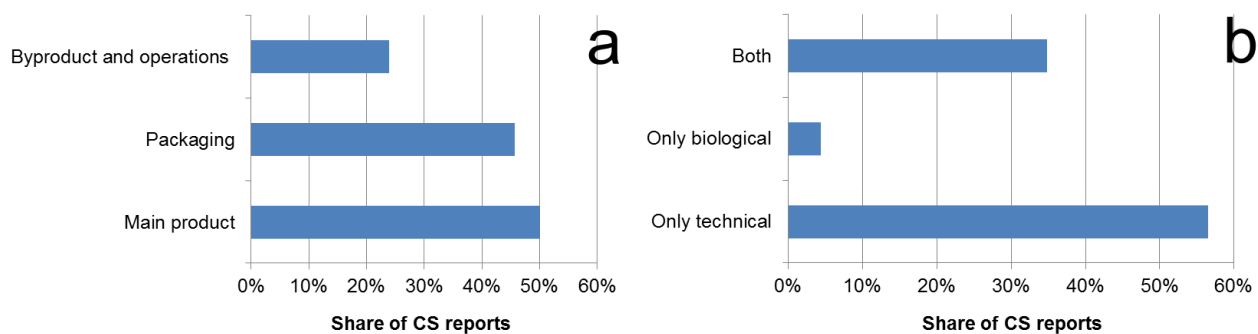


Figure 5. Systems where Circular Economy-related activities are applied to (a) and nutrient cycles considered (b). Note that the percentages do not sum up to 100% in Fig. 5b because no system could be identified in 2 corporate sustainability (CS) reports.

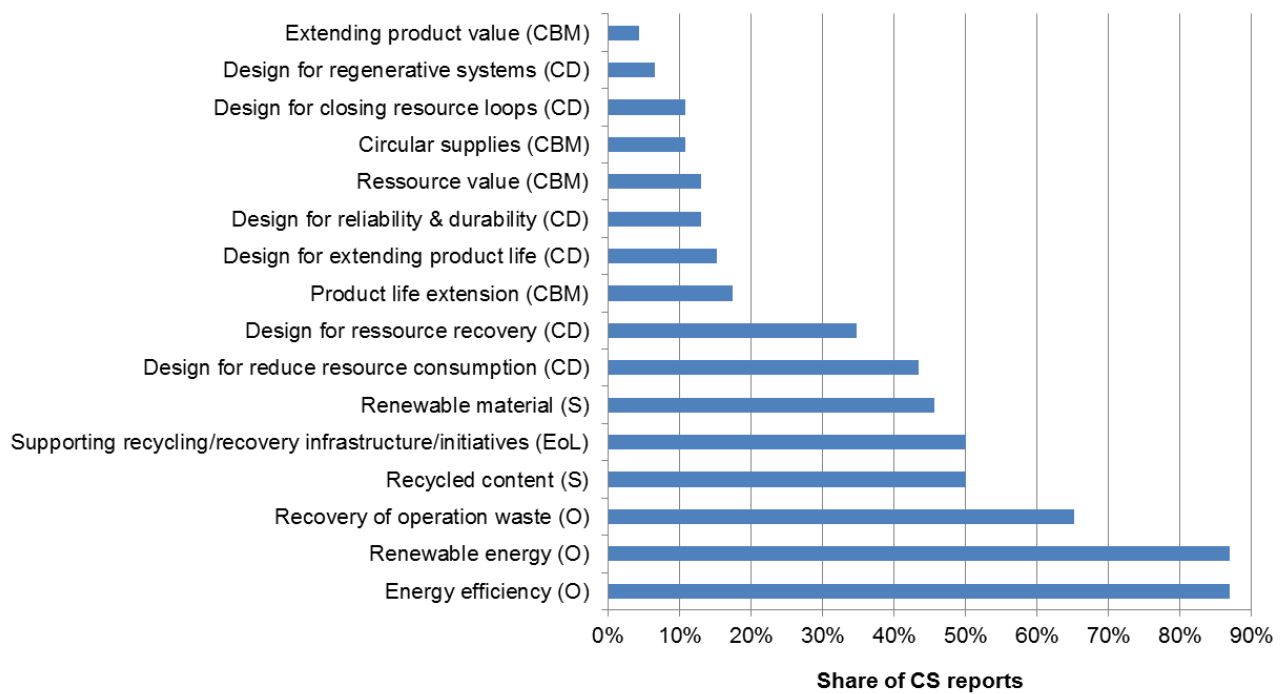


Figure 6. Summary of Circular Economy-related activities reported by companies in their corporate sustainability (CS) reports, including Circular Economy-flagged and non-flagged activities, and considering the five categories: operations (O), raw materials sourcing (S), end-of-life (EoL), circular design strategy (CD) and circular business models (CBM).

