Master's Thesis

Master Sustainable Business and Innovation

Enabling circular business model innovation for plastic waste solutions: collaboration between incumbents and startups

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Foreword

I hereby present my master´s thesis 'Enabling circular business model innovation for plastic waste solutions: collaboration between incumbents and startups'. In this theses the focus lays on companies who are working on innovations to tackle the problem of plastic waste pollution. This is an urgent but complex problem that stretches beyond country boarders and involves many stakeholders, as is the case with most environmental issues. Despite the magnitude of this problem, plastics as only recently gained attention from circular economy scholars and with this theses I hope to contribute to this important strand of research. The research for this thesis was conducted during an internship at Impact Hub Amsterdam, an organization who support impact entrepreneurs by offering a co-working space, offices, events and community. I worked at the programs team and got in touch with many inspiring starting entrepreneurs, as well as more experienced entrepreneurs looking for investment. Their visions, creativity and hard work truly inspired me and I am thankful to have had the honour to work with them.

My thesis project started in December '19 and shortly after my proposal was approved the COVID-19 pandemic hit. Luckily my internship continued, but instead of working at the Hub together with my colleagues and surrounded by entrepreneurs, I was stuck at home. The intelligent lockdown and cancelation of events posed major challenges for the team in terms of adapting their work to the new reality and the effects of the pandemic still continue to affect Impact Hub. The positivity of my colleagues and their work ethic is what has driven me through this time.

I hope my work contributes to our understanding of the transition towards a circular economy for plastics and motives startups and incumbents to work together to achieve this goal. Time will tell what the effects of the COVID-19 pandemic will be, but the perseverance of the entrepreneurs and professionals I met during this project give me good hope.

Lotte Kortbeek

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Abstract

The role of plastics in the circular economy has recently gained attention amongst policymakers, industry and scholars as a result of increased public awareness for the plastic waste issue. Incumbents in the fast moving consumer goods sector are recognized as major contributors to this issue through the production of plastic packaging. Startups are seen as a source of radical innovation and the two parties are often investigated separately, or as competitors in the CE transition. This thesis set out to rather take their dynamics into account in assessing the barriers and enablers for circular business models for plastics in the fast moving consumer goods industry. Semi-structured interviews with circular startups were done to develop a coding framework that was used to assess CSR reports from incumbents. Insights were enriched by expert interviews on the dynamics between startups and incumbents. Results showed that technical barriers are of high importance for both startups and incumbents, which appears to be a specific characteristic of plastic. Collaboration was identified as main enabler and can be divided in the following categories: internal collaboration, supply chain collaboration and facilitated collaboration. Strategic partnerships along the value chain enable innovation and provides opportunity for startups to provide technical solutions for challenges faced by startups. Also, standards for circular use of plastics and metrics and systems for impact measurement could be established through collaboration. Furthermore, collaboration between startups and incumbents could enable collaborative learning . This creates understanding of what each other's contribution is to the CE transition, it enables mutual sense making and can have a positive effect on the introduction of new beliefs and values with incumbents and it build mutual trust. It is therefore argued that startups-incumbent collaboration is a self-reinforcing mechanism and accelerator of the transition to a CE for plastic. Further research to validate this hypothesis is recommended.

Executive Summary

The issue of plastic pollution has gained attention from the public and policymakers, resulting in public demand for more circular use of plastics and related policies. The EU announced to ban certain products made from single use plastics as soon as 2021, forcing companies to develop alternatives. Furthermore, the Ellen McArthur Foundation introduced the Plastic Pact initiative, where companies voluntarily commit themselves to goals related to reducing the use of plastics and increasing recycling rates mainly for packaging. These regime level changes mostly affect incumbents in the fast moving consumer goods industry. On the other hand there are numerous startups who introduce ways to recycle post-consumer waste, reuse packaging systems and more sustainable packaging alternatives. The role of plastic in the circular economy is only now gaining attention from scholars and lacks extensive empirical research. Furthermore, incumbents and startups are often studied separately, but their dynamics and interaction are interesting in the context of transition theory and important because of possible collaboration and mutual learning. Therefore, the following research questions are asked:

1. What plastic waste reduction strategies are currently being implemented by Dutch incumbents and startups and why?
2. What are the barriers and enablers of circular business models for the Dutch plastics industry and how do they impact implementation?
3. How can startups and incumbents in the Dutch plastics industry gain from mutual learning and collaboration?

To answer these questions, ten startups are interviewed and ten CSR reports from incumbents are analysed, also four experts working for key organizations are interviewed to provide additional insights to the dynamics of startups and incumbents. Findings show that the startups from the sample all pursued one circular business model strategy. The strategies that are found are recycle (six out of ten), reuse (two out of ten) and reduce (two out of ten). The incumbents all pursued two strategies, namely recycle and reduce, which is in compliance with the goals of the Plastic Pact and are the strategies that fit their business model most. In regard to the barriers and enablers of circular business models for plastics, it was found that technical barriers are highly relevant for both incumbents and startups. Although many plastics can be recycled, there are issues with quality, aesthetics and price and reusable packaging poses challenges in terms of combining durability with functionality. Furthermore, the plastic waste management system poses a barrier for innovation, because innovations such as biodegradable plastics do not comply with the current processes. Technical barriers are only marginally found in earlier research on CE implementation and can thus be seen as a new finding related to the FMCG industry. Both incumbents as startups see collaboration as the most important enabler, because through collaboration knowledge and resources are shared which enables innovation. Furthermore, CE standards for plastics and the development of metrics and measurement systems could be developed through collaboration. In this thesis it was argued with the use of theory on learning, that next to these materialistic advantageous collaboration also entices collaborative learning. This creates understanding of what each other's contribution is to the CE transition, it enables mutual sense making and can have a positive effect on the introduction of new beliefs and values with incumbents and it build mutual trust. It is therefore argued that startups-incumbent collaboration is a self-reinforcing mechanism.

Practical implications of this research are: first, matchmaking between incumbents and startups could contribute to solving technological challenged faced by incumbents. This is a role that could be taken

on by incumbents themselves through challenges, by innovation platforms or by governmental bodies. Furthermore, governmental bodies could engage with industry to establish CE standards for plastics and re-evaluate current legislation to eliminate limiting factors to innovation. Furthermore, the identification of the waste management infrastructure as barrier poses a challenge for municipalities to make these operations ´future-proof', for which close collaboration with waste companies is needed. Second, for managers and entrepreneurs, these findings can be seen as an invitation to engage more with either startups or incumbents on the basis of shared value creation instead of fear of disruption or losing your niche. A first step to collaboration is recognizing the need for collaboration to achieve a CE for plastic and use this to define the project's vision. Second, in order to overcome internal resistance to change a designated team could be established with employees that have thorough understanding of CE and the specific project for the company and preferably with previous experience with incumbent-startup collaboration to lower cognitive barriers. Third, potential partners can be selected, evaluated and engaged. This last step could be done with the support of a third party or within another project, such as the Plastic Pact. This helps set the precondition of having a common goal and understanding of urgency to tackle the issue of plastic by transition to a CE.

Contents

List of abbreviations

BM	Business Model
CBM	Circular Business Model
CBMI	Circular Business Model Innovation
CSR	Corporate Social Responsibility
CSU	Circular Startup
FMCG	Fast Moving Consumer Goods
NGO	Non-governmental Organization

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1. Introduction

"We need to raise our level of ambition and match it with bold and urgent action to accelerate the transition to a circular economy for plastics." – Dame Ellen McArthur

Every year, 10% of the global plastic pollution ends up in the oceans, making them increasingly polluted (Fitzgerald, 2011). Plastic is a versatile product, but its durability enables it to persist in natural ecosystems for a long time, which affects marine life by accidents, entanglement and ingestion, spread of invasive species across the ocean an mass extinction of coral (Schneider et al., 2018). Furthermore, plastic degrades into small fragments, or microplastics, that pose a risk to the food chain and appear to be an emerging cause of soil pollution (de Souza Machado et al., 2018; Duis & Coors, 2016) and freshwater pollution (Wagner et al., 2014).

The EU alone produces 26 million tonnes of plastic waste each year (European Commission, 2018), of which only about 9% of plastic waste is recycled in the EU (European Commission, 2018). Plastic waste can be post-industrial, for example waste streams from production processes, or post-consumer, mainly in the form of single-use plastic packaging. This latter form makes up the majority of plastic application, with 26% of the total volume of plastic used (Ellen Macarthur foundation, 2016). Recycling rates of post-industrial waste are higher than of post-consumer, due to easier collection, homogenuous composition, lower risk of contamination, greater compatibility with the following production process, lower price and free-market availability (Paletta et al., 2019). Post-consumer waste is consists of mainly plastic packaging introduced to the market by the fast moving consumer goods (FMCG) industry (Gong et al., 2019). The FMCG industry entails products that are utilized at high pace and demand, because they are necessities (Claeys, 2020). Most products found in a grocery or convience store are fast moving consumer goods. A study by the Ellen MacArthur Foundation (2016) shows that after a short first-use cycle, 95% of the economic value of plastic packaging is lost to the economy, with an equivalent of USD 80 – 120 billion anually. Furthemore, the same report shows that the negative externalities described before represent a financial burden estimated conservatively at USD 40 billion, which is greater than the plastic packaging industry's profit pool. In order to overcome these drawbacks, system effectiveness needs to be enhanced to reduce environmental impact while increasing economic value (Ellen Macarthur foundation, 2016; Gong et al., 2019).

