Investigation into Circular Economy of plastics: The case of the UK Fast Moving Consumer Goods industry

Abstract

Despite the recognised importance of the issue of plastic waste and an emerging circular economy (CE) in recent years, there is a lack of comprehensive and relevant studies regarding CE and the role of plastics. This study addresses a significant gap in the literature by revealing current initiatives implemented in the UK fast moving consumer goods (FMCG) industry through an in-depth exploration of four case organisations that have committed to the UK Plastic Pact, a pioneering collective initiative on plastic recycling. The study discloses a variety of present initiatives within the industry including the removal of unrecyclable plastics, packaging innovation, in-store retailer schemes, and label modifications. Collaboration was concluded as an essential enabler, internally and across the industry. Fundamental barriers were identified as inadequate infrastructure to support plastics in the CE and technical implications of packaging.

Keywords: Circular Economy; FMCG industry; plastic recycling; plastic packaging; barriers and constraints; UK Plastic Pact

1 INTRODUCTION

The ocean is becoming increasingly polluted by plastic waste, with 10% of global plastic pollution ending up in the world's oceans each year (Fitzgerald, 2011). Although the properties of plastic make it an extremely versatile material, its durability however enables it to stay in our eco-system for a considerably long time. This has a severe impact on the ocean's marine life, including accidents and harm from entanglement and ingestion, spread of invasive species across the ocean, and mass extinctions of coral (Schneider *et al*., 2018). Furthermore, plastics fragmented in the marine environment, known as microplastics, are not only damaging the food chain but have also been identified as an emerging source of soil pollution (Rillig, 2012; Duis and Coors, 2016) and freshwater contamination (Wagner *et al*., 2014), emphasising the scale of the plastics issue.

In Europe alone, 25.8 million tonnes of plastic waste is generated and of that, less than 30% of it is collected for recycling (European Commission, 2018). With the Blue Planet acting as a major catalyst of public concern, governments and businesses have begun to acknowledge the urgent need to tackle the problem. Government-enforced initiatives and legislations have been introduced, with targets set in Europe for all plastic placed on the market to be either reusable or recyclable in a cost-effective manner by 2030 (EC, 2018). To support this change, the concept of Circular Economy (CE) has gained importance on policy makers' agendas (Brennan *et al*., 2015). Plastic is recognised amongst the five priority areas for progression towards circularity, released as a key movement of the resources and waste strategy for England (GOV, 2018).

The CE is also expected to promote economic growth and create a net saving for EU businesses of up to €600 billion, whilst similarly reducing environmental impacts (Kalmykova *et al*., 2018). Additional to governments taking action, 250 organisations have signed a global commitment to "eradicate plastic waste and pollution at the source" (NPE, 2018) through the 'UK Plastic Pact', a collaborative initiative led by WRAP, the Waste & Resource Action Programme charity (WRAP, 2018a). It hopes to bring together the entire plastic packaging value chain behind a common vision and an ambitious set of targets (WRAP, 2018a). Those who have signed the pact include the world's largest packaging producers, brands, recyclers and NGOs most of which are part of the fast moving consumer goods (FMCG) industry (NPE, 2018).

The surge in attention regarding the challenge of plastic use in society has motivated this study. It is evident that the topic is highly relevant and an important agenda for multiple stakeholders.

The mission of the Plastic Pact is to accelerate the transition of the CE, with three key targets to *eliminate*, *innovate* and *circulate* (WRAP, 2018a). Consequently, this research investigates how organisations are applying new initiatives to achieve these targets. The following research questions were formulated to facilitate the achievement of the research aim:

1. *What are the plastic recycling initiatives currently being implemented by FMCG firms?*
2. *Why do FMCG firms join NGO-led plastic recycling initiatives?*
3. *How do the barriers and enablers of CE focused on plastic in the UK impact implementation by the FMCG industry?*

Together, these research questions help to explore the plastic reduction initiatives currently being implemented by the UK FMCG industry, to understand the motivational factors for FMCG firms to introduce plastic-focused CE initiatives, and to identify the barriers to and enablers for implementing CE initiatives in the UK FMCG industry.

2 LITERATURE BACKGROUND

This section reviews the two key streams of literature underlying this research – namely, CE in general and plastics within CE in particular.

2.1 Circular Economy

The current linear economy is made up of production and resource consumption on a 'produce-use-dispose' basis, with no policy for re-use or regeneration of the resources (Ellen MacArthur Foundation, 2012). Such a model is considered wasteful and a burden on the environment, thus leaving room for the CE trend to emerge (Michelini *et al*., 2017). The CE concept shifts away from the linear model, offering a 'closed loop' model that enables resource utilisation, with the main purpose to reduce waste, natural resource use, and greenhouse gas emissions (Bastein *et al*., 2013).

The concept of CE was first generated by environmental economists Pearce and Turner (1989), who first envisioned a circular economic system that transitioned from linear to circular. The modern view of CE has included several different schools of thought, ranging from the 'Cradle to Cradle' philosophy (McDonough and Braungart, 2002), Performance Economy (Stahel, 2010), Industrial Ecology by Lifeset and Graedel (Ayres, 2002), Natural Capitalism (Hawken *et al*., 1999) and the Blue Economy systems approach (Pauli, 2010).

CE in recent academic literature consists of several literature reviews (e.g., Ghisellini *et al*., 2016; Lieder and Rashid, 2016; Sauvé *et al*., 2016; Murray *et al*., 2017), studies focusing on the definition of CE (Kirchherr *et al*., 2017; Korhonen *et al.*, 2018), an analysis of the central concepts (Govindan and Hasanagic, 2018), and the geographical distribution of studies (Lieder and Rashid, 2016), with a particular focus on China (Liu and Bai, 2014; Zhu *et al*., 2018; Shao, 2019) and European countries (Katz-Gerro and Sintas, 2019; Bundgaard and Huulgaard, 2019; Demirel and Danisman, 2019). The literature, however, lacks consensus on the definition of CE and the limited focus on business and economic factors. Outside of academic literature, CE has gained increasing attention thanks to the Ellen McArthur Foundation since the publication of their first report in 2012 (Ellen MacArthur Foundation, 2012), which was soon followed by the first EU commissions communication on CE in 2014 (EC, 2014).

According to Govindan and Hasanagic (2018), CE literature was initially dominated by the 3Rs – Reduce, Reuse, and Recycle. However, since the topic has grown and developed this has extended to 6Rs to also include Recover, Redesign, and Remanufacture, which are showing better results for encouraging re-use (Govindan and Hasanagic, 2018). In order to support organisations, there are six action areas to implement the principles of CE; these are depicted by the ReSOLVE framework created by the Ellen MacArthur Foundation (2015), outlined as Regenerate, Share, Optimise, Loop, Virtualise and Exchange, which provides the fundamental constructs of circular business models (Lewandowski, 2016).