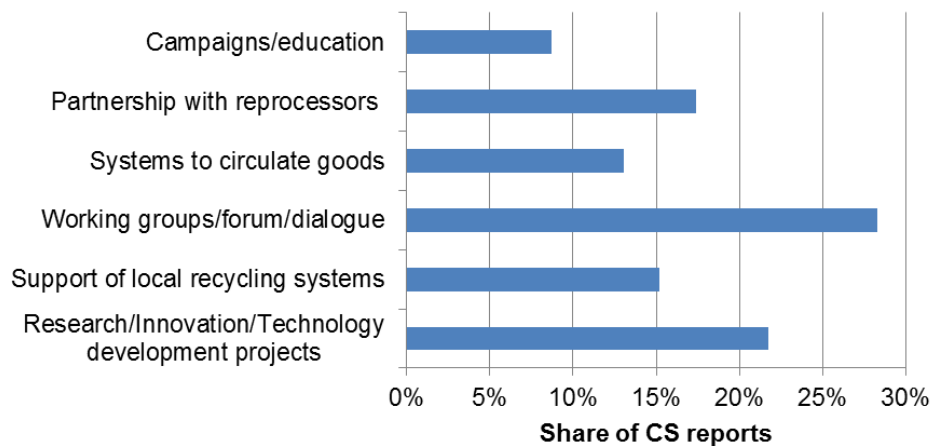


Figure 7. Summary of external collaboration types in the context of Circular Economy as reported in the corporate sustainability (CS) reports.

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Appendix

Company name	Report name	Region	Sector
Amcor Limited	Sustainability Review 2016. Creating a new world of packaging	Oceania	Packaging
Asics Corporation	Sustainability Report 2015. We are Asics	Asia	Household Goods & Textiles
Ball Corporation	2016 Sustainability Report	North America	Packaging
Barilla G e R Fratelli SpA	Good for You, Good for the Planet 2016 Report	Europe	Food & Beverage
Bonduelle Groupe	Registration Document 2015-2016	Europe	Food & Beverage
C&A Global ¹	Global Sustainability Report 2015 Summary. Material Impacts	Europe	Household Goods & Textiles
Carlsberg Breweries AS	Carlsberg Group Sustainability Report 2015	Europe	Food & Beverage
China Agri-Industries Holdings Limited	2015 CSR Report	Asia	Food & Beverage
Coca-Cola Enterprises Inc (CCE)	Corporate Responsibility & Sustainability Report 2015/2016	North America	Food & Beverage
Colgate-Palmolive Company	Colgate Sustainability Report 2015. Giving the World Reasons to Smile	North America	Personal Care & Household Products
Dairy Crest Group plc	Annual Report 2016. Going for Growth	Europe	Food & Beverage
Davines SpA	Sustainability Report Davines Group 2015	Europe	Personal Care & Household Products
Diageo plc	Annual Report 2016	Europe	Food & Beverage
Eco-Products	Sustainability Report 2016	North America	Household Goods & Textiles
Expresso Fashion BV	Social Report [1st April 2015 31st March 2016]	Europe	Household Goods & Textiles
Fromageries Bel SA	2015 Communication on Progress of the Bel Group's CSR	Europe	Food & Beverage
Groupe Rocher	The Essentials of CSR 2015	Europe	Personal Care & Household Products
Groupe SEB	2015 Financial Report and Registration Document	Europe	Household Goods & Textiles
Growmark Inc	Corporate Responsibility Report 2016. Taking Care. Paying Forward	North America	Food & Beverage
H&M ²	Sustainability Report 2015. Conscious Actions	Europe	Household Goods & Textiles
Heineken NV	Sustainability Report 2015. Brewing a Better World	Europe	Food & Beverage
IKEA AB	IKEA Group Sustainability Report FY16	Europe	Household Goods & Textiles
Inditex SA	Annual Report 2015	Europe	Household Goods & Textiles
KappAhl Holding AB	KappAhl 2016	Europe	Household Goods & Textiles