A more circular plastic value chain is proposed, where attention is given to reducing the amount of virgin plastic produced, and enhancing the economics of end-of-life solutions to prevent plastic-waste ending up in landfills, incineration or the environment, and with this maintaining the economic value of plastic material in the economy (Ellen MacArthur Foundation, 2016; Ellen Macarthur foundation & ARUP, 2019). This concept of a circular economy (CE) has gained traction with policy makers, scholars and entrepreneurs. CE has been put forward as solution for the problems that come from the current linear, make, use, dispose model of our economy (Ghisellini et al., 2015; Kirchherr et al., 2017; Korhonen et al., 2018). It aims to keep materials in the economy at the highest possible utility, by narrowing, slowing and closing resource loops. This proposed transition can be interpreted as a sustainability transition as described by Geels (2002), wherein landscape pressures such as policy and long term economic developments influence the regime, that consist of incumbents and other regime players, while accumulation of niche activity aims to brake through to the existing regime. Businesses are considered key organizations in the transition to a CE and can be both regime players (incumbents) as niche players (startups). The R-framework by Henry et al. (2019), explains what circular business model (CBM) strategies can be pursued to this end: Recover, Recycle, Reuse, Reduce, Regenerate (in order of value of resource detention). Businesses that are pursuing these strategies, are practising CBM innovation, which can be aimed at upstream, downstream and source circularity (Henry et al., 2019), referring to where in the value chain the innovation has the most impact. The role of plastic in the CE

has long remained unclear and research on this topic has only recently started to emerge. Stewart and Niero (2018) concluded that there is a rise of CE uptake in the FMCG industry, with packaging as area of interest. Furthermore, Gong et al. (2019) investigated the barriers and enablers encountered by incumbents implementing plastic focussed CE practises in the FMCG industry in England. They identified a lack of focus on business models, strategies and product design in existing literature, a gap to which this thesis aims to contribute.

The plastics problem has gained attention amongst government and businesses, who are starting to understand the urgency and have adopted CE as a possible solution. Targets to ensure all plastics on the market are reusable or recyclable have been set by the EU for 2030 in the form of government-enforced legislations (CE, 2018). For example, the EU adopted the EU plastics strategy (European Commission, 2018). In line with government action and efforts from NGO's, businesses are starting to organise for a more circular plastic value chain under the Plastic Pact (Ellen MacArthur Foundation, 2017) as part of the New Plastics Economy Global Commitment (Ellen MacArthur Foundation, 2016). This global initiative is translated to national initiatives, for example, in the UK the Plastic Pact initiative is led by WRAP and in the Netherlands it is initiated by the Ministry of Infrastructure and Water Management. This last example of the Plastic Pact NL shows industry steering by government and the resulting adoption of CE practises by the plastics industry.

These developments on landscape and regime level are further stimulated by efforts from niche players. In their study on the respective roles of sustainable startups and 'greening' incumbents, Hockerts & Wüstenhagen (2010, p.489) argue that "the sustainable transformation of industries is not going to be brought about by either startups or incumbents alone, but instead that their interaction is essential". In this light, it would be interesting to study the specific motivations, barriers and enablers encountered by startups and incumbents in their journey towards circular business models for plastics. Therefore, the following research questions are asked:

1. What plastic waste reduction strategies are currently being implemented by Dutch incumbents and startups and why?
2. What are the barriers and enablers of circular business models for the Dutch FMCG industry and how do they impact CE implementation?
3. How can startups and incumbents in the Dutch plastics industry gain from mutual learning and collaboration?

The outcome of this thesis will be the following: firstly, better understanding of the strategies, motivation, barriers and enablers of plastic-focused circular business models of startups and incumbents, and their respective differences. Secondly, opportunities for mutual learning and cooperation are identified. Empirical data is gathered through semi-structured interviews and CSR reports and analysed using a hybrid coding process. Findings are assessed based on the CBM strategy and CBM innovation frameworks (Henry et al., 2019), barriers and enablers of CMBI (Kirchherr et al., 2018) and phases of sustainability transformation of a market (Hockerts & Wüstenhagen, 2010).

2. Theoretical Framework

2.1 Circular Business Models

The goal of CE is to alleviate pressure on increasingly scarce natural resources, reduce waste production and greenhouse gas emissions, by closing material and energy loops (Korhonen et al., 2018). Various research strands can be identified, there are for example studies on the definition and analysis of central concepts and geographical oriented studies with a strong focus on China and European countries (e.g. Geissdoerfer et al., 2017; Gong et al., 2019; Kirchherr et al., 2017). Awareness of the CE concept has been catalysed by the Ellen MacArthur Foundation, who have published their first report on CE in 2012 (Ellen MacArthur Foundation, 2012). This was picked up by the European commission in 2014, with their publication of communication on CE (EC, 2014). To address the issues imposed by the current ´take, make, waste´ model, system change is needed, as well as changing the logic of value creation and shaping new transaction models (Bocken et al., 2014). For businesses, implementing CE practises means creating environmental (and preferably social) value in addition to economic value. They can do this by incorporating CE principles and guidelines for BM design that are aimed at increasing resource efficiency and effectiveness, ultimately changing the approach to economic value and interpretation of products in order to close material and energy loops (Bocken et al., 2019). The process of CBMI is understood as 'innovating the business model (i.e., updating the elements of an existing business model, or establishing a new organization and associated business model) to embed, implement and capitalize on circular economy practices' (Bocken et al., 2019). Bocken et al. (2018), identify several new variables that have to be considered with CBMI, that increase the complexity and uncertainty compared to ´regular´ BMI. The ones relevant for the FMCG industry are 'reverse logistics', 'quality, quantity and timing of return of resources' and 'customer perceptions and preferences'. Also, the absolute environmental impact and benefits that stem from CBMI are a source of debate amongst scholars, because CE requires changes at the systems level, which makes environmental impact difficult to measure at the business model level (Manninen et al., 2018). The R-framework mentioned in the introduction is a framework introduced by scholars to describe the various circular strategies businesses can implement. The definitions of the five strategies are given in table 1 and will be used for answering RQ1.

Table 1. R-framework coding for RQ1

CBM Strategy	Definition
Regenerate	Maintain and increase the delivery of biological ecosystem services (i.e. the benefits provided) to society, for instance through urban agriculture, green roofs or aquaponics.
Reduce	Increase efficiency of product design or manufacturing by preventing or minimising the use of specific hazardous materials or any virgin materials, or allowing for more intensive product use.
Reuse	Bring products back into the economy after initial use, or extend the lifespan of products and their parts (through repair, second-hand markets etc.)

Recycle	Process materials through, e.g., shredding or melting to obtain the same (upcycling) or lower (downcycling) quality.
Recover	Incinerate residual flows with recovery of embodied energy.

Source: Henry et al. (2019)

Studies have aimed to differentiate startups from incumbents in terms of characteristics and strategies, also in the fields of sustainability and more recently circular innovation strategies (e.g. Henry et al., 2019; Hockerts & Wüstenhagen, 2010). De los Rios and Charnley (2017), state that in principle, both can be 'CE pioneers', because this is mostly defined by a company's circular spirits and entrepreneurial capabilities. However, startups are seen as a source of radical and disruptive innovation, due to their higher flexibility and responsivity to market changes (Hockerts & Wüstenhagen, 2010). In contrary, uptake of CE practises and business models is still low among corporates (Henry et al., 2019), even though they are the largest producers of plastic and thus plastic waste. So, implementation of circular business models by incumbents can save a significant amount of virgin plastics and plastic waste (Hahladakis & Iacovidou, 2018). Recent studies on CE strategies implemented by incumbents show that they tend to focus on end-of-life solutions and sourcing strategies, placing them in the 'Recycle' and 'Reuse' categories (Stewart & Niero, 2018; Ünal & Shao, 2018). The explanations given for this is that incumbents poses technological know-how and capital that is needed to implement the needed logistics (e.g. reverse-logistics and altering waste-streams) (Neely, 2008; Veleva & Bodkin, 2018). In conclusion, both actors are relevant albeit for different reasons. Incumbents have a large potential for environmental impact reduction, and startups can be a source of best-practise examples. Circular business models can be focussed on improving the circularity of the value chain upstream (value creation systems), downstream (value capture and delivery), or be fully circular by combining both (Urbinati et al., 2017). Henry et al. (2019) add the 'source' category to refer to CE innovations that are technical in nature and exist within the core company. According to the same study, incumbents mostly focus on end-of-life solutions and reuse strategies and startups implement more rigorous circular strategies that are aimed at downstream processes and industrial symbiosis.

2.2 Barriers and Enablers of CBMI

Research shows that innovation trajectories are currently aimed mainly at eco-efficiency, in other words optimizing business-as-usual and are thus maintaining the status-quo (Blühdorn, 2013). This is not surprising given that regime players benefit from this and engage in activities to protect the status-quo, also understood as regime resistance (Geels, 2014). Also, according to Chesbrough (2010), the business model in place determines to a high degree the information that enters and circulates in the firm, and this 'prevailing logic' causes business model lock-in. Destabilization of regime institutions, path-dependencies and systemic transformation is needed to shift from "management of unsustainability" to "doing better things" (Gorissen et al., 2016; Lazarevic & Valve, 2017). In that regard, including transition thinking into business model innovation approaches might help move beyond eco-efficiency and stimulate repurposing to make sustainable transaction schemes more attractive for businesses (Gorissen et al., 2016). Gorissen et al. (2016) combined business model theory with transition thinking by placing the business model canvas (Osterwalder & Pigneur, 2010) inside the multilevel perspective (Geels, 2002) to broaden the scope of business model thinking to have it include the dynamics of change and aspects of (un)sustainability. Furthermore, for system innovation to occur

there have to be reinforcing dynamics between niche players, who promote transformative ways of value creation, and incumbents, who possess the potential to overcome barriers such as business rules, behavioural norms and success metrics (Rotmans & Loorbach, 2010; Grin, 2010; Johnson, 2010). Specific barriers and enablers for the implementation of CE practises by incumbents have been identified by scholars. In their study, Kirchherr et al. (2018) find that the main CE barriers are a lack of consumer awareness and hesitant company culture, which they label as cultural barriers. These cultural barriers are driven by market barriers, such as the lacking economic viability of circular business models. The experimental search for viable circular business models by niche players could offer solutions to these barriers faced by incumbents. What stands out in this study, is that no technological barrier is identified as pressing CE barrier. An earlier study by Walker et al. (2008) has found that barriers were often internal and enablers external, what implies that businesses might be lacking internal capacity to implement practises proposed by external actors such as governments and NGOs. Furthermore, collaboration and symbiotic partnerships have been identified as a CE accelerator (Pauli, 2010; Stahel, 2010), which has been translated to a framework with collaboration as key pillar by Lewandowski (2016).