2.1.1 Circular Economy: barriers and enablers

Transitioning towards a CE has been associated with many barriers, along with enablers, listed in Table 1. A typical approach to study the barriers takes the form of a single case study (Torstensson, 2016; Hopkinson *et al*., 2018). Torstensson's (2016) study of a large business-

to-business (B2B) company identified barriers as financial, cultural, technological, structural and contextual factors. Similarly, Hopkinson *et al*. (2018) conducted an in-depth case study over a 30-year period, within which numerous barriers were identified, including lack of manager insight and cost-benefit data. Yet this longitudinal study with strong validity only provides a look into a single industrial case of a Japanese company. Ritzén and Sandström (2017) found similar barriers which applied to a small sample of organisations.

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Research into barriers to implementation has also revealed the key enablers, which a study by Walker *et al*. (2008) identified as being either internal or external. Supported by literature, the study also found that drivers were often external while barriers were internal (Walker *et al*., 2008), possibly implying that organisations may not have the capacity to support their transition, despite the external push. By studying organisations that have joined a NGO, there is the potential to assess the difference that this might have on their abilities. Furthermore, this could further challenge current main drivers of CE which are the legislative and governmental bodies, NGOs and consultancy firms (Kalmykova *et al*., 2018).

Weetman (2016) identified internal enablers and external accelerators, looking into how organisations are 'thinking differently' to unlock new ways of generating and capturing value. Biomimicry links closely with the central ideas of CE as well as the thoughts of the Blue Economy (Pauli, 2010), using the idea of nature's patterns and strategies to innovate sustainable solutions (Pauli, 2010; Weetman, 2016). Furthermore, it is clear that technology plays an important role in implementation. However, as seen in Table 1, numerous researchers have considered it a barrier due to the lack of capabilities and financial resources.

Research by Lewandowski (2016) supports collaboration as an accelerator towards CE, and they propose a new framework with collaboration as a key pillar. Similarly, most researchers within the CE field suggest that collaboration and symbiotic partnerships are the key components in achieving successful CE practices (McDonough and Braungart, 2002; Pauli, 2010; Stahel, 2010). While some call for a focus on the relationship between suppliers and producers (Witjes and Lozano, 2016), others suggest more top-down and bottom-up approaches to CE implementation (Lieder and Rashid, 2016).

2.2 Circular Economy of plastics

CE of plastics has one essential component in regard to how plastic waste is seen, and that is to change the mind frame of waste to resources. Such a change in thinking opens up a variety of different opportunities for utilisation, innovative products, linkages between industries, information flow to consumers, and new policy instruments (STAP, 2018). For instance, Iacovidou *et al.* (2017a) proposed a conceptual approach that expands beyond conventional methods of estimating value, to access how complex value is created, destroyed and distributed in resource recovery from waste systems, which creates a pathway towards circular economy. In another study, Iacovidou *et al.* (2017b) established assessment methods that focus on resource recovery from waste, considering a few domains or even a single domain of value, and they suggested that only refined sets of metrics could allow the optimisation of the multi-dimensional value of materials, components and products. Overall, these studies provide excellent examples of how resources and wastes are intertwined, and how resources can be recovered from wastes.

In terms of recycling, plastics are often divided into seven categories of which three types are commonly recycled (i.e. PET, HDPE and PP), one type is sometimes recycled (i.e. LDPE) and the rest are almost never recycled (i.e. PVC, PS and others). The limited capability of recycling is due to geographical/political differences, differing waste stream sizes and the quality of each type of plastic. For example, due to its high marketability and technical value, clear PET is recovered and recycled into new products (Hahladakis and Iacovidou, 2018), high-density polyethylene (HDPE) can be recycled several times without losing the quality, while other types of plastic require more processing (Scott, 2015). More recently, Beltran *et al.* (2019) suggested that to improve the recyclability of poly(lactic acid) (PLA) and reduce the consumption of raw materials, two additives – namely a chain extender and an organic peroxide – could be used. On the other hand, some studies have focused on waste management of plastics. Horodytska *et al.* (2018) conducted a review of plastic films recycling and waste management technologies and they found that plastic films recycling rates are still very low, and multilayer films recycling technologies are still underdeveloped. They suggest that the deinking process and other decontamination technologies should be considered, and further research should be directed towards closed-loop recycling systems. Hahladakis and Iacovidou (2019) provided an overview on how the design, production, collection and sorting of post-consumer plastic waste can present challenges for plastic waste

recycling, and this can, in turn, result in several trade-offs. They suggest that the evaluation of the multi-dimensional implications of trade-offs that arise from the post-consumer plastic waste recycling is essential in measuring the long-term sustainability of resource recovery from waste systems.

In relation to CE, a study by Huysman *et al*. (2017) highlighted the different waste treatment options currently in place for plastic. The challenge for CE in this context is the lack of indicators situated at a micro level (products/companies) to categorise the used plastics into appropriate treatments. In comparison, most indicators are already on a macro-economic level (countries/regions); for example Japan's 3R policy (Takiguchi and Takemoto, 2008). Consequently, the development of a CE performance indicator, which quantifies the performance of *actual* obtained benefit over the *ideal* environmental benefit, was completed (Huysman *et al*., 2017).

Of the polymers used in packaging, flows of PET have attracted the most attention in scientific literature. According to Welle (2011), the collection of PET bottles sold in the EU continues to increase, with 10-20% growth rates per year. Further success in other countries can be highlighted through material flow analysis, as done in Austria and China. Austria reached their CE plastic targets (Eygen *et al*., 2018), and in China the strategies for plastic waste led to a reduction of Greenhouse Gas emissions (Liu *et al*., 2018).

There is significantly less literature around plastics in CE compared with more established materials in the CE system. However, there is considerable theory development over recent years regarding plastics in CE. Dominated by EMF goals for the plastics sector, these involve applying an open systematic and collaborative approach whilst improving the economic viability of recycling and re-use of plastics, thus drastically reducing leakages of plastics into the environment (Ellen MacArthur Foundation, 2016). These goals are recognised by scientists (STAP, 2018) and organisations (WRAP, 2018a) worldwide.