Company name	Report name	Region	Sector
Keurig Green Mountain	Sustainability Report Fiscal Year 2015	North America	Food & Beverage
Luigi Lavazza SpA	Sustainability Report 2015	Europe	Food & Beverage
LVMH-Moët Hennessy Louis Vuitton SA	LVMH 2015 Environmental Report	Europe	Household Goods & Textiles
Marimekko Corporation	Sustainability Review 2015	Europe	Household Goods & Textiles
Mayr-Melnhof Karton AG	Annual Report 2015	Europe	Packaging
Mohawk Industries Inc	2015 Corporate Responsibility & Sustainability Report	North America	Household Goods & Textiles
Nike Inc	FY14/15 Sustainable Business Report. Sustainable Innovation is a Powerful Engine for Growth	North America	Household Goods & Textiles
Oy Karl Fazer AB	Fazer Groups Corporate Responsibility Review 2015	Europe	Food & Beverage
Pepsico Inc	Sustainability Report 2015. Performance with Purpose. 2025 Agenda	North America	Food & Beverage
Pernod Ricard SA	Registration document 2015/2016	Europe	Food & Beverage
Procter & Gamble Inc	P&G 2016 Citizenship Report	North America	Personal Care & Household Products
RCL foods Limited	Our Sustainability Business Report for the Year Ended 30 June 2016	Africa	Food & Beverage
SABMiller plc	Sustainable Development Report 2016	Europe	Food & Beverage
Scottish Leather Group Limited	Group Sustainability Report Year ending 31st March 2015	Europe	Household Goods & Textiles
Sealed Air Corp	Sustainability Report Issued 2016	North America	Packaging
Shaw Industries Group Inc	Sustainability Report 2015	North America	Household Goods & Textiles
Société BIC	2015 Sustainable Development Report. Made to Last	Europe	Household Goods & Textiles
Svenska Cellulosa Aktiebolaget AB ¹	Sustainability Report 2015	Europe	Personal Care & Household Products
Tarkett SA	2015 Activity & Sustainability Report. Committed to Better Living Spaces	Europe	Household Goods & Textiles
Tetra Pak Group	Sustainability Update 2016. Food. People. Future	Europe	Packaging
Thimm Holding GmbH & Co Kg	Sustainability Report 2016. People, Ideas, Solutions	Europe	Packaging
Åhléns AB	Sustainability Report 2015	Europe	Household Goods & Textiles

¹ Report added to the sample since the company is included in the categories “FMCG & Packaging” and “Furniture, Textile and Flooring” of the CE100 directory (<https://www.ellenmacarthurfoundation.org/ce100/directory>)

² Report added to the sample since the company is a founding company of the EMF and belongs to the textile industry

Table A1: List of reviewed corporate sustainability reports, including company name, report name, region where the headquarters are registered and sector of activity. All subsidiaries’ reports that had featured the list were excluded, thus the focus is solely on mother companies.

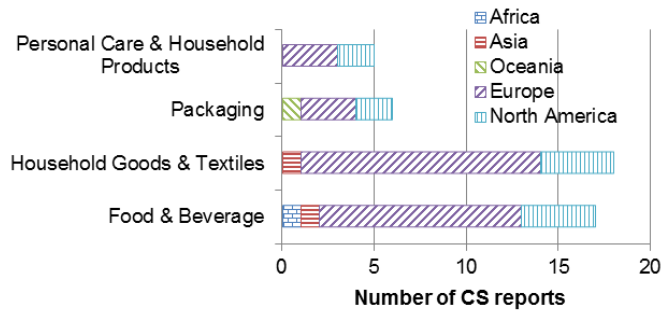


Figure A1. Regional and sectoral distribution of CS reports in the sample.

Principle	Keywords
Reduce	Rethink, re-think, refus, redesign, re-design, minimiz, minimis, prolong, <i>extend*</i> ,
Reuse	Reus, <i>repurpos</i> , refurbish, repair, <i>second life</i> , <i>maintain</i>
Recycle	Recycl, remanufactur
Recover	Recover

*In italics are keyword added inductively from the data.