2.3 Collaboration for system change

Transition thinking scholars see learning as the aggregation of knowledge in niches through experimentation (Geels & Deuten, 2006), but learning between niches and regimes is overlooked and lacks empirical research (Beers et al., 2016). The importance of learning by and between organizations in sustainability transitions has only recently been addressed in a study by van Mierlo and Beers (2020), where they explore the relevance of various theories on learning processes for transition theory. This provides interesting insights for this thesis, because their findings, especially on *collaborative learning,* support that the importance of collaboration for the transition towards a circular economy goes beyond resource sharing and knowledge development by functioning as a transition accelerator. Collaborative learning is understood as a process of sense making and negotiation of meaning that occurs through interaction between individuals or groups (Baker et al., 1999; Dillenbourg, 1999)**.** Participants learn from each other by sharing their individual understanding about the problem at hand and work towards a common understanding. The differing backgrounds of the individuals can lead to conflict, but this is not seen as a barrier for learning but rather as something that can be conductive to the process (Vermunt & Verloop, 1999). Misunderstandings about a person's or organization's contribution and about respective understanding of a concept or issue are more likely to occur when individuals come from radically different backgrounds. In transition context, this is the case between niche and regime players (startups and incumbents). However, these misunderstandings are overcome through verification of one's understanding of another's contribution, delaying opinionated responses and accepting disagreement (Beers et al., 2016)**.** Collaborative learning might relieve the identified barriers to collaboration between startups and incumbents, by building a better understanding of each other's contribution to the CE transition and their respective challenges. Furthermore, as touched upon in the introduction, interaction between startups and incumbents functions as an accelerator for system change towards sustainability (Hockerts & Wüstenhagen, 2010). Establishing long-term partnerships with organizations within the circular value chain (or rather value system) is essential for incumbents and startups for creating and capturing value. Startups use strategic partnerships with incumbents to reduce costs, risks, and improving company reputations and social impacts (Veleva & Bodkin, 2018). For incumbents, these partnerships offer opportunities to engage in more radical or disruptive innovation and can offer solutions related to reversed logistics and the recycling of waste streams (Veleva & Bodkin, 2018; York & Venkataraman, 2010). By analysing the progress made by startups and incumbents working on a certain sustainability issue, the phase of market transformation

can be determined. Hockerts and Wüstenhagen (2010), identify four phases; First, sustainability startups, led by idealists, introduce a sustainable innovation to the market, often quickly followed by phase two, namely incumbents adopting their own version of the sustainability innovation. Third, a second form of sustainable startups emerge, which are more focussed on growth and breaking out of the niche created by the pioneers. This is followed by the fourth phase, where incumbents see both market potential for large scale adoption of the sustainability innovation and increasing thread from the sustainability startups, causing them to embrace the innovation.

3. Methodology

An inductive qualitative approach is chosen, because this lends itself for the emergence of new insights from raw data (Thomas, 2006). Furthermore, the method aids in the development of theory around new phenomena, such as the role of plastic in the CE transition and the dynamics between incumbents and startups in this field. The comparative approach (Oost, 2006), is chosen here to identify possible learning and cooperation opportunities between startups and incumbents. This approach suits here, because of its comparative ability to identify key differences between barriers and enablers faced by startups and incumbents, which allows for theory expansion. First, CE strategies, CBM innovation types and barriers and enablers of CBMI for startups are identified, for which semi-structured interviews with founders of circular startups are conducted. Second, these findings are used to create a coding framework to analyse incumbents´ CSR reports with.

3.1 Data collection

The data is collected through semi-structured interviews with plastic-waste startups from the Netherlands and Australia and with experts working for key organizations such as knowledge institutes and consulting agencies. In total ten startups and four experts have been interviewed. Semi-structured interviews assure that the same subjects are covered in each interview, but leaves room for additional insights which support the theory-building process (Warren, 2002). For this purpose, an interview guide is developed based on the theoretical framework. Interviews were conducted until data saturation was reached, which means that no new themes are observed in the data (Guest et al., 2006). The number of incumbents was chosen to match the number of CSU's interviewed to support easy comparison. The geographical focus area for this research is the Netherlands, but during the research the opportunity arose to include interviews with Australian based startups to the dataset. These interviews have not been conducted, but have been independently analysed by the author. The inclusion of Australian startups strengthens the practical relevance of this research, due to recent announcement of collaboration between Australian and Dutch governments on CE (*Dutch and Australian Foundations join forces for a circular economy - Holland Circular Hotspot*, n.d.). Interviews with incumbents could not be conducted due to external factors (COVID-19), therefore the CSR reports and expert interviews are chosen as alternative approach. Incumbents included in the sample are chosen based on their participation with the Plastic Pact NL, because this shows their commitment to tackling the plastic waste issue. This commitment is essential, because these companies are actively working on transitioning to a more circular business model, thus encounter barriers and enablers.
Instead of interviews, CSR reports were collected and analysed.

3.2 Data analysis

Transcripts of the interviews were entered in NVivo software to conduct data analysis through an inductive and deductive coding process called hybrid coding to aid in theme development (Bryman, 2012). NVivo software is often used in qualitative research and helps with the storage and analysis of unstructured data. For the deductive approach the concepts of the R-framework and CBM innovation types were used to code the data, then an inductive approach was used for the coding of barriers and enablers by identifying keywords from the data. This approach resulted in a coding framework (Appendix 2) that was used to analyse the CSR reports. Again, the hybrid approach was used to analyse meaning units where companies discussed their approach to the plastic issue, similar to the approach of Stewart and Niero (2018). Meaning units are "sets of sentences containing aspects related to each other through their content and context" (Graneheim & Lundman, 2004). First, the meaning units are coded based on the R-framework, CMB innovation types and the coding framework derived from the interviews. Then, an inductive approach was taken to derive barriers and enablers specific for incumbents. The results of this two step analysis were combined to compare the results of startups

and incumbents and these findings were enriched by insights from interviews with key organisations who provided context and external insights to the CSR reports and the dynamic between startups and incumbents.

3.3 Internship

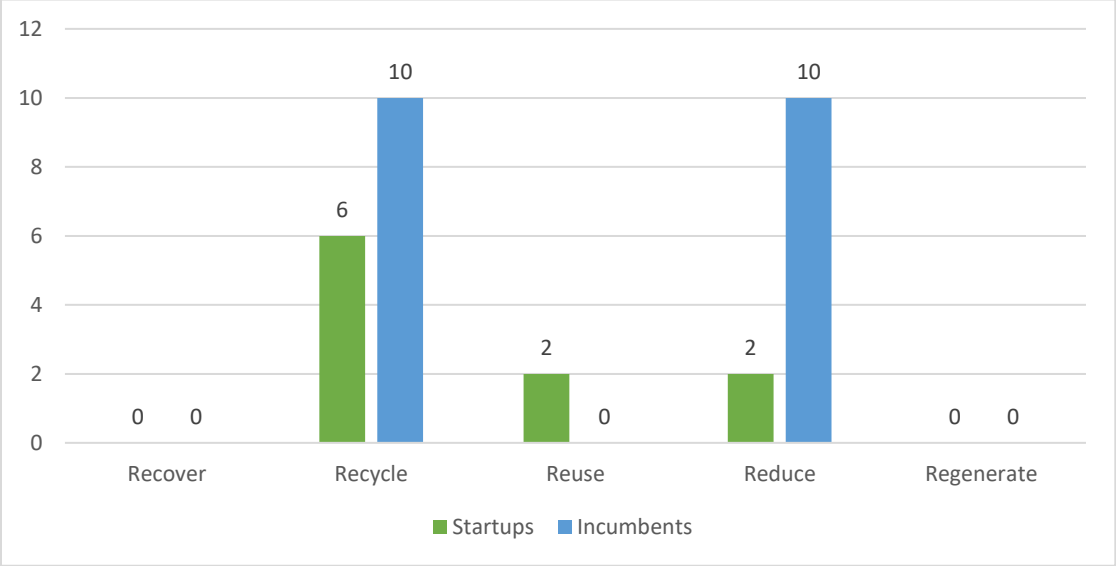
During the thesis project, an internship at the Impact Hub Amsterdam is conducted. The Impact Hub is an organization that supports impact entrepreneurs through community building and programs, and hereby offering their expertise and network. It is part of a global network of Impact Hubs in over 100 cities with more than 16,000 members. The internship includes supporting the programs team in developing and organizing incubator and accelerator programs for impact entrepreneurs. Through these activities, the network of the author is expanded to that of the Impact Hub, which means access to the plastics-ecosystem of the Netherlands. In addition, knowledge and expertise available at the Impact Hub is also available and can serve as valuable contribution for this study.

4. Results and Discussion

4.1 Plastic waste reduction strategies

This relates to the first research question: *What plastic waste reduction strategies are currently implemented by Dutch incumbents and startups and why?* To answer this question, the current activities and future goals of the startups and incumbents have been categorized based on the R-framework. The results of this analysis are shown in figure 1 below. The first thing that stands out of the analysis is that all incumbents pursued two plastic waste reduction strategies, i.e. recycle and reduce, whereas startups only pursued one. This is remarkable, because it contradicts the finding by Henry et al. (2019) that startups usually pursue more circular strategies than incumbents. This finding is based on an analysis of startups and incumbents across various sectors, so the finding that startups pursue less circular strategies than incumbents could be specific to plastic-focused circular companies. Furthermore, startups have limited resources, which limits their capacity to pursue different strategies simultaneously (Veleva & Bodkin, 2018). All interviewees stated that they founded their companies because they saw an issue that they wanted to address through entrepreneurial action, for which they then developed (mostly technical) innovations. *"Over 90% of toys are made from materials that are typically not recycled, right about 10% of the products are recycled. So, when you multiply that by the number of children globally you have a very large volume. So we just saw the significant waste. There are so many ways to do things better here. That was key driver."* (Company S8). The idealistic nature of the founders causes this focus on one issue which leads to solutions that fall into one circular business model strategy (Hockerts & Wüstenhagen, 2009).