Numerous solutions have been proposed, including the production of plastic from alternative feedstock. This involves sources such as sugarcane, oils, cellulose and natural occurring biopolymers (STAP, 2018). Bio-plastics are compostable and will biodegrade in 180 days or less; however they are not meant to be recycled with other types of plastic (Reddy *et al*., 2013). Bio-based plastics were introduced to the market in 2014 and expected to increase

drastically through their use with drop-ins, such as bio-PET and bio-PE (Ellen MacArthur Foundation, 2016). However, the production of such material is not cost-competitive with fossil-based plastics, which proves a challenge for organisations and individuals who may not want to pay premiums for bio-based plastics. In the UK context, the re-use of plastics and use of circular models are not yet widely applied. It is estimated that 60% of landfill waste that includes 15,000 tonnes of PET plastic would have been worth between £375,000 and £1.95million had they been recycled (Ethical Corporation, 2018).

2.2.1 Circular Economy of plastics in the FMCG sector

According to Stewart and Niero (2018), there is a rise in CE integration within the FMCG sector, based on sustainability agendas of corporations. Despite an increase in the focus towards products and packaging, the role of plastics remains unclear. Additionally, just as the literature above suggested, there is little focus on circular business models, strategies and product design. One study that focused on the FMCG industry suggested that the implementation of CE needs to develop the new value propositions, including cost reduction, revenue growth, new sales, retention of customers and new services to be successful (Mishra *et al.*, 2018). As plastics in CE are beginning to emerge within the FMCG industry, this highlights an opportunity within the research to explore its implementation in more detail.

After reviewing and consolidating the literature, an explorative research framework is proposed in Figure 1 to facilitate the data analysis and discussion in order to answer the three research questions.

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3 RESEARCH METHODOLOGY

This study applies a holistic, multiple case-study method proposed by Yin (2008). Using open questions, it falls under an exploratory category which helps to gain a true idea of what is happening in practice (Saunders *et al.*, 2016). As we are exploring an under-researched phenomenon, a case study method in theory building is appropriate (Eisenhardt, 1989).

3.1 Data collection and interview design

The interviews were semi-structured, providing a dynamic exchange of ideas based on the researchers' open-ended questions (Roulston, 2010). The design affords the researchers the flexibility to change the order of subjects discussed or add additional questions. The discussions included 12 open-ended questions (see Appendix 1).

All interviews were conducted in the UK and carried out face-to-face or via Skype on the occasion that face-to-face could not be scheduled. Each interview lasted around 40 minutes, and was audio-recorded. They were then transcribed verbatim in full and checked for accuracy to allow thorough data analysis. Secondary data were extensively applied to supplement the analysis of the primary interview data. The gathering of secondary data drew from a number of sources, including documentation, archival records, organisation communications, annual reports, NGOs, and other online sources accessible to the public.

3.2 Selection criteria

The use of Plastic Pact signatories (WRAP, 2018b) for the purposive selection criteria helped to ensure the chosen organisations were committed to reduce and re-use their plastic content and ultimately provide valuable insights for the investigation. Four organisations – two FMCG suppliers and two FMCG retailers – agreed to take part, and their characteristics are detailed below in Table 2. The professionals selected for interview were engaging in CE activity within the case organisations and either had a packaging or a communications background.

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3.3 Data analysis

Thematic analysis was selected to explore the collected data; this has been identified as a key tool for identifying, analysing and reporting patterns and themes within data (Braun and Clarke, 2006).

Firstly, an inductive approach was used in the codification of findings, thought to be a 'critical link' between data collection and explanation of meaning (Charmaz, 2006). Careful attention was paid to the entirety of data throughout, maximising exploration of all themes,

rather than only seeking prior themes (Ryan and Bernard, 2003). Once specific patterns were uncovered, the next step was to group the summaries of the codes into smaller categories or themes (Miles *et al.*, 2014). Next, the researchers referred back to the literature review to interpret emerging patterns by comparing the obtained findings (Braun and Clarke, 2006). Themes have been split by their perceived internal and external orientations, similar to the approach adopted by Walker *et al*. (2008).

4 RESULTS

4.1 Current initiatives in plastics to transition towards a Circular Economy

This section focuses on the first research question, "*What are the plastic recycling initiatives currently being implemented by FMCG firms?*" Several initiatives were identified, including innovation, knowledge, society and CE framework, and these are discussed as below.

Initiatives included some form of innovation in all cases. The supplier case organisations focused on long-term solutions for plastic packaging within a CE context. Company B stated, "*We are also looking at innovation…what we need to make our pouch recyclable but actually what other materials we could use that would work"* (Interviewee 2). Alternatively, FMCG retailers promoted innovation within their stores; *"…we are trailing all sorts of ways of putting our products on the shelf without packaging"* (Company C, Interviewee 3). New technology emerged as a key outcome of the Plastic Pact, emphasised by Company B: "*Some of the Plastic Pact members are doing consulting and this year we are going to look really in depth into the collection, sorting and recycling technology"* (Interviewee 2).

Appearing in two forms, another initiative was improving consumer knowledge through recycling labels. Company A is joining an 'impact recycling scheme' whereas Company D is redesigning packaging to reflect changes and improve customer understanding. "…*our big salad bags were unrecyclable film before, and we have now changed them over to PE…. They will have a logo on the back saying 'fully recyclable' at the front of store, so people know they can chuck that in there*" (Company D, Interviewee 4). Similarly, Company A plans to incorporate the plastic CE into each brand identity.

One of the initiatives focuses on society, and FMCG retailers have introduced initiatives in stores. Companies C and D are trialling their own collection bins for packaging: *"At the front*

of the store you can recycle your plastic bags and also recycle other plastic films" (Company D, Interviewee 4). These were described by Company C as "*a good way of sounding out how people are going to behave with this type of recycling process"* (Interviewee 3).

All cases referred to initiatives supporting the Plastic Pact commitments, including the pledge to remove unrecyclable plastic packaging from their supply chains: *"...eliminating unnecessary single use plastic packaging ... specifically, PVDC and PVC plastics are things we want to start replacing quickly"* (Company A, Interviewee 1). This action was a success within Company D, who reported that "*83% of own brand packaging [that] meets widely recycled criteria…"* (Company D, Interviewee 4). Good supplier collaboration was also noted for all these initiatives.

4.2 Motivational factors, barriers and enablers for joining the UK Plastic Pact

The following sections address the second and third research questions, "*Why do FMCG firms join NGO-led plastic recycling initiatives?*" and "*How do the barriers and enablers of CE focused on plastic in the UK impact implementation by the FMCG industry?"* Table 3 summarises the motivational factors, barriers and enablers for the case companies to join the Plastic Pact.