Table A2. List of keywords used in RQ1 based on Kirchherr et al. (2017)

Category	Definition
Systemic dimension	CE is mentioned in relation with the need for a shift/radical change/transition away from today's system (economy, sector, business).
General statement	CE is mentioned in a general descriptive, normative, aspirational statement.
Concrete activities	CE is associated to concrete undertakings internally or externally.
Beneficial linkage	CE is considered as one way to progress towards sustainability among others. (Geissdoerfer et al., 2017)
Conditional linkage	CE is considered as a condition for reaching sustainability. (Geissdoerfer et al., 2017)
Tradeoff linkage	CE is considered to lead to sustainability trade-offs (both benefits and negative outcomes). (Geissdoerfer et al., 2017)

Table A3. Overview of coding categories for RQ1 and RQ2.

Categories	Definition
Recycled content (S)	The company reports using recycled material in its products
Renewable material (S)	The company reports using material from renewable sources in its products
Energy efficiency (O)	The company indicates adopting measures to save energy
Renewable energy (O)	The company indicates using energy from renewable sources
Recovery of operation waste (O)	The company reports measures for reusing/recycling the waste/byproducts it produces in its operations
Supporting recycling/recovery infrastructure/initiatives (funding, campaign, research) (EoL)	The company indicates measures to support the recycling system
Design for closing resource loops (CD)	Design for biodegradability, Design with healthy/smart processes/materials (Moreno et al., 2016)
Design for reduce resource consumption (CD)	Design with healthy/smart processes/materials; Design for reduction of production step; Design for light weighting, miniaturizing; Design for eliminating yield losses/material/resources/parts/packaging; Design for reducing material/resource use (Moreno et al., 2016)
Design for reliability & durability (CD)	Design on demand or on availability; Design the appropriate lifespan of products/components (Moreno et al., 2016)
Design for product attachment & trust (CD)	Create timeless aesthetics; Design for pleasurable experiences; Meaningful design (Moreno et al., 2016)
Design for extending product life (CD)	Design for repair/refurbishment; Design for easy maintenance, reuse and repair; Design for upgradability and flexibility (Moreno et al., 2016)
Design for dematerialization of products (CD)	Design for product-service systems; Design for swapping, renting and sharing. (Moreno et al., 2016)
Design for resource recovery (CD)	Design for easy end-of-life cleaning, collection and transportation of recovered material/resources; Design for cascade use; Design for (re)manufacturing and dis- and re-assembly; Design for upcycling/recycling (Moreno et al., 2016)
Design to reduce environmental backpacks (CD)	Design for the entire value chain; Design for local value chains (Moreno et al., 2016)
Design for regenerative systems (CD)	Design for biomimicry; Design for biological and technical cycles (Moreno et al., 2016)
Circular supplies (CBM)	“A business model based on industrial symbiosis in which the residual outputs from one process can be used as feedstock for another process” (Moreno et al., 2016)
Resource value (CBM)	“A business model based on recovering the resource value of materials and resources to be used in new forms of value” (Moreno et al., 2016)
Product life extension (CBM)	“Those business models that are based on extending the working life of a product” (Moreno et al., 2016)
Extending product value (CBM)	“Those business models based on offering product access and retaining ownership to internalize benefits of circular resource productivity” (Moreno et al., 2016)
Sharing platforms (CBM)	“Those business models that enable increased utilization rates of products by making possible shared use/access/ownership (Moreno et al., 2016)

Table A4. Overview of mapping framework for CE-related activities (RQ3), adapted from Moreno et al., (2016). S= sourcing. O=operations. EoL=End-of-life. CD=circular design. CBM=circular business model.