Figure 1: Plastic waste reduction strategies of startups and incumbents.



Note: A company can pursue multiple strategies simultaneously.

Of the ten startups that were analysed six are working with an innovation based on recycling, two are introducing a reuse system and two are working on innovations that reduce the use of plastic. All recycling technologies are aimed at processing post-consumer waste, the reuse startups both focus on reusable packaging and the startups that are classified as reduce are both developing alternatives to single use consumer plastics. Furthermore, six out of the ten startups combine their core innovation with socio-institutional innovation. For example, one startup developed a technology that can recycle large amounts of post-consumer plastic in a cost-efficient manner and uses it to establish short, local value streams by acquiring waste locally and selling their end-product to the same community. Thereby

creating new relationships in the value chain and embedding their technological innovation in a socio-economic context. The startups from the sample thus contribute more to the required systemic changes to achieve a circular economy, which is in line with previous findings (Henry et al., 2019). They focus mostly on active customer involvement (50%) and working with inter-organizational waste streams (30%).

The plastic waste reduction strategies implemented by incumbents are recycle and reduce. Their biggest contribution to the plastics issue lays in the packaging of their products, so strategies aimed at reducing the production and accumulation of plastic waste are mostly related to the design of their packaging. This includes redesigning packaging so less plastic (in weight) is needed, the packaging is recyclable and recycled plastic is used for the production. Previous research on the implementation of CE practises by incumbents shows that incumbents generally pursue lower-ranked CBM strategies focussed on end-of-life management (Stewart & Niero, 2018). Reuse appears to be an unfavourable strategy for these companies, although some mention it briefly in their CSR report, concrete actions, projects or goals in this regard are absent. Although incumbents tend to possess the resources needed to set up a reuse system (Veleva & Bodkin, 2018), breaking away from the single-use packaging model would require socio-institutional innovation which is more commonly associated with startups (Boons & Lüdeke-Freund, 2013; Geels, 2005; Hekkert et al., 2007; Henry et al., 2019). Regenerate and recover are both not pursued by any incumbent or startup, which indicates that these strategies might not fit the needs of plastic-focussed circular companies.

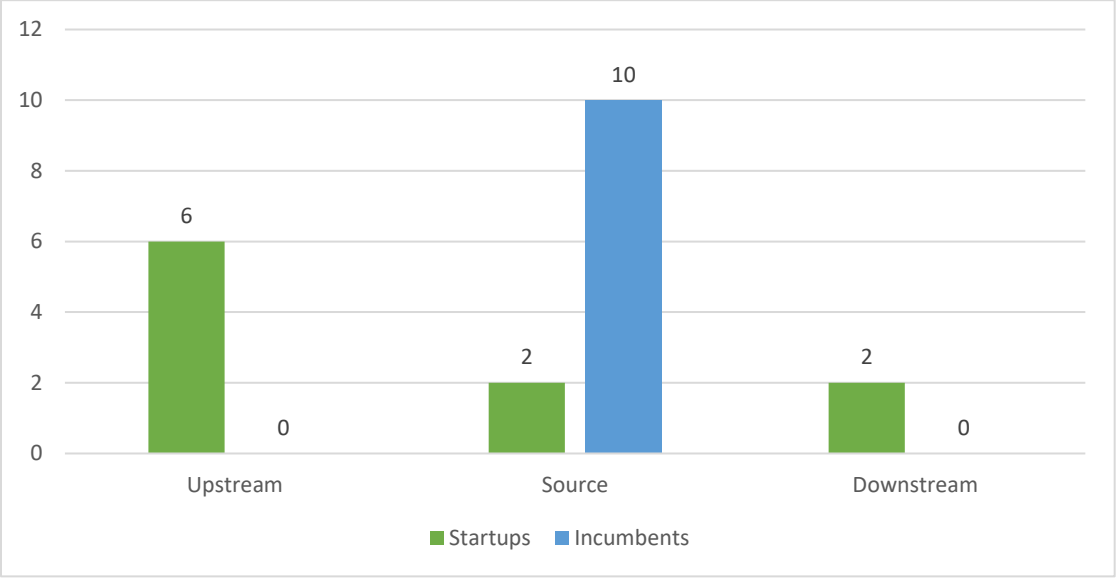
From a business model perspective, the choice for the recycle and reduce strategies by incumbents makes sense, because product design (including packaging) is part of their core business. Redesigning the packages to contain less -and better recyclable plastics and altering the production process to allow the use of recycled plastic is coherent with their existing assets and business model. It only requires knowledge on sustainable packaging and production processes, for which new partnerships are easily made, and doesn't require complicated reversed logistics or increased customer involvement as would be the case for reusable packaging. Veleva and Bodkin (2018) point towards the resources of incumbents as enabler for reuse- based business models, however such a shift in business model strategy is often hindered by inertia caused by lock-in at the organisational, technical, industrial and institutional level (Guldmann et al., 2019; Neely, 2008). Furthermore, reduced use of natural resources means reduced costs, which resonates with the business logic of fast moving consumer goods producers (Evans et al., 2017). Paragraph 4.2 will provide a more detailed analysis of the barriers and enablers of circular business model innovation found in this study.

4.2 Innovation strategies

A second comparison is made between the innovation strategies of startups and incumbents, shown in figure 2. It is evident that the incumbents that were analysed mainly focus on internal innovations, such as product design, source materials and altering key processes, because these are compatible with their existing assets as explained previously. Therefore, their efforts are placed in the source category. They do show efforts to establish circularity standards in collaboration with their competitors and within their supply chain, but this is merely done to enable the innovations on product and process level. Startups are more distributed amongst the innovation types, with upstream as main focus (six out of ten), followed by source (two out of ten) and downstream (two out of ten). Startups working on recycling innovations are placed in the upstream category, because they are creating new value from waste streams. Furthermore, due to the novelty of the production process they are often working on establishing standards and increased integration along the supply chain. The two startups that implement a source type innovation are developing products that require alternative resources to plastic, making them product design oriented. There are two startups developing reuse solutions,

which involves servitisation and active customer involvement, placing them in the downstream category.

Figure 2: CBM innovation types



4.3 Barriers and Enablers of circular business models for plastics innovations

In the following section the barriers and enablers encountered by startups and incumbents implementing plastic waste reduction strategies are discussed. A comparison is made between startups and incumbents in terms of similarity of barriers and enablers, to answer the second research question: *What are the barriers and enablers of circular business models for the Dutch plastics industry and how do they impact implementation?* The results are summarized in table 3. The themes that are discovered are categorized into the following codes: company culture, government, society, market, technology, collaboration and funding. Also, a division has made between internal and external factors.

Barriers

The most pressing barrier that was found is the business case for circular plastics (B5, 60% of startups and 40% of incumbents), which refers to the cheap price of virgin plastic along with the technical advantages that it has compared to the more expensive recycled plastic or reusable containers that comes with technical drawbacks that influence product aesthetics. "*…if you use recycled plastic it is almost impossible to compete against virgin plastic. So why would you do that, it is contaminated, it might be damaged"* (Company S1). This barrier was further aggravated as a result of the COVID-19 pandemic, which effects on the economy caused the oil prices to dip. For startups, this barrier poses the challenge of developing a recycle technique or product that is able to compete on the market, for incumbents it means that implementing CE practises results in higher sourcing costs and challenges in terms of product marketability. The issue of reduces aesthetics was also found by Gong et al. (2019), however in this study the inherent drawback of pricing is not identified as specific barrier. The choice to combine the two is related to the inheritability of the two factors to plastics, contemporary recycle and reuse innovations are not able to compete with virgin single-use plastics in terms of pricing and aesthetics. Therefore, these factors are combined under the business case for plastics recycling.

This barrier (B5), relates to two other important barriers, namely technical limitations (B6, 50% of startups and 10% of incumbents) and consumer culture (B3, 20% of startups and 30% of incumbents). The former of which refers to the technical limitations of plastic recycling and reuse. It was found that startups working on reuse systems were also working on developing reusable packaging, because this was not yet available on the market. Both stated that this development posed the necessary technical challenges, which shows how dominant the single-use plastic paradigm is in knowledge development. "*When you look at the current options for shampoo bottles, they are all made for single-use. What we need doesn't exist yet"* (Company S4). Furthermore, critical remarks were made by some interviewees about the technical feasibility of the goals of the Plastic Pact, in terms of recyclability of packaging materials, and about the technical feasibility of biodegradable plastics (often used by incumbents in response to public concern about litter). Technological barriers have previously been identified by studies on CE implementation (Ritzén & Sandström, 2017; Rizos et al., 2016), but it is also subject to debate (Kirchherr et al., 2018; Paletta et al., 2019). The finding that current technology forms a barrier seems to be related to the qualities of plastic, for example, Gong et al. (2019) also found this to be a barrier in their study on plastics in the CE. Furthermore, and this relates to consumer culture (B3), consumer's increasing individuality and preference for price and convenience favours single-use packaging; reuse means increased consumer involvement and recycled material means less attractive packaging. "*This is the duality of the consumer, on the one hand they are becoming increasingly aware about sustainability issues, on the other hand they choose products that appeal to them based on price, aesthetics and convenience"* (Organization O2).

It was found that recent innovations in the field of sustainable packaging are not suitable for the current waste management infrastructure. For example, biodegradable plastics take longer than normal compostable waste to process, so composters do not want it in their plants. "*This innovative product of startup X is technical recyclable, but the Dutch waste management infrastructure can't handle it, so it ends up incinerated"* (Organization O2). Furthermore, the infrastructure is dominated by big waste management companies, which makes it difficult for startups to enter this market and get access to waste streams. Governmental organizations such as municipalities could potentially play an important role in opening up this infrastructure to startups and new operational models.

Change agents sometimes encounter internal resistance to change when advocating for sustainability strategies (B1, 50% of key organizations and 30% of startups). This barrier relates only to incumbents, because the startups are all founded based on circularity purposes. This barrier was also found to be an issue for startups who want to work with incumbents; they found the incumbents employees to be reluctant to partner with a startup and try something new. The internal resistance to change as a barrier for CE implementation is also found by Govindan and Hasanagic (2018), who point at management as possible barrier. However, this study finds that resistance to change can come from all levels in the organization. For example, it can be managers who are reluctant to the ideas of their employees, and it can be vice versa. Both situations where found in this study, therefore the two are referred to as internal resistance to change.