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4.2.1 Motivational factors

The results revealed a diverse range of motivational factors for joining the Plastic Pact. All interviewees stated that a key motivation factor was collaboration and gaining knowledge. Other themes fell under society, including concerns voiced by consumers and positive reputation opportunity. Organisation-related motivational factors were important with all cases addressing the environment; keeping up with competition and new impending regulations were also identified. Overall, the themes were fairly evenly split between internal and external orientation.

4.2.2 Barriers to implementation

Barriers were a major theme derived from the interviews and revolved around the following sub-themes including lack of infrastructure, financial, social and technical components.

All organisations agreed that a vital barrier in the FMCG industry is lack of infrastructure. *"The UK infrastructure has very much been built around long investment cycles for the waste industry… they're not ready to change quickly to the way they process waste materials. We can do all we like at the front end but until somebody starts collecting it, then that is one of the drawbacks"* (Company C, Interviewee 3). Frustration in the inconsistency across the UK was highlighted by all interviewees: one stated, *"…not all councils have the same rules and not the same across the whole of the UK, making sorting and collection quite difficult"* (Company B, Interviewee 2).

All highlighted the costs that accompany implementing a plastics CE. Joining the Plastic Pact incurs a cost, and changes to more recyclable plastic content introduces further financial burdens. *"...there is an added cost in working through a lot of these initiatives... even moving away from black plastic trays to clear plastic, we looked at this recently and it's going to cost around half a million pounds a year to switch"* (Company A, Interviewee 1).

Public participation was also an issue raised by the organisations. Although challenging, engaging consumers in the recycling of plastic packaging is important for CE success. This was thought to be because "*customers are unaware of what is recyclable and what isn't"* (Company D, Interviewee 4). An interviewee from Company A added, *"…consumers don't want to take responsibility for it, they don't want to pay extra council tax for more to be recycled, they don't want to pay at the till for products that are being made with more expensive packaging…"* (Company A, Interviewee 1).

CE implementation also faced technical barriers. Two organisations confirmed limitations to current packaging, preventing it from being introduced into the CE. The challenge was emphasised in the sorting process. *"Our packaging is so light, we are struggling with the mechanical supply chain for sorting the plastic"* (Company B, Interviewee 2). This includes plastic film; "*Film is the most challenging of all…it is very difficult to collect because it is flimsy and doesn't go through the typical mechanical recycling processes"* (Company C, Interview 3). Film also requires collection in large quantities.

Another technical barrier related to the aesthetic issues with recycled content, making it less appealing for brands and consumers. "*We are looking into different ways that we can add more recycled content in… if you are looking at clear bottles and trays it can slightly tint the*

colour" (Company D, Interviewee 4). This was likewise found by another organisation in the secondary research (Innocent, 2019).

4.2.3 Enablers to implementation

The enablers mentioned by the case organisations were much more aligned with each other than any other themes; these include management, collaboration, society, and CE framework.

Senior support within the organisation was recognised as a major support for driving the message of change internally and bringing departments on board with CE initiatives. ".. *We are quite lucky to have senior people in our business who really get this and who are willing to take it on*" (Company A, Interviewee 1).

Internal collaboration is frequently mentioned, assisting ease of change and encouraging innovation. Company D highlighted, "*Back in January we had an 'Oceans 19' project, 24 of our graduates were pulled away from their roles to work on plastics for three weeks"* (Interviewee 4). This is also evident in Company B: *"The procurement team is working with us in terms of our portfolio supplier, making the portfolio bigger and helping to understand the process"* (Interviewee 2).

Interviewees acknowledged the importance of industry collaboration, including sharing knowledge and potential to collaborate on costs. "*By having people on the journey with you, you can share knowledge and start to think about how you can share costs"* (Company C, Interviewee 3). Supplier support is also noted as a crucial enabler, and suppliers were depicted as engaged and willing to take on the plastic CE initiatives. "*Our food suppliers who aren't packaging focused are more than happy to work with us with what we were wanting, so we just went around and educated a lot of them on the benefits of certain types of packaging..."* (Company D, Interviewee 4).

The majority mentioned social enablers, including consumer encouragement and cooperation, with initial initiatives attracting a positive response. Company B stated, *"...more and more people are joining but, also, we are getting more questions about 'what can I do with my pouches?'. We are getting more recyclers every day*" (Company B, Interviewee 2).

A final enabler is the belief that the CE in the FMCG industry will become efficient, resulting in others joining. Interviewee 3 (Company C) felt strongly about this: "*The value in a linear economy will start to decline rapidly and people will start to see that going to a zero-waste structure is a much more lean and efficient way to operate a business.*" Table 4 presents a summary of the initiatives, motivational factors, barriers and enablers of the case organisations.

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5 DISCUSSIONS

5.1 Circular Economy initiatives of plastics

This study found that there are important differences regarding CE of plastics between suppliers and retailers in the FMCG field. Despite literature finding that retailer-led collection systems are difficult to co-ordinate (Mishra *et al*., 2018), the retailers in this study found positive progress in recollection programmes due to direct contact and the capability of creating own waste collection structures. Moreover, the deficiencies in supporting infrastructure are actually proving to be a successful trigger for retailers to recycle their plastic, although these cases are large organisations in the UK with direct contact with their consumers and the ability to communicate their CE processes. On the other hand, suppliers face the issues of missing direct contact with the consumer and thus are unable to communicate their CE processes. It must be pointed out that all the cases were planning on investing in CE processes, either through innovation or long-term solutions to their packaging; this is a key factor according to literature (Weetman, 2016). Moreover, the case companies displayed important behavioural components of CE, in the form of collaboration, sharing best practices and so on. For suppliers the only option at the moment was to rely on the recycling company called “Terracycle”. Finally, the importance of belonging to the Plastic Pact is highlighted by the fact that those who had prior relationships were also far more ahead in their CE processes. Additionally, case companies expressed that tax proposals would become a motivator to accelerate the transition towards CE.

This study explains varied CE initiatives of plastics for each case organisation. Despite the differences, the findings demonstrate an alignment across all four cases in terms of the complete elimination of all unrecyclable packaging from their processes. This alignment

supports the first step to removing the linear culture as encouraged by the Ellen MacArthur Foundation (2016). STAP (2018) mentioned that a key solution for the above is a shift towards recyclable material with properties designed for a CE.

Another method to reduce single-use plastic is the focus on consumer participation. This takes a variety of forms in the results, including the change to recycling labels, return schemes, and consumer engagement with the independent recycling company, Terracycle. These initiatives are supported in secondary data and the existing body of literature was efficient in anticipating and portraying public participation as a key action for CE success, with consumer engagement and national effort proposed in Lieder and Rashid's (2016) CE implementation strategy.