Company name	Extract coded for “systemic dimension of CE”
Amcor	“With an explicitly systemic and collaborative approach, the initiative aims to advance the plastics value chain into a virtuous cycle of value capture, stronger economics, and better environmental outcomes” (Amcor, 2016)
C&A	“We want to help lead the fashion industry away from the make, use, dispose economy to one that allows us to keep resources in use for as long as possible.” (C&A, 2016)
Carlsberg Breweries	“Resources and products should be designed and used in continuous resource loops. The only long-term sustainable answer to waste is to reduce and, ultimately, eliminate it.” (Carlsberg Breweries, 2016)
CCE	“We are very clear that our economy cannot continue in its current take-make-dispose model and we need to transform to a circular economy model” (CCE, 2016)
Davines	“All these signs are telling us that the future lies in a circular economy. Unlike the old linear system, the new model is based on ethical and sustainable development, thanks to re-use and minimising waste. A circle has no beginning and no end, and therefore can renew itself, assuring the future of generations to come.” (Davines, 2016)
Eco-products	“At the end of the day, everything comes back to waste diversion for us. It’s our reason for being and it is reflected in our new mission statement that you will find if you keep reading. Compostable foodservice packaging is at its best when it enables the diversion of food scraps and other organic material from landfills. In order for that to happen, there has to be a systems approach that takes into account all inputs, incorporates a consistent communications strategy, and integrates with the haulers and facilities who will accept the material and turn it into an ecologically essential and economically valuable product. That is starting to sound like the kind of circular economy we want to be a part of.” (Eco-Products, 2016)
Groupe SEB	“Circular economy requires an approach of fitting of channels (e.g. recycling, reuse...). This economic system is based on exchanges and production. At every stage of the life cycle of the products, goods and services, it aims to increase the efficiency of the resources and to reduce the impact on the environment while enabling the welfare of the individuals.” (Groupe SEB, 2016)
H&M	“We want to move towards a 100% circular business model. This means nothing less than completely turning around how our industry has been operating for decades – moving away from a linear production model to one that uses once-created products as the resource for new desirable fashion.” (H&M, 2016)
Heineken	“There is increasing focus on how businesses can move from a linear value chain model towards a Circular Economy in which products and resources are reused or refurbished as part of new product life-cycles.” (Heineken, 2016)
IKEA	“Transitioning to a circular economy. Take make dispose. That's the model our economy is based on. But it's not sustainable.” (IKEA, 2016)
KappAhl	“We have also joined phase two of the Mistra Future Fashion programme that aims to create conditions for a circular economy in the fashion industry.” (KappAhl, 2016)
Nike	“We envision a transition from linear to circular business models and a world that demands closed-loop products – designed with better materials, made with fewer resources and assembled to allow easy reuse in new products.” (Nike, 2016)
SABMiller	“In working towards the ambitious new climate goals, society needs to move to a more efficient, circular economy focused on eliminating waste and emissions and creating value from what remains.” (SABMiller, 2016)
SCA	“In 2015, the EU Commission presented its circular economy strategy that will lead to societal change in many areas. SCA recognizes the need for solutions that drive the circular economy and actively applies this thinking to all of its products.” (SCA, 2016)
Tarkett	“CONTRIBUTING TO A CIRCULAR ECONOMY Tarkett is committed to the transition from a linear to a circular economy model, which consists of recycling resources in a loop from the design and production phases to later use and recovery stages.” And “A key element of our approach is our longstanding commitment to the circular economy. As we move away from a linear economy that depletes finite resources, we take advantage of all opportunities to select materials that are good for people’s health and the environment, and recycle and reuse our products or materials from other

	industries.” (Tarkett, 2016)
Tetra Pak	“We have also signed up to the CE100, an innovative programme set up by the Ellen MacArthur Foundation to support the long-term development of a circular economy: one that is restorative and regenerative by design. (Tetra Pak, 2016)
Ählens	“We have also asked ourselves: what role can Ählens play in a future society based on a circular economy?” (Ählens, 2016)

Table A5. Coding results for the systemic dimension addressed in RQ1.

Company name	Linkage	Extract
Carlsberg Breweries	Conditional	“Resources and products should be designed and used in continuous resource loops. The only long-term sustainable answer to waste is to reduce and, ultimately, eliminate it.” (Carlsberg Breweries, 2016)
Colgate-Palmolive	Conditional	“Building a circular economy in which industrial materials and packaging can be recycled and reused is an important part of a sustainable future.” (Colgate-Palmolive, 2016)
Davines	Conditional	“All these signs are telling us that the future lies in a circular economy. Unlike the old linear system, the new model is based on ethical and sustainable development, thanks to re-use and minimising waste. A circle has no beginning and no end, and therefore can renew itself, assuring the future of generations to come.” (Davines, 2016)
H&M	Conditional	“The fashion industry is using more resources than the planet allows. As demand increases, so will waste, pollution and carbon emissions while resources will become increasingly scarce. Moving towards a circular model will be key for our future success and growth. This is why we are currently working to update our sustainability strategy.” (H&M, 2016)
IKEA	Conditional	“Transitioning to a circular economy. Take make dispose. That's the model our economy is based on. But it's not sustainable.” (IKEA, 2016)
Barilla	Beneficial	“Promote cooperation with farmers to make the agricultural sector more sustainable according to circular economy models” (Barilla, 2016)
Growmark	Beneficial	“Our dedication to sustainable measures is not limited to the land. In business, we look for opportunities that have impact far beyond our core purpose and that support a circular economy.” (Growmark, 2016)
Inditex	Beneficial	“In 2015 we also made progress towards the circular economy model with the Closing the Loop project, which combines environmental and social sustainability to pursue the goal of ensuring no used textile item ends up in landfill.” (Inditex, 2016)
Luigi Lavazza	Beneficial	“This served as an opportunity for Lavazza to confirm its commitment that sees it involved in an intense activity of research and innovation aimed at developing sustainable solutions that are inspired by the philosophy of a circular economy.” (Luigi Lavazza, 2016)
Tarkett	Beneficial	“We innovate by developing technology and specific designs to improve people’s well-being, for example by contributing to indoor air quality, by creating an inspiring colorful environment and by improving sound control in living spaces. Our eco-innovations based on healthy materials and our recycling model contribute to our vision of a sustainable and profitable development. This commitment to the circular economy is beneficial for society and the planet, as well as improving our teams’ pride and motivation.” (Tarkett, 2016)

