TRASH TO TREASURE

A Multiple Case Study of Finnish Companies That Create Economic Value from Waste Materials

Master’s Thesis
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Spring 2018
Abstract

Circular economy, and particularly business models that can facilitate it, is a growing topic in academic literature. However, there have been few case studies to examine how circular economy business models are put into practice. This study fills that gap by studying five Finnish companies that create economic value from waste materials: Durat, which makes solid surface materials with 30% pre-consumer plastic; Finlayson, which makes home textiles and now has product lines made in part from waste materials; UPM, which produces pulp, paper and energy and has a zero solid waste goal that has led to the productization of some industrial byproducts; Palpa, which manages Finland’s take-back system for beverage containers and sells what it collects; and TouchPoint, which makes workwear from sustainable fabrics, including some made from waste materials.

This study uses an exploratory multiple case study research design using heterogeneous sampling to find circular economy trends that transcend individual industries. The interviews and archival materials were analyzed using thematic analysis to identify drivers for companies to adopt circular economy business models and gatekeepers that can either help or hinder the implementation of those models. The findings were positioned within Boons and Lüdeke-Freund’s four business model elements: supply chain, customer interface, financial model and value proposition.

The study found that circular economy initiatives bring different value propositions for the company, its customers, its partners and the environment. New networks and partnerships are essential for implementing circular economy initiatives, and these might be new symbiotic relationships with existing members of the supply or value chain. The role of services is growing in circular economy-minded companies, but those services must make end user participation easy and include a consumer education component. The financial impacts are ambiguous and affect companies differently depending on their structures. Increased costs are possible, but there can also be financial benefits, especially for companies that can attract sustainability-oriented investments and/or for companies explicitly founded on offering sustainable products.

This study also found that business models operate as systems, rather than as a collection of discrete elements as the business model canvas representation suggests, that work together to create a virtuous cycle of ever-rising investments and profits. Sustainable business models (including circular economy ones) are intended to also create a second virtuous cycle of positive environmental change. However, for companies that are part of complex, global supply chains, the definition of material sustainability may be ambiguous because they cannot always identify the ecosystems from which their materials came, thus limiting their positive environmental impacts.

Keywords circular economy, sustainability, business models
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ACKNOWLEDGEMENTS

First of all, I would like to thank the five companies that participated in this study: Durat, Finlayson, UPM, Palpa and TouchPoint. I appreciate their willingness to share time, insights, and documents with me.

Secondly, I would like to thank my supervisor Professor Minna Halme for her guidance throughout the process, as well as to the rest of the Aalto REwood research project team for their support, insight and funding. Professor Mark Hughes, Senior Research Scientist Mika Kuisma, Assistant Professor Gerhard Fink, Yishu Niu and Kaarle Rasi. I would also like to thank Dr. Kennedy Obombo Magio for his guidance as I began the research process.

Additionally, I would like to thank the Aalto Creative Sustainability faculty and my fellow CS students for expanding my thinking about sustainability and supporting me throughout my master’s studies.

Finally, I would like to thank my friends and family for shaping my education in more ways than I can name, starting when I was a little girl watching my mother write her own master's thesis.
1. Introduction

1.1. Background and Context

Human history has been punctuated by periods of transformative technological changes that gave rise to previously unimaginable levels of resource surplus. These surpluses in turn radically altered the