In addition, as discussed by Geng and Doberstein (2008), governments should play a leading role in promoting CE in the forms of regulation, supporting new environmental technologies, and organising public education. Although the UK government has placed plastic reduction as a core agenda and has a plastic tax in the pipeline (HM Treasury, 2018), the results indicated a general lack of supplementary government initiatives for CE implementation. What could be an accelerator is exposed as a potential barrier to their initiatives, symbolising a hint from the FMCG industry for greater government support.

An initiative not mentioned in the study is the use of bio-plastics as an alternative material for packaging. Literature identified bio-plastic as a possible solution for the industry (Reddy *et al*., 2013). However, with no mention in the interviews, this implies a lack of support for bio-plastic from FMCG organisations. It is possible to reason that although the biodegradable plastic fits with the biological loop demonstrated by the Ellen MacArthur Foundation (2016), the need for collection infrastructure remains.

Company D outlined that working with suppliers was a key initiative through educating them in sustainable materials. Nidumolu *et al*. (2009) suggested that sustainability leads to innovation; this is supported by this study, with innovation as a key theme in the drive for plastic CE implementation, also consistent with Weetman's (2016) conclusions.

5.2 Barriers

The study revealed barrier similarities but also some controversial results. Firstly, it is possible that the supply chain barrier identified by Ritzén and Sandström (2017) is not a barrier for plastics in CE within the FMCG industry. UK law GSCOP (Grocery Supply Code of Practise) protects food suppliers from being dictated to by FMCG organisations, meaning they cannot demand suppliers to use certain packaging types (GOV, 2019). However, the study indicates strong supplier cooperation and willingness to change to sustainable packaging in line with the organisation's preference. The discoveries have the potential to argue that the FMCG supply chain already has the capabilities to re-generate plastic with recycled content; therefore this issue is not a barrier as indicated by Ritzén and Sandström's (2017) but is in fact an enabler of new initiatives. The lack of alignment is likely due to the different industry contexts and can be underpinned as an addition to literature.

Alternatively, a theme in the results which supports Ritzén and Sandström (2017) and Torstensson (2016) is infrastructure as a barrier. The research findings indicated that collection and sorting infrastructure are of paramount importance, yet still represent a key barrier for plastics in CE, a finding not clear in the secondary data. This is having a significant impact on the pace of change and is thus a priority area. As discussed, it has led to retailer case organisations taking on control for the collection of the non-widely recyclable content.

The research discovered technical barriers with the use of recycled plastic, this being the colour changing when re-used in new packaging, ultimately impacting the amount used. This is an issue that literature has failed to address, along with the additional challenge of designing packaging that complies with multiple safety requirements and regulations, whilst remaining suitable for CE. This is impacting organisations' choice of materials and further queries around financial viability. A possible rationale behind the lack of literature concerning these technical issues is that plastic within the CE is still a relatively new. Continued research and innovation will be required to help overcome this implication, opening up an avenue for future exploration.

Govindan and Hasanagic (2018) considered both management and CE framework as barriers. Although management was indicated as a barrier in some results, findings did not uncover CE framework as a barrier, instead indicating confidence in the design. This is likely due to partnership with the Plastic Pact. As highly anticipated in the literature review, financial

requirement was also an identified barrier. Consequently, organisations indicated a reliance on collaboration to help overcome this and a cost reduction on raw materials once re-used. Finally, the study disclosed society as a main barrier, conforming to existing findings from Geng and Doberstein (2008). Controversially, the majority identified this theme as an essential enabler to CE Initiatives, highlighting findings with a dual role. Overall, there is consensus that barriers can be overcome through innovation and collaboration.

5.3 Enablers

The enablers for plastic CE implementation appear to have the most alignment with existing literature. Govindan and Hasanagic (2018) categorised society as an enabler, indicating that customers' growing awareness about environmental impacts is putting pressure on industries to introduce CE processes. The study expresses an agreement from the case organisations, with consumer encouragement and cooperation both considered as enablers in the FMCG industry.

The study disclosed a lack of internal enablers, limited to internal collaboration and senior support. However, these fall under a broad theme of collaboration, including external enablers – *industry collaboration* and *supplier support*. This corresponds with the enablers cited by Lewandowski (2016) and Witjes and Lozano (2016). Collaboration is signified as having a positive impact on innovation and supports the Ellen MacArthur Foundation's (2016) conclusion that a single organisation will not fully benefit from CE initiatives if working alone, thus encouraging other FMCG organisations to join the Plastic Pact. In addition, Govindan and Hasanagic (2018) detailed a lack of management support and know-how in their research as a barrier; however, the findings revealed senior support as an enabler to initiatives, indicating good stakeholder education within organisations.

5.4 Revised conceptual framework

Incorporating the findings, Figure 2 depicts the revised framework that summarises the motivational factors, barriers to and enablers for the case companies to join the current plastic recycling initiatives.

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6 CONCLUSION

The emergent findings have revealed plastic as a highly relevant issue for the FMCG industry, with organisations either now implementing or planning initiatives to tackle the environmental issue by using the CE concept. This study is one of the first to focus specifically on the role of plastics in CE in the context of the UK. To gain a preliminary view of the plastic sector in UK, four pioneering firms were accessed and investigated. In addition, as the topic of plastics in CE is relatively new, this study provides a conceptual framework with the aim to support the actions of organisations in the UK and beyond. The aim of the research has been addressed, with practical understanding gained of how FMCG organisations are implementing these initiatives. Core practices comprised of changes to packaging through innovation or collaboration with their supply chain, the education of consumers through packaging labels and in-store initiatives and, finally, retailers trialling collection facilities to remove complications to the CE process and encourage participation.

The study also identified numerous barriers, dominated by technical implications, lack of infrastructure, and lack of public participation. This has exposed the need for further innovation in packaging that is CE-suitable and fit for purpose, along with advanced sorting technology that accommodates all types of plastic. Additionally, governmental input for sustainable collection infrastructure is required across the UK to support the industry. However, the findings revealed a high level of motivation to fulfill the commitments of the Plastic Pact, with collaboration having the greatest impact on the internal and external enablers of their initiatives. Although the study takes an industry focus, it has undoubtedly detected a momentous action from a variety of stakeholders, further highlighting collaboration as a driver for success of CE and alignment across the entire industry; the Plastic Pact is significant in this action. Overall, the main findings share similarities with extant literature, yet generate unique challenges based on the plastic material, along with the organisation’s position in the supply chain.