Table A6. Coding results for the linkage between CE and sustainability (conditional and beneficial linkages) with regard to RQ2.

	FULL SAMPLE	SECTORS		REGIONS	
Research question		HGT	FB	Europe	North America
RQ1:	Share of reports				
“R” principles					
Reduce	35%	41%	29%	37%	25%
Reuse	46%	53%	41%	47%	50%
Recycle	59%	71%	29%	57%	58%
Recover	20%	18%	35%	20%	25%
Systemic dimension					
Presence of systemic dimension	37%	47%	24%	43%	25%
Level of implementation					
Concrete activity(ies)	76%	88%	71%	80%	67%
Only general statements	24%	12%	29%	20%	33%
RQ2					
Linkage					
Conditional	13%	12%	12%	13%	17%
Beneficial	11%	6%	18%	13%	8%
Unclear	76%	82%	71%	73%	75%
Sustainability aspects					
Environmental	48%	41%	47%	57%	33%
Economic	28%	12%	41%	23%	33%
Social	7%	6%	0%	10%	0%
RQ3					
Application system					
Main product	50%	67%	18%	47%	58%
Packaging	46%	28%	71%	47%	42%
By-products	24%	17%	41%	33%	0%
Nutrient cycles					
Both	35%	17%	59%	43%	17%
Only biological	4%	0%	12%	3%	0%
Only technical	57%	78%	24%	50%	75%
CE-related activities					
Recycled content (S)	50%	61%	41%	47%	67%
Renewable material (S)	46%	50%	35%	50%	33%
Energy efficiency (O)	87%	94%	82%	87%	92%
Renewable energy (O)	87%	89%	82%	90%	83%
Recovery of operation waste (O)	65%	56%	76%	63%	75%
Supporting recycling/recovery infrastructure/initiatives (EoL)	50%	39%	53%	47%	67%
Design for closing resource loops (CD)	11%	11%	12%	10%	17%
Design for reduce resource consumption (CD)	43%	28%	59%	30%	75%
Design for reliability & durability (CD)	13%	22%	6%	13%	17%
Design for product attachment & trust (CD)	0%	0%	0%	0%	0%
Design for extending product life (CD)	15%	33%	6%	10%	25%
Design for dematerialization of products (CD)	0%	0%	0%	0%	0%
Design for resource recovery (CD)	35%	33%	35%	27%	58%
Design to reduce environmental backpack (CD)	0%	0%	0%	0%	0%
Design for regenerative systems (CD)	7%	11%	6%	7%	8%
Circular supplies (CBM)	11%	11%	18%	13%	8%
Product life extension (CBM)	17%	44%	0%	23%	8%
Extending product value (CBM)	4%	11%	0%	7%	0%

Collaboration practices					
Research/Innovation/Technology development projects	22%	22%	18%	23%	17%
Support of local recycling systems	15%	0%	24%	3%	42%
Working groups/forum/dialogue	28%	39%	18%	30%	25%
Systems to circulate goods	13%	33%	0%	17%	0%
Sourcing partnership with reprocessors	17%	33%	6%	17%	25%
Campaigns/education	9%	6%	12%	7%	17%

Table A7. Overview of results for RQ1-3 with sectoral and regional differentiation. With regard to the sectors, we only provide the results for the Food & Beverage (FB) and the Household Goods & Textiles (HGT) sector since Packaging and Personal Goods and Household Products are very limitedly represented in the sample. Similarly, with regard to the regions, we only provide the results for Europe and North America.