For startups, current legislation (B2, 60% of startups) was found to be a major barrier, because their products or processes often relate to 'grey areas' in legislation. For example, one interviewee mentioned a startup that makes fuel from plastic waste, but the law states that fuel can only come from fossil resources they are not eligible to sell on the market, even though their fuel is chemically identical to fossil fuel. Many entrepreneurs in this study encountered similar issues with existing legislation and the limited resources startups possess make it difficult for them to address these. The CSR reports that were analysed showed incumbents' concern about upholding required standards for food packaging that are related to food safety, but no other form of issues with legislation. Another barrier that mainly affects startups is an example of the interesting dynamics between startups and incumbents, namely greenwashing (B4, 30% of startups). Greenwashing occurs when a company

claims a product to be sustainable through advertisement, when in reality the environmental benefits are marginal to non-existent (Delmas & Burbano, 2011). Various startups mentioned that they encounter scepticism from (potential) clients towards their activities due to greenwashing by incumbents or that they would not work with certain incumbents in fear of being used for greenwashing activities.

Enablers

More enablers than barriers are identified in this study and higher consensus exists among the interviewees on the identified themes. All internal enablers are related to company culture, i.e. entrepreneurial mission (E1, 90% of startups) and CSR managers (E2, 20% of startups and 25% of key organizations). The first was only found in startups and refers to the prioritization of environmental or social impact over making profit, resulting in more rigorous innovations and business models. The companies are established with the purpose of achieving higher circularity rates in the plastics industry and profit is a means to this end. This corresponds with the theory proposed by Hockerts and Wüstenhagen (2010), who state that in early stage of market transformation, sustainability startups are led by idealists who introduce rigorous innovations to a niche market. The second, CSR managers, refers to the CSR managers and their departments that have been set up by incumbents recently, which is the result of senior support to sustainability initiatives and related desire to internalize knowledge, measurement and reporting of progress. The effect is that sustainability goals are aligned throughout the organization and collaboration between departments is better coordinated. This not only results in better sustainability performance of incumbents, it also makes collaboration with startups easier for both sides, because CSR managers are aware of the value startups can offer and are able to serve the interests of startups without solely looking at business gain. "*Nowadays luckily all large companies have CSR managers, who looks at the business case and is the spider in the web of all the other departments. When we started five years ago we had to figure that all out by ourselves and there was no clear way of working within these companies"* (Company S1). The finding of this enabler is new to theory, however there are some related enablers found by Gong et al. (2019), namely senior support and internal collaboration.

The following enablers are correlated: public awareness (E4, 60% of startups and 30% of incumbents), policy (E3, 50% of startups and 30% of incumbents) and demand for circular products (E5, 90% of startups and 30% of incumbents). Various case companies speak of a *"wave of awareness for the issue of plastic pollution"* (Company S1). Both parties refer to the importance of sharing the message of addressing the issue of plastic pollution through their products or marketing. For many startups, their product has to convey their message, because for them it's about making impact and getting people aware and sometimes to get them to take action. For incumbents, brand image is important and implementing CE practises for plastics is also used for marketing purposes, which makes it more attractive for them to partake in initiatives such as the Plastic Pact. "*Often companies want to be the first, connect their name to it, own a sustainability initiative. Eventually everyone gets to use it but they just want to show everyone that they're the first. Then they're also willing to pay*" (Organization O2). This public awareness creates support base for environmental policy in the plastics sector and increases the demands for circular products. Environmental policy creates business opportunities, because in order to reach policy goals innovations are often needed. For example, Australia recently introduced a deposit scheme to increase the efficiency of their waste collection which enabled business models for innovations within this scheme. "*I saw these container deposit schemes being legislated for around Australia and anytime where you create a brand new billion dollar industry over night through legislation, where nobody really knows what the winning models are going to be and there has to be a way for new people, for innovative folk, to come in and do something in*

that sector" (Company S9). Next to policy, public awareness also translates to increased demand for circular products, something that is felt by both B2B and B2C companies in the plastics industry. "*The plastic waste issue is so popular that we don't have to do any marketing, people come to us"* (Organization O3). Such demand makes CBMI attractive for both incumbents and startups, because it makes circular business models for plastics innovations economically viable.

The most important theme that surfaced was collaboration, of which two types are identified, i.e. facilitated collaboration (E7, 30% of startups and 50% of incumbents) and supply chain collaboration (E8, 50% of startups and 40% of incumbents). Facilitated collaboration occurs when parties work together on a common goal under guidance of a third party, often NGO led initiatives such as the Plastic Pact or the Alliance to End Plastic Waste. This unlocks knowledge exchange and creates a level playing field for the parties involved. "*In the field of sustainable packaging there is great willingness to work together. We get all the big supermarkets in one room, which is very special, this only happens for sustainability issues"* (Organization O2). Supply chain collaboration is a newly found enabler for circular business models in the plastics industry. Previous research refers to supply chain inertia as a barrier to CE implementation, but this conclusion is not supported by the results shown here (Ritzén & Sandström, 2017). Supply chain collaboration accelerates innovation and unlocks new business models by the deployment of resources towards a common goal. "Soda c*ompanies are teaming up with waste management companies to build these new plants. This harmonization of strategic goals is great, because that's creating this demand for better recovery of plastics"* (Company S9).

Table 2: Barriers and Enablers (S = Startup, I = Incumbent, O = Key Organisation)

Internal / External	Codes	Theme	Description	Cases	Example quotes
Barriers to Circular Business Models for Plastics					
Internal	Company Culture	**B1: Internal resistance to change**	Change agents encounter resistance to change within their company.	S3, S5, S9, O1, O2	*"At first, the implementation of circular strategies was difficult to understand for some colleges, people fear what they don't know."*
External	Government	**B2: Current legislation**	Innovations are not compatible with existing legislation.	S1, S2, S4, S5, S7, S9, O1, O3	*"We have a big need for clear legislation, because this would allow us to show our customers our products are safe even though they're made of waste."*
	Society	**B3: Consumer Culture**	Consumers are increasingly individualistic and favour convenience and price.	S1, S4, I2, I3, I6, O2	*"If you look at the number of unique items in packaging sold by supermarkets, this has increased tremendous over the last years due to individualization of society."*

	Market	**B4: Greenwashing**	Customers have become sceptical towards circular innovations due to greenwashing by incumbents.	S1, S2, S7, O2, O3	*"Lots of bigger companies do greenwashing, when you do good things sometimes people don't believe you."*
		B5: Business Case for Circular Plastic	Cheap price of virgin plastic and costs of processing plastic waste and reusable packaging lead to competitive advantage of virgin plastic.	S1,S2, S3, S6, S7, I1, I2, I8, I10, O1, O2	*"(…)take a look what is the problem, and well one of the issues is that plastic is so cheap. It's good for everything."*
	Technology	**B6: Technical limitations**	Innovations are needed to increase circularity rate of plastics. Both to increase recycling rates and to find solutions for reuse.	S1, S2, S3, S4, S6, I2, O2, O3	*"The goals that are set are intense and sometimes technical impossible, it then becomes a question of definition of recyclability."*
		B7: Current waste management infrastructure	Plastics innovations are often not compatible with the waste management system.	S2, S3, S4, O2, O3	*"This innovative product of startup X is technical recyclable, but the Dutch waste management infrastructure can't handle it, so it ends up incinerated."*
Enablers for Circular Business Models for Plastics					
Internal	Company Culture	**E1: Entrepreneurial Mission**	Company is established with the purpose of battling the plastic waste issue. Profit is a means to this end.	S1, S2, S3, S4, S5, S6, S7, S8, S10	*"We're initially getting into this to drive change and I don't think you can do that by taking a capitalistic view on selling."*
		E2: CSR Managers	CSR managers and their sustainability departments within incumbent organisations increase the uptake of circular practises.	S1, S9, I8, O2	*"For example, incumbents X and Y now have CSR departments, there you see the change happening within these companies."*

External	Government	**E3: Policy**	Governmental policy for the circular economy validates circular business models.	S5, S6, S7, S9, S10, I8, I9, O1, O2	*"(…) very few companies are willing to invest and make big changes unless its ordered by policy or legislation."*
	Society	**E4: Public awareness**	Growing attention and sentiment for the environmental issues caused by plastic waste.	S1, S2, S5, S8, S9, S10, I2, I3, I4, O2, O3	*"Public concern is also growing about the resources being used to produce packaging, the recyclability of packaging and the volume of packaging. This concern has led to commitments by some leading manufacturers, including incumbent X, to minimise resource inputs and increase the recyclability of packaging."*
	Market	**E5: Demand for circular products**	Increasing demand for circular products and recyclate make circular business models economically viable.	S1, S2, S3, S4, S5, S7, S8, S9, S10, I1, I7, I8, O1, O2, O3	*"The demand for innovation comes from our clients and stakeholders (...) I believe that the market is the biggest thing that could help achieve a circular economy for plastics."*
	Technology	**E6: Innovation**	Innovations in recycling processes, reuse solutions etc enable new business models.	S1, S2,S3, S4, S6, S8, S9, S10, I1, I2, I3, I5, I6, I9, I10, O1, O2, O3	*"One of our ambitions is to use more recycled plastic. With this in mind, in 2018 we started exploring how we can turn plastic household waste into new products."*
	Collaboration	**E7: Facilitated Collaboration**	Cooperation between market actors facilitated by a neutral third party enables knowledge exchange and levels playing field.	S2, S3, S5, I1, I6, I8, I9, I10, O1, O2, O3	*"Big competitors can collaborate on sustainability, but this requires a neutral party like organisations X and Y."*

	E8: Supply Chain Collaboration	Cooperation within the supply chain accelerates innovation and supports innovative business models.	S5, S6, S8, S9, I3, I8, I9, I10, S10, O1, O2, O3	*"Incumbents are demanded to recycle more plastic, so they're teaming up with waste management companies to build these new plants. This harmonization of strategic goals is great."*

4.4 Towards Collaboration for Market Transformation

In order to restructure the linear economic system to a circular model, businesses need to collaborate with all stakeholders: from research organizations, regulators, suppliers, customers, waste management and logistics to competitors (Angelis & Howard, 2018; Brown, Bocken & Balkenende, 2018). The characteristics of a circular economy, such as the alternative appliance of waste streams, make that collaboration leads to improved efficiency and effectiveness of business operations. In a recent report of Circle Economy (2020) four advantages of collaboration in a circular economy are identified: change on industry level, competitive advantage through resource sharing, being financially viable by sharing R&D costs or producing higher volumes and knowledge creation and sharing. Both incumbents and startups need collaboration with external stakeholders to create circular products, but their abilities to create new business models differs, as discussed above. In summary, incumbents face higher external pressure due to increased public awareness around plastics and possess the resources to develop new products and business models. However, they are also dealing with business model lock-in and often experience internal resistance to change. Startups can profit from increased public awareness by introducing novel products and innovative business models due to their agility, but they are often tight on resources. Collaborations between incumbents and startups are deemed important for the transition to a CE for plastics by most interviewees. However, due to the inherent differences described above, such collaborations pose challenges for both parties. These barriers can be overcome with the interference of a third party that can bring both parties together and create a level playing field. More importantly, this third party could function as matchmaker by introducing companies to each other with the aim to create industrial symbiosis. The most important barriers and enablers that were identified are described in table 4.