This study has demonstrated initial progress, representing potential for the CE as a solution to the plastic issue and an early contribution to the growing field of study. As it was completed in the early stages of CE implementation for plastics within the FMCG industry, the study therefore forms part of an evolving landscape of research into plastic CE practices. The sample size of this research was limited to the organisations that agreed to take part in an

interview; to achieve greater reliability a higher volume of interviewees would have been desirable. Likewise, despite the difference between case organisations, a greater sample would have facilitated further cross-case analysis, improving the generalisability of the findings to the entire FMCG industry. Future research is encouraged to further advance knowledge in this area. Researchers could address a larger sample of FMCG organisations to gain broader understanding of initiatives, to include not only the firms that have already started planning to move forward to a more environmentally friendly and circular economy, but also firms that have not joined the UK Plastic Pact, and their reasons for this. It is also important to analyse the effectiveness of initiatives over a longer period of time. Possible attention could be paid to the consumers' reaction to the implemented initiatives, along with effective education methods to increase cooperation. Further research could also address supply chain management concerning plastics and how the multiple tiers of supply chain members support innovation, as well as the particular order in which different participants have joined the NGO-led CE initiatives. Finally, additional investigation could tackle the amendments required to the UK collection and sorting infrastructure to ensure the success of CE on plastics.

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Appendix 1. Interview Protocol

Introduction

1. Could you describe your role in the company?

2. What is the overall sustainability strategy of your company?

Motivations for joining the UK Plastic Pact

3. What are your company's motivations to join the UK Plastic Pact?

4. What research did you carry out before committing to the Pact?

Current initiatives in place and long-term goals

5. What current initiatives do you have in place to support your transition towards a plastic circular economy?

6. What other departments (functions) are involved in these initiatives?

7. What progress have you made so far?

8. What are your long-term goals?

Current obstacles to and enablers in transitioning towards a plastic circular economy

9. What are the obstacles for your company to implement a plastic circular economy?

10. What are the enablers to support your company with transition towards a plastic circular economy?

The engagement of your supply chain members

11. How do you engage with supply chain members and transfer the new circular requirements?

Concluding

12. Is there anything else you would like to share about the project or your company?

Table 1. Barriers to and enablers of CE identified in the literature

Barriers of Circular Economy	**Sources**
Lack of Capital	Govindan and Hasanagic (2018); Ritzén and Sandström (2017); Torstensson (2016); Rizos *et al*. (2016); Liu and Bai (2014); Geng and Doberstein (2008)
Policy	Geng and Doberstein (2008)
Public Participation	Geng and Doberstein (2008)
Technology	Govindan and Hasanagic (2018); Ritzén and Sandström (2017); Torstensson (2016); Geng and Doberstein (2008)
Attitude and knowledge	Govindan and Hasanagic (2018); Ritzén and Sandström (2017); Berchicci and Bodewes (2005)
Structural (Infrastructure/ SCM)	Ritzén and Sandström (2017); Torstensson (2016); Eijk (2015); Preston (2012)
Cultural	Govindan and Hasanagic (2018); Torstensson (2016); Liu and Bai (2014)
Contextual	Torstensson (2016); Liu and Bai (2014)
Government	Govindan and Hasanagic (2018)
Management	Govindan and Hasanagic (2018)
CE Framework	Govindan and Hasanagic (2018)
Enablers of Circular Economy	**Sources**
Policy and economy	Mishra *et al*. (2018); Govindan and Hasanagic (2018)
Digital tools	Mishra *et al*. (2018)
Environmental protection	Govindan and Hasanagic (2018)
New internal incentives	Mishra *et al*. (2018)
Society	Govindan and Hasanagic (2018)
Access to finance	Mishra *et al*. (2018)
Health	Govindan and Hasanagic (2018)
Organisational characteristics	Mishra *et al*. (2018)
Product development	Govindan and Hasanagic (2018)
Collaboration	Mishra *et al*. (2018); Lewandowski (2016); Witjes and Lozano (2016); Lieder and Rashid (2016)

Table 2. Case organisations descriptions

Organisation	Supplier or Retailer?	Annual Revenue	Number of Employees	Joined the Plastic pact?	Sustainability strategies
A	FMCG Supplier	£2.3 Billion	20,000 +	December 2018	Involved in Supplier Ethical Database Exchange and Ethical Trading Initiative. Partnership with Terracycle. Zero Waste to Landfill Strategy. Low carbon emissions as a result of 'Fewer & Friendlier Miles'. 100% palm oil from sustainable sources.
B	FMCG Supplier	£60 Million	70+	April 2018	A member of the B Corporation movement. Supporter of FareShare. Partnership with Terracycle. Coordinate 'Make a Difference' days for their employees to get involved in. Work with the Carbon Trust.
C	FMCG Retailer	£10 Billion	80,000 +	April 2018	By 2022, all packaging will be widely recycled. By 2025, all key raw materials will come from sustainable sources. Halve food waste by 2025. Employee community volunteering. Aim to reduce greenhouse gas emissions by 80% by 2030. Raise money for numerous charities. Change towards healthier products.
D	FMCG Retailer	£57 Billion	440,000 +	April 2018	Member of UN Global Compact and committed to advancing Sustainable Development Goals. Partnership with WWF. Targets to support colleagues to live healthier lives and customers to make healthier choices. To make sustainable products. Never use more packaging than needed and use sustainable sources, reuse and recycle. To help halve global food waste. Help local communities thrive, contributing socially and economically.

Table 3. Motivational factors for, barriers to and enablers of CE of plastics

Internal/External	Codes	Theme	Description	Cases Providing Supporting Evidence	Example quotes
Motivational factors for joining the Plastic Pact					
Internal	Organisation-related	**M1: Desire to reduce environmental impact**	Recognition of the environmental impact of current packaging waste and volume of their individual plastic contribution.	A, B, C, D	*Company B "As a company we want to make a difference, we are very conscientious about our impact on the planet and we've always known that packaging was an issue."*
		M2: Prior collaboration with EMF	Already complying with EMF advice and initiatives; the Plastic Pact aligns with these.	C, D	*Company D "We knew the commitments would be very similar to our commitment with EMF."*
		M3: Current Initiatives inadequate	Current initiative of using terra-cycle does not provide a long-term solution.	A, B	*Company A "The terracycle partnership wasn't enough, it was never going to be enough to be able to recycle all of our wrappers, we couldn't afford that, it's not cost effective enough, so it's of limited scale."*
	Regulation	**M4: External Measure**	The Pact is an external measure for the organisation to act against, also providing some governance to practices.	C	*Company C "The main motivation is really to give us an external measure against which we can act."*
External		**M5: Government Policy**	New policies and potential introduction of 30% plastic content tax make it worthwhile to introduce CE practices.	A	*Company A "...the government is going to be consulting soon on plans to impose a tax on manufacturers like us if we use plastic packaging that is less than 30% recycled content."*
	Competition	**M6: Reputation**	Enabling in plastic reduction will have a positive reflection on the organisations and industry's reputation.	A, C	*Company A "We'd like for our whole plastics and recycling strategy to essentially be a positive story that we can use, in terms of building up the reputation of the business..."*

		M7: Competitor pressure	Competition had signed up to the Plastic Pact Commitments.	A	*Company A "When it came out, it really did encompass most of our big customers and competitors as well. So, it seemed to be something that was already getting a lot of industry attention…"*
		M8: Customer pressures	Large retailers that sell their product have signed up to the Plastic Pact.	A	*Company A "This is something we need to do if we want a long-term partnership with the big retailers..."*
		M9: Publicity and PR	Opportunity to increase company publicity with being associated with the Plastic Pact.	A	*Company A "…provide the opportunity to generate more publicity and PR around what we are doing."*
	Society	**M10: Consumer concern**	Customers are starting to become more aware and are expecting recyclable alternatives from the industry.	A, B	*Company A "…overwhelmingly consumers are worried about plastic."*
	Collaboration	**M11: Industry Collaboration**	Opportunity to collaborate with professions and other organisations in the industry.	A, B, D	*Company B "Our main motivation was really working on collaboration and getting people together. We have been in touch with WRAP a lot, even beforehand as we knew they were the best people working with waste management the most."*
Barriers to implementation of CE of plastics					
Internal	Financial	**B1: Financial requirement**	The initial production cost increases with the transfer to recyclable plastic. The Plastic Pact requires an annual fee.	A, C	*Company A"...there is an added cost in working through a lot of these initiatives... even moving away from black plastic trays to clear plastic, we looked at this recently and it's going to cost around half a million pounds a year to switch."*
	Management	**B2: Shareholder buy-in**	The shareholders need to approve investment into plastic reduction initiatives.	C	*Company C "Inevitably when you are dealing with shareholders, you are dealing with investments, things can't just change overnight. You need to plan it, you need to put the money in and actually*

					get approval for the money."
		B3: Internal department buy-in	The CE initiatives impact a range of departments and their allocated budgets.	A	*Company A "…the challenge for us as the steering group for this business is to demonstrate the value that can be gained from it; we need to convince those marketing and procurement teams…"*
	Technical	**B4: Maintaining Food Safety**	The alternative packaging options need to meet food safety specifications and hold a shelf life.	B	*Company B "We have barriers in terms of what we need to do to our products to make them safe and give them the shelf life that they need and with ambient temperatures."*
		B5: Aesthetics issues	Including recycled plastic content in new packaging is causing it to turn a yellow colour.	B, D	*Company D "We are looking into different ways that we can add more recycled content. The only issue with that is that if you are looking at clear bottles and trays is it can slightly tint the colour, it doesn't remain clear and it can be slightly yellow in colour."*
Internal and External	Technical	**B6: Current technology**	Technological limitations with the current packing design variations. Particularly flexible plastic.	B, C	*Company B "Our packaging is so light, we are struggling with the mechanical supply chain for sorting the plastic."*
External	Government	**B7: Lack of government support**	Government not invested in or taking on the cost of CE changes.	A	*Company A "Government doesn't want to take on more cost either…."*
		B8: Lack of collection infrastructure and local council alignment	The current infrastructure does not support the scale of plastic and councils accept different types.	B, C, D	*Company C "The UK infrastructure has very much been built around long investment cycles for the waste industry, 20-30 years' worth of investment into equipment means they're not ready to change quickly to the way they process waste materials. We can do all we like at the front end but until somebody start collecting it then that is one of the drawbacks."*
	Contextual	**B9: Brexit/Government uncertainty**	Brexit uncertainty is creating issues with investments.	C	*Company C "…Brexit has created all sorts of mayhem with everybody, nobody knows where their investments should go because obviously, we don't know where the money is going to go."*
	Market	**B10: Slow pace of change**	Infrastructure and policies are not changing quickly, holding up a successful and functioning CE.	C	*Company C "...the speed of change is probably a bit slow for what's required to make the big change in the industry."*
		B11: Remaining	Product sales dropping due to	A, D	*Company D "We will change things to be*

		market competitive	changes in packaging or increased market pricing.		*recyclable and then the sales will drop because it doesn't look as nice as it did before."*
External	Society	**B12: Public participation**	Lack of public awareness, making it difficult to reuse/recycle/remanufacture packaging. Customers also reluctant to pay more for recyclable content.	A, C, D	*Company C "The customer is king, we don't want to upset them but all the while they should actually be taking a more responsible part in what we actually do as a disposal."*
	CE Framework	**B13: Lack of supplier clarity**	The suppliers are trying to offer solutions that are not suitable for CE initiatives.	B	*Company B "Lack of clarity from the supplier; we received probably 3-4 emails a day from people who have a solution for us but when we take a look, they give you a lot of 'sparkle' but what they are suggesting is not quite fit for purpose."*
Internal		**B14: Intangible Benefit**	Difficult to measure the tangible benefit of transferring to recyclable plastic.	A	*Company A "...what's much harder is to put a cash value on the benefits."*
Enablers to implementation of CE of plastics					
Internal	Management	**E1: Senior Support**	Senior stakeholders support and help to communicate the new initiatives.	A, B, D	*Company A "We are quite lucky to have senior people in our business who really get this and who are willing to take it on."*
	Collaboration	**E2: Internal Collaboration**	Teams are working together to implement and generate new initiatives.	A, B, D	*Company D "Back in January we had an 'Oceans 19' project, 24 graduates of our graduates were pulled away from their roles to work on plastics for three weeks."*
External		**E3: Industry collaboration**	Organisations in FMCG are working together and sharing best practice.	A, B, C	*Company C "...by having people on the journey with you, you can share knowledge and start to think about how you can share costs."*
		E4: Supplier Support	Suppliers are willing to change their practices and comply with new changes.	B, D	*Company D "When we produced the RAG list and set out all our targets a lot of our suppliers did say this is great, this is what we have been waiting for from the industry..."*
	Society	**E5: Consumer**	Customers are starting to become	A, B, D	*Company A "...customers are one of the things that*

		awareness and encouragement	more aware of industries' impact on the environment and are expecting recyclable alternatives.		*are helping to push this along. We have seen from the research that we did that retailers have signed up to the Plastic Pact already…"*
		E6: Consumer Cooperation	Customers bringing recycling plastic packaging is key to the success.	B, D	*Company B "...more and more people are joining it but also we are getting more questions about 'what can I do with my pouches'? We are getting more recyclers every day."*
	Government	**E7: Government Collaboration**	The Secretary of State for the Environment providing advice and support.	C	*Company C "The Secretary of State for Environment is very good, Michael Gove has been incredibly supportive and very positive."*
	CE Framework	**E8: CE Efficiency**	The CE structure is much leaner and more efficient. It could increase long-term revenue generation.	B, C	*Company C "The value in a linear economy will start to decline rapidly and people will start to see that going to a zero-waste structure is a much more lean and efficient way to operate a business."*