Table 3: Barriers and Enablers of collaboration between Incumbents and Startups.

Incumbents/ Startups	Code	Description	Example Quote
		Barriers to Collaboration	
Incumbents	**Internal Resistance to Change**	Startups operate under a different business logic that is often new to the incumbent. This can evoke hesitation to work together.	*"A startup is used to doing everything quick, they might change a plan in 15 minutes. That doesn't work for an incumbent."*
Startups	**Protection of Niche**	Startups often deliver products to a niche market, that they want to protect from incumbents' cheap pricing.	"*If your brand isn't strong enough, people will always choose the cheaper option. So for now we prefer to offer to selected parties only."*
		Enablers of Collaboration	

Incumbents	**CSR Strategy**	Having a CSR strategy in place enables incumbents to identify innovative startups that can help them achieve their goals.	"*A smart incumbent has a couple of startups around them that they can learn from.*"
Startups	**Entrepreneurial Vision**	It depends on the entrepreneurial vision of the founders if a startup is willing to work with corporates.	*"Founders who are looking to scale are more willing to collaborate with incumbents than founders who are looking to protect their niche."*
External	**Facilitation of CE Transition**	Various actors (e.g. incumbents, municipalities and innovation platforms) organize CE programs where startups and incumbents are matched.	*"A circular economy is about ecosystems, so parties have to work together. That's why we took on the role of matchmaker."*

Various opportunities for collaboration are found in the results, which are elaborated below. As discussed by previous studies (e.g. Manninen et al., 2018; Mishra et al., 2018; Rizos et al., 2016), establishing strategic partnerships along the value chain is critical for the creation of viable business models and the results of this study support this. Entrepreneurs who engage with their suppliers are able to develop their innovations faster and increase their sustainable impact. *"We worked together with the software developer to make improvements in the software happen faster than planned, which enabled better control of the robotic arm, increased computing capacity and changing parts so we can better control what we're doing"* (Company S6). For incumbents who suffer from inertia (Veleva & Bodkin, 2018), strategic partnerships can increase their agility and innovative capacity. "*Thanks to our strategy, we accomplished working with new partners who give our organization a new impulse to grow and allow us to become more agile"* (Company I9). Such collaboration provides opportunities for startups to provide technical solutions for issues incumbents struggle with. For example, an incumbent that would like to achieve zero-waste offices can supply their plastic waste to a startup that turns it into furniture for the same office. *"There will always be companies who can't reduce the use of virgin plastics at all. This is connected to food and people's health. We need to focus more on solutions, what we can do for these companies to have their plastic recycled into something else after use"* (Company S2). Furthermore, collaboration could be aimed at the development of CE standards for products as the existence of standards would allow companies to show their consumers that their products are safe. It could furthermore increase a company's reputation, because it provides credibility to their (marketing) statements on CE. Governmental bodies also play a role in this, because existing legislation is a limiting factor for CE business models for plastic. By working together with industry in developing standards for plastics in the CE they provide a tool for companies to achieve the governmental mandates on CE. Especially in the field of packaging, where food safety is of high concern, it is important to keep legislation up to date because otherwise it can become a limiting factor to innovation. This study found that 8 out of 10 startups engage actively with their actors in their value chain to develop production standards. "*The main issue with suppliers is that there is a lot of suppliers that say they have this kind of product, but you don't know if it's the real product. They say they have certification but it are weird certifications so we have to interview what are components of all the things"* (Company S10). Another opportunity for collaboration exists around establishing impact

measurement metrics and systems. As discussed before, impact measurement of CE business models is difficult due to the systemic nature of CE (Boons & Lüdeke-Freund, 2013; Enia Rossi et al., 2019; Veleva & Bodkin, 2018). *"If company X would take full responsibility for their packaging and move to a reusable system, the world would look very different. Does is make company X more sustainable per se? That depends on your calculation. You have to think in systems."* (Organization O3). Therefore, to be able to track progress and adjust measures accordingly, companies are setting up measurement systems in collaboration with their value chain. *"Together with our suppliers we're working on an extensive zero measurement that will guide our decisions regarding the reduction of our plastic packaging"* (Company I8). It was found that startups often do not have the financial resources to measure their impact extensively, thus collaborating with incumbents who can provide funding offers an opportunity. The opportunities described here are mostly aimed at increasing efficiency, however, there are also intangible benefits to collaboration which aid CE transition. According to learning theory, collaboration will provide opportunities for collaborative learning. This builds trust and mutual understanding of each other's contributions to the CE transition (van Mierlo & Beers, 2020). Multiple interviewees mentioned a noticeable difference between incumbents and startups who collaborated with a company from the other category before: they see the other more as complementary than disruptive and feel more confident in engaging with the other party. *"I come from a larger company so for me collaboration between corporates and startups is easy. But I also see startups who don't have this experience who struggle with it"* (Organization O3). *"You see once they (incumbents) have collaborated with startups before, they don't find it as scary anymore"* (Company S1). Following this logic, collaboration between incumbents and startups is a self-reinforcing mechanism that can potentially accelerate the transition towards a CE for plastic.

5. Limitations

In this section, the study´s limitations are addressed. Firstly, the sample of startups is formed with the use of Impact Hub´s network and based on availability of respondents. The sample is therefore not necessarily a valid representation of circular startups in the plastics sector. This limitation is further relevant due to the small N of respondents. Secondly, no incumbents are interviewed for this study, as was the original setup of the study, but instead CSR reports were chosen as data input for the sample of incumbents. Using CSR reports for the analysis of sustainability strategies is a valid research method, as shown by Stewart and Niero (2018). During the research project, the COVID-19 pandemic hit and the activities of the author's internship at Impact Hub changed as a result. For example, various events that would have provided network opportunities with incumbents were cancelled. Attempts to include incumbent's interviewees through the snowballing technique and contacting them through social media or email remained unfruitful. The author aimed to improve the validity of the research by triangulation of the results, both by relating the findings to existing literature and by including interviews with experts from key organizations. Triangulation is a tool commonly used by qualitative researchers to increase research validity, because qualitative research inherently deals with subjectivity which can (partly) be overcome by combining various sources or methods (Golafshani, 2003).

Lastly, as previously touched upon, this research was carried out during the COVID-19 pandemic, which has affected the transition to a CE for plastics in various ways. For example, more single use plastics are used in the form of face masks and gloves and take-away establishments no longer accept reusable cups from customers. Furthermore, due to the economic recession that followed, oil prices dipped, resulting in recycled plastic to become economically unviable due to the low price of virgin plastics. In contrary to these findings, interviewees also expressed optimism towards the possibilities of 'rebuilding' the economy with a strong focus on increased circularity. In short, the course and

conditions of the CE transition are changing rapidly, but preferably, research is carried out under consistent circumstances to reveal correlations and causality, otherwise known as *ceteris paribus* (*Ceteris Paribus Laws*, 2011). This changing environment means that if this study is to be repeated in the future, results are expected to differ from the findings presented here. The author aimed to be thorough in describing the research method and by providing the interview guide (appendix 1) and coding framework (table 3), to achieve qualitative rigor (Thomas & Magilvy, 2011). It would be interesting to repeat this study in the future, to address the effect of the COVID-19 pandemic on circular business model innovation for plastics.

6. Theoretical and Policy implications

This research contributes to the emerging body of literature on barriers and enablers of CE implementation and studies on the role of plastic in the CE, which is still in infant stage. Several barriers and enablers emerged from the analysis of companies in the Dutch FMCG industry that appear to be specifically related to business models for the circular use of plastics. These are ´business case for circular plastic`, `current technology´ and ´waste management infrastructure´. The technological nature of these barriers is contradictive to the shared notion by CE scholars that CE implementation is a matter of cultural barriers. For further theory development it would be meaningful to perform empirical research on the barriers and enablers of CE implementation in different sectors and related to different materials, because this would generate a more detailed understanding of the challenges across sectors. For companies who are looking to address the environmental impact of their plastic production this research highlights the need to acquire and develop knowledge on the possibilities and limitations of circular use of plastics. In this regard, collaboration as overarching enabler plays an important role, with facilitated collaboration and supply chain collaboration as subthemes. As shown in the discussion, facilitated collaboration between startups and incumbents could help create strategic partnerships in the value chain. Matchmaking between incumbents and startups could contribute to solving technological challenged faced by incumbents. This is a role than could be taken on by incumbents themselves through challenges, by innovation platforms or by governmental bodies. Furthermore, governmental bodies could engage with industry to establish CE standards for plastics and re-evaluate current legislation to eliminate limiting factors to innovation. Furthermore, the identification of the waste management infrastructure as barrier poses a challenge for municipalities to make these operations ´future-proof', for which close collaboration with waste companies is needed. For managers and entrepreneurs, these findings can be seen as an invitation to engage more with either startups or incumbents on the basis of shared value creation instead of fear of disruption or losing your niche. A first step to collaboration is recognizing the need for collaboration to achieve a CE for plastic and use this to define the project's vision. Second, in order to overcome internal resistance to change a designated team could be established with employees that have thorough understanding of CE and the specific project for the company and preferably with previous experience with incumbent-startup collaboration to lower cognitive barriers. Third, potential partners can be selected, evaluated and engaged. This last step could be done with the support of a third party or within another project, such as the Plastic Pact. This helps set the precondition of having a common goal and understanding of urgency to tackle the issue of plastic by transition to a CE.