Table 4. Summary of data analysis

Organisation	Initiatives	Motivational factors	Barriers	Enablers
A	- Internal steering group - Recycling label scheme - Removal of unrecyclable plastic - Partnership with Terracycle - Internal recycling champions	- Competitor Pressure - Positive reputation - Government regulation - Consumer concern and pressures - Customer pressures - Previous initiatives inadequate - Reduce waste contribution	- Financial requirement - Stakeholder buy-in - Consumers' reluctance to pay more - Lack of government support - Maintaining competitive pricing - Intangible benefit	- Senior support - Internal collaboration - Customer encouragement - Industry collaboration
B	- Partnership with Terracycle - Collaboration with suppliers - Investment into collection, sorting and recycling technology with current packaging - Long-term innovation	- Reduce waste contribution - Consumer concern and pressures - Industry collaboration	- Lack of collection infrastructure and local council alignment - Lack of supplier clarity - Current packaging limitations - Maintaining food safety - Aesthetic issues with recycled content	- Supplier support - Consumer cooperation - Senior support - Internal collaboration - Customer encouragement - Industry collaboration
C	- Removal of unrecyclable plastic - Trailing products without packaging - Consumers returning plastic back to the store	- Reduce waste contribution - Reputation - External governance/measure - Prior collaboration with EMF	- Financial requirement - Lack of collection infrastructure and local council alignment - Current packaging limitations - Slow pace of change - Consumer engagement - Shareholder buy-in	- Industry collaboration - Government collaboration - CE efficiency
D	- Recycling label scheme - Categorise packaging material into a RAG list - Removal of unrecyclable plastic - Trialling products without packaging - Consumer return plastic back to the store	- Reduce waste contribution - Industry collaboration - Prior collaboration with EMF - Consumer concern and pressures	- Lack of collection infrastructure and local council alignment - Consumer engagement - Aesthetic issues with recycled content	- Senior support - Internal collaboration - Customer encouragement - Industry collaboration - Consumer cooperation - Supplier support

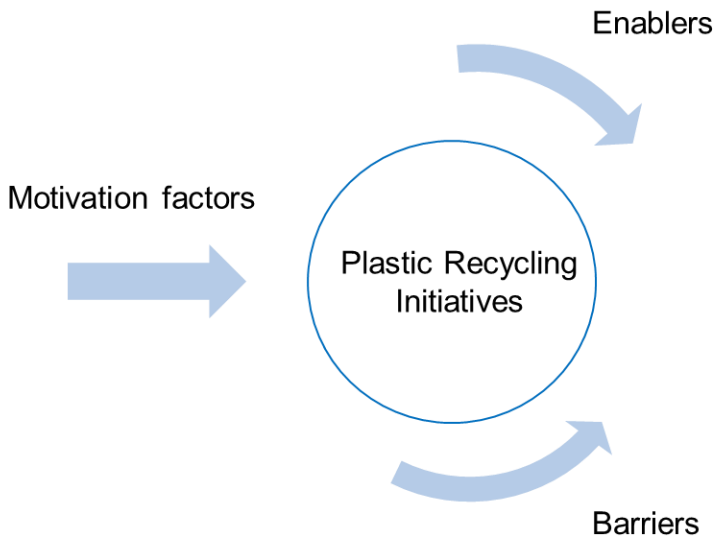

Figure 1. Explorative research framework

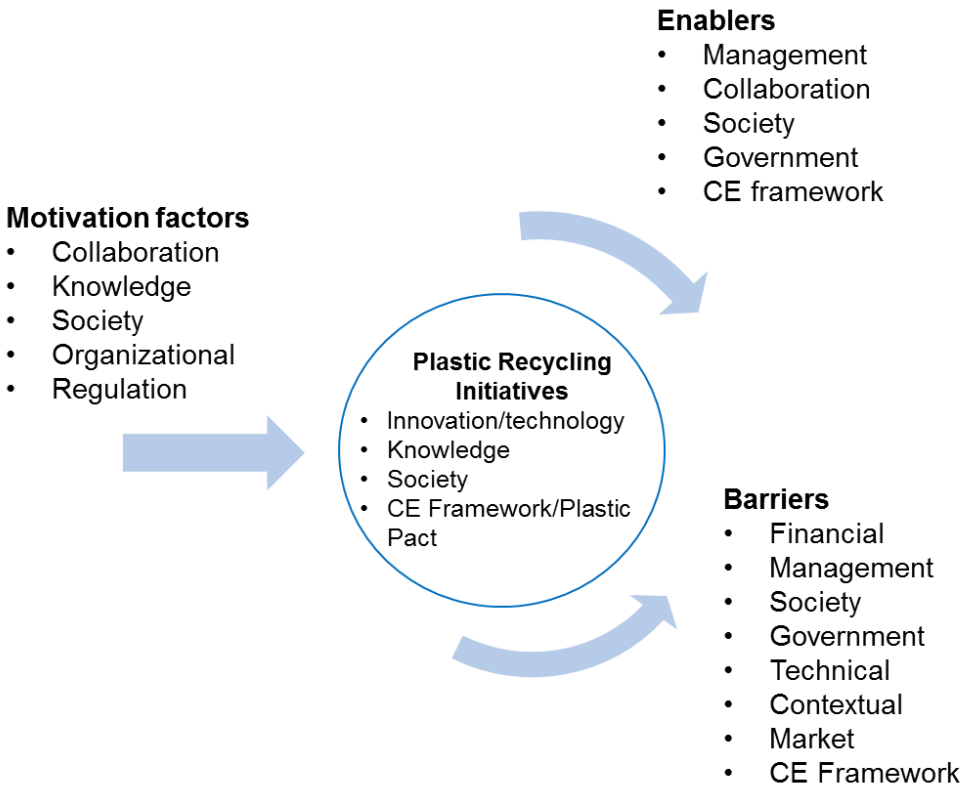

Figure 2. Revised framework of motivational barriers and enablers factors for joining the plastic recycling initiatives