7. Conclusion

The findings presented in this thesis show that plastic is a relevant issue for the FMCG industry, which gained the attention from incumbents and startups. Results showed that the market transition towards a CE for plastics is still in early stage and systemic changes are needed to push the transition forward. It was found that startups pursue less CBMI strategies than incumbents, which contradicts earlier findings. Larger N studies are needed to determine whether this is a characteristic of CBMI for plastic

or the result of differences in methodology followed. The study revealed that in contrast to earlier findings on barriers for CE implementation, technical barriers are an important limitation for the development of circular business models for plastic. The barriers that came forward in this theme are 'current technology', 'waste management infrastructure' and 'business case of circular plastic'. The enablers that were found are in line with existing literature as collaboration was identified as key enabler. Collaboration for CE is a recognized enabler of innovations on product and business model level and is found in different areas, i.e. 'supply chain collaboration', 'facilitated collaboration', and internal collaboration executed by 'CSR departments'. The findings presented here indicate that it could be valuable to research barriers and enablers for CE implementation across different industries to get a more detailed understanding. This would furthermore aid the development of management guidelines for individual industries. The author recognizes that the concept of CE is a holistic approach and can be investigated in totality, however CE implementation by industry is still in early stage and detailed empirical research is needed to understand and guide this implementation further. This thesis explored possible benefits of collaboration between startups and incumbents to accelerate the CE transition of plastics and found that next to benefits for value creation, solving technical challenges and the creation of CE standards for plastics, collaboration between these parties could also stimulate collaborative learning. This is expected to stimulate collaboration in the future, making collaboration between startups and incumbents a self-reinforcing mechanism. This thesis makes a first step towards the integration of theories on learning and transition theory, which is a promising emerging research strand. Empirical research on the feasibility and effects of startup-incumbent collaboration could be enriched by taking the perspective of collaborative learning into account and investigating the hypothesis of collaboration as self-reinforcing mechanism. In regard to the limitations of this study, it would be interesting to repeat this study over a longer period of time to analyse barriers and enablers as the market transition progresses and to possibly monitor the effects of the COVID-19 pandemic.

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Literature

Angelis, D., & Howard, R. (2018). *Supply Chain Management and the Circular Economy: Towards the Circular Supply Chain*.

Baker, M., Hansen, T., Joiner, R., & Traum, D. (1999). The role of grounding in collaborative learning tasks. In *Collaborative Learning. Cognitive and Computational Approches.* Elsevier Science.

Beers, P. J., Van Mierlo, B., & Hoes, A.-C. (2016). *Toward an Integrative Perspective on Social Learning in System Innovation Initiatives*. *21*(1). https://doi.org/10.5751/ES-08148-210133

Blühdorn, I. (2013). The governance of unsustainability: Ecology and democracy after the post-democratic turn. *Environmental Politics*, *22*(1), 16–36. https://doi.org/10.1080/09644016.2013.755005

Bocken, N. M. P., Short, S. W., Rana, P., & Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner Production*, *65*, 42–56. https://doi.org/10.1016/j.jclepro.2013.11.039

Bocken, N., Strupeit, L., Whalen, K., & Nußholz, J. (2019). A review and evaluation of circular business model innovation tools. *Sustainability (Switzerland)*, *11*(8), 1–25. https://doi.org/10.3390/su11082210

Boons, F., & Lüdeke-Freund, F. (2013). Business models for sustainable innovation: state-of-the-art and steps towards a research agenda. *Journal of Cleaner Production*, 9–19. https://doi.org/10.1016/j.jclepro.2012.07.007

Ceteris Paribus Laws. (2011). http://plato.stanford.edu/entries/ceteris-paribus/

Circle Economy. (2020). *Will You Be My Partner*.

Claeys, B. (2020, January). *Fast moving consumer goods (FMCG): The complete guide*. https://www.qrcode-tiger.com/fast-moving-consumer-goods-fmcg-are-all-moving-into-customized-qr-codes

de Souza Machado, A. A., Kloas, W., Zarfl, C., Hempel, S., & Rillig, M. C. (2018). Microplastics as an emerging threat to terrestrial ecosystems. *Global Change Biology*, *24*(4), 1405–1416. https://doi.org/10.1111/gcb.14020

Delmas, M. A., & Burbano, V. C. (2011). The Drivers of Greenwashing. *California Management Review*, *54*(1).

Dillenbourg, P. (1999). What do you mean by collaborative learning? In *Collaborativelearning: Cognitive and Computational Approaches.* (pp. 1–19). Elsevier Science. https://telearn.archives-ouvertes.fr/hal-00190240

Duis, K., & Coors, A. (2016). Microplastics in the aquatic and terrestrial environment: sources (with a specific focus on personal care products), fate and effects. *Environmental Sciences Europe*, *28*(2). https://doi.org/10.1186/s12302-015-0069-y

Dutch and Australian Foundations join forces for a circular economy - Holland Circular Hotspot. (n.d.). Retrieved July 13, 2020, from https://hollandcircularhotspot.nl/news/dutch-and-australian-foundations-join-forces-for-a-circular-economy/

Ellen Macarthur foundation. (2016). *The New Plastics Economy - Rethinking the Future of Plastics*. https://doi.org/10.4324/9780203965450

Ellen MacArthur Foundation. (2016). *THE NEW PLASTICS ECONOMY: RETHINKING THE FUTURE OF PLASTICS & CATALYSING ACTION*.

Ellen MacArthur Foundation. (2018). *Plastics Pact - New Plastics Economy* . https://www.newplasticseconomy.org/projects/plastics-pact

Ellen Macarthur foundation, & ARUP. (2019). *City Governments and Their Role in Enabling a Circular Economy Transition*.

Enia Rossi, E. ^, Bertassini, A. C., Dos, C., Ferreira, S., Neves Do Amaral, W. A., & Ometto, A. R. (2019). Circular economy indicators for organizations considering sustainability and business models: Plastic, textile and electro-electronic cases. *Journal of Cleaner Production*, *247*. https://doi.org/10.1016/j.jclepro.2019.119137

European Commission. (2018). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A European Strategy for Plastics in a Circular Economy*. https://doi.org/10.1021/acs.est.7b02368

Evans, S., Vladimirova, D., Holgado, M., Van Fossen, K., Yang, M., Silva, E. A., & Barlow, C. Y. (2017). Business Model Innovation for Sustainability: Towards a Unified Perspective for Creation of Sustainable Business Models. *Business Strategy and the Environment*, *26*(5), 597–608. https://doi.org/10.1002/bse.1939

Fitzgerald, E. (2011). *Pacific Ocean Plastic Waste Dump*. https://www.ecology.com/2011/09/10/pacific-ocean-plastic-waste-dump/

Geels, F. (2005). *Technological Transitions and System Innovations: A Co-Evolutionairy and Socio-Technical Analysis*. Edward Elgar Publishing. https://books.google.nl/books?id=SDfrb7TNX5oC&dq=Technological+Transitions+and+System+Innovations:+A+Co-Evolutionairy+and+Socio-Technical+Analysis&lr=&source=gbs_navlinks_s

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. In *Research Policy* (Vol. 31).

Geels, F. W. (2014). Regime Resistance against Low-Carbon Transitions: Introducing Politics and Power into the Multi-Level Perspective. *Theory, Culture & Society*, *31*(5). https://doi.org/10.1177/0263276414531627

Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The Circular Economy – A new sustainability paradigm? *Journal of Cleaner Production*, *143*, 757–768. https://doi.org/10.1016/j.jclepro.2016.12.048

Ghisellini, P., Cialani, C., & Ulgiati, S. (2015). *A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems*. https://doi.org/10.1016/j.jclepro.2015.09.007

Golafshani, N. (2003). The Qualitative Report Understanding Reliability and Validity in Qualitative Research. In *The Qualitative Report* (Vol. 8). http://www.nova.edu/ssss/QR/QR8-4/golafshani.pdf

Gong, Y., Putnam, E., You, W., & Zhao, C. (2019). Investigation into circular economy of plastics: The case of the UK fast moving consumer goods industry. *Journal of Cleaner Production*, *244*. https://doi.org/10.1016/j.jclepro.2019.118941

Gorissen, L., Vrancken, K., & Manshoven, S. (2016). Transition thinking and business model innovation-towards a transformative business model and new role for the reuse centers of Limburg, Belgium. *Sustainability (Switzerland)*, *8*(2). https://doi.org/10.3390/su8020112

Govindan, K., & Hasanagic, M. (2018). A systematic review on drivers, barriers, and practices towards circular economy: a supply chain perspective. *International Journal of Production Research*, *56*,

1–2. https://doi.org/10.1080/00207543.2017.1402141

Guest, G., Bunce, A., & Johnson, L. (2006). How Many Interviews Are Enough?: An Experiment with Data Saturation and Variability. *Field Methods*, *18*(1), 59–82. https://doi.org/10.1177/1525822X05279903

Guldmann, E., Bocken, N. M. P., & Brezet, H. (2019). A Design Thinking Framework for Circular Business Model Innovation. *Journal of Business Models*, *7*(1), 39–70.

Hahladakis, J. N., & Iacovidou, E. (2018). Closing the loop on plastic packaging materials: What is quality and how does it affect their circularity? *Science of the Total Environment*, *630*, 1394–1400. https://doi.org/10.1016/j.scitotenv.2018.02.330

Hekkert, M. P., Suurs, R. A. A., Negro, S. O., Kuhlmann, S., & Smits, R. E. H. M. (2007). Functions of innovation systems: A new approach for analysing technological change. *Technological Forecasting and Social Change*, *74*(4), 413–432. https://doi.org/10.1016/j.techfore.2006.03.002

Henry, M., Bauwens, T., Hekkert, M., & Kirchherr, J. (2019). A Typology of Circular Start-Ups – An Analysis of 128 Circular Business Models. *Journal of Cleaner Production*, 118528. https://doi.org/10.1016/j.jclepro.2019.118528

Hockerts, K., & Wüstenhagen, R. (2009). Greening Goliaths versus emerging Davids-Theorizing about the role of incumbents and new entrants in sustainable entrepreneurship. *Journal of Business Venturing*, *25*, 481–492. https://doi.org/10.1016/j.jbusvent.2009.07.005

Hockerts, K., & Wüstenhagen, R. (2010). Greening Goliaths versus emerging Davids - Theorizing about the role of incumbents and new entrants in sustainable entrepreneurship. *Journal of Business Venturing*, *25*(5), 481–492. https://doi.org/10.1016/j.jbusvent.2009.07.005

Kirchherr, J., Piscicelli, L., Bour, R., Kostense-Smit, E., Muller, J., Huibrechtse-Truijens, A., & Hekkert, M. (2018). Barriers to the Circular Economy: Evidence From the European Union (EU). *Ecological Economics*, *150*(April), 264–272. https://doi.org/10.1016/j.ecolecon.2018.04.028

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, *127*(September), 221–232. https://doi.org/10.1016/j.resconrec.2017.09.005

Korhonen, J., Honkasalo, A., & Seppälä, J. (2018). Circular Economy: The Concept and its Limitations. *Ecological Economics*, *143*(January), 37–46. https://doi.org/10.1016/j.ecolecon.2017.06.041

Lazarevic, D., & Valve, H. (2017). Narrating expectations for the circular economy: Towards a common and contested European transition. *Energy Research & Social Science*, *31*, 60–69. https://doi.org/10.1016/j.erss.2017.05.006

Lewandowski, M. (2016). Designing the business models for circular economy-towards the conceptual framework. *Sustainability (Switzerland)*, *8*(1), 1–28. https://doi.org/10.3390/su8010043

Manninen, K., Koskela, S., Antikainen, R., Bocken, N., Dahlbo, H., & Aminoff, A. (2018). Do circular economy business models capture intended environmental value propositions? *Journal of Cleaner Production*, *171*, 413–422. https://doi.org/10.1016/j.jclepro.2017.10.003

Mishra, JL, Hopkinson, PG, & Tidridge. (2018). Value creation from circular economy-led closed loop supply chains: a case study of fast-moving consumer goods. *Production Planning & Control*, *26*(6), 509–421. https://doi.org/10.1080/09537287.2018.1449245

Neely, A. (2008). EXPLORING THE FINANCIAL CONSEQUENCES OF THE SERVITIZATION OF MANUFACTURING. In *Operations Management Research* (Vol. 1, Issue 2).

Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation: A handbook for visionaries, game changers and challengers. *Journal of Business Management*, *5*(7). http://www.academicjournals.org/AJBM

Paletta, A., Leal Filho, W., Balogun, A.-L., Foschi, E., & Bonoli, A. (2019). Barriers and challenges to plastics valorisation in the context of a circular economy: Case studies from Italy. *Journal of Cleaner Production*, *241*. https://doi.org/10.1016/j.jclepro.2019.118149

Ritzén, S., & Sandström, G. Ö. (2017). Barriers to the Circular Economy - Integration of Perspectives and Domains. *Procedia CIRP*, *64*, 7–12. https://doi.org/10.1016/j.procir.2017.03.005

Rizos, V., Behrens, A., van der Gaast, W., Hofman, E., Ioannou, A., Kafyeke, T., Flamos, A., Rinaldi, R., Papadelis, S., Hirschnitz-Garbers, M., & Topi, C. (2016). Implementation of circular economy business models by small and medium-sized enterprises (SMEs): Barriers and enablers. *Sustainability (Switzerland)*, *8*(11). https://doi.org/10.3390/su8111212

Schneider, F., Parsons, S., Clift, S., Stolte, A., & Mcmanus, M. C. (2018). Collected marine litter-A growing waste challenge. *Marine Pollution Bulletin*, *128*, 162–174. https://doi.org/10.1016/j.marpolbul.2018.01.011

Stewart, R., & Niero, M. (2018). Circular economy in corporate sustainability strategies: A review of corporate sustainability reports in the fast-moving consumer goods sector. *Business Strategy and the Environment*, *27*(7), 1005–1022. https://doi.org/10.1002/bse.2048

Thomas, D. R. (2006). A General Inductive Approach for Analyzing Qualitative Evaluation Data. *American Journal of Evaluation*. https://doi.org/10.1177/1098214005283748

Thomas, E., & Magilvy, J. K. (2011). Qualitative Rigor or Research Validity in Qualitative Research. *Journal for Specialists in Pedriatic Nursing*, *16*, 151–155. https://doi.org/10.1111/j.1744-6155.2011.00283.x

Ünal, E., & Shao, J. (2018). *A taxonomy of circular economy implementation strategies for manufacturing firms: Analysis of 391 cradle-to-cradle products*. https://doi.org/10.1016/j.jclepro.2018.11.291

Urbinati, A., Chiaroni, D., & Chiesa, V. (2017). Towards a new taxonomy of circular economy business models. *Journal of Cleaner Production*, *168*, 487–498. https://doi.org/10.1016/j.jclepro.2017.09.047

van Mierlo, B., & Beers, P. J. (2020). Understanding and governing learning in sustainability transitions: A review. *Environmental Innovation and Societal Transitions*, *34*, 255–269. https://doi.org/10.1016/j.eist.2018.08.002

Veleva, V., & Bodkin, G. (2018). *Corporate-entrepreneur collaborations to advance a circular economy*. https://doi.org/10.1016/j.jclepro.2018.03.196

Vermunt, J. D., & Verloop, N. (1999). Congruence and friction between learning and teaching. *Learning and Instruction*, *9*(3), 257–280. https://doi.org/10.1016/S0959-4752(98)00028-0

Wagner, M., Scherer, C., Alvarez-Munos, D., Brennholt, N., Bourrain, X., & et al. (2014). Microplastics in freshwater ecosystems: what we know and what we need to know. *Environmental Sciences Europe*, *26*(12). https://doi.org/10.1016/0163-8343(83)90040-3

York, J. G., & Venkataraman, S. (2010). The Entrepreneur-Environment Nexus: Uncertainty, Innovation, and Allocation. *Journal of Business Venturing*. https://doi.org/10.1016/j.jbusvent.2009.07.007

Wirtz, B.W.; Pistoia, A.; Ullrich, S.; Göttel, V. Business Models: Origin, Development and Future Research Perspectives. Long Range Plan. 2016, 49, 36–54.

Appendix 1 – Interview guide startups

Introduction

1. What is your role in the company?
2. Could you describe the business model?
3. Could you describe the general sustainability strategy of the company?
4. What are the long-term goals? And how are they measured?
5. How would you describe the company culture regarding sustainable innovation?

Motivation

6. What is the company's purpose? Why did the founders start a company focussed on plastic waste reduction?
7. Is there a trade-off between profit, planet and people?
8. Who in your company is responsible for ongoing innovation?

Current practises

9. What are you currently working on? Internal processes/ expansion plans?
10. What partnerships do you have in place to support these practises?
11. Is collaboration with other actors important in reaching the company goals?

Barriers and enablers

12. What obstacles have you encountered during the startup phase of your business, due to the focus on plastic waste?
13. What has helped during this process?
14. What future barriers and enablers do you foresee?
15. Are you operating in a niche? (How? Plastics recycling is not new)
16. Do you see a market wide transformation?
17. What is your take on incumbents that are implementing initiatives to reduce plastic waste? Are you involved with them in this transition?
18. What is needed to create a circular economy for plastics?

COVID-19

19. How is your organization affected by the COVID-19 pandemic?
20. What actions did you take that you experience as positive and would like to continue?
21. What actions did you take that you experience as negative and would like to end?
22. What new cooperation's developed between yours and other's organizations? What is the purpose of this cooperation?
23. Can you explain why this cooperation started now?
24. Does the COVID-19 crisis positively or negatively influence the transition to a circular economy for plastics and why?

Follow-up

25. What other actors in the plastic field inspire you and why?
26. What other parties/ companies should I talk to and can you connect me?

Appendix 2 – Coding Framework

Code	Description
B1: Current legislation	Innovations are not compatible with existing legislation.
B2: Consumer Culture	Consumers are increasingly individualistic and favour convenience and price.
B3: Greenwashing	Customers have become sceptical towards circular innovations due to greenwashing by incumbents.
B4: Business Case for Circular Plastic	Cheap price of virgin plastic and costs of processing plastic waste and reusable packaging lead to competitive advantage of virgin plastic.
B5: Technical limitations	Innovations are needed to increase circularity rate of plastics. Both to increase recycling rates and to find solutions for reuse.
B6: Current waste management infrastructure	Plastics innovations are often not compatible with the waste management system.
	Enablers for Circular Business Models for Plastics
E1: Entrepreneurial Mission	Company is established with the purpose of battling the plastic waste issue. Profit is a means to this end.
E2: CSR Managers	CSR managers and their sustainability departments within incumbent organisations increase the uptake of circular practises.
E3: Policy	Governmental policy for the circular economy validates circular business models.
E4: Public awareness	Growing attention and sentiment for the environmental issues caused by plastic waste.
E5: Demand for circular products	Increasing demand for circular products and recyclate make circular business models economically viable.
E6: Innovation	Innovations in recycling processes, reuse solutions etc enable new business models.
E7: Facilitated Collaboration	Cooperation between market actors facilitated by a neutral third party enables knowledge exchange and levels playing field.

E8: Supply Chain Collaboration	Cooperation within the supply chain accelerates innovation and supports innovative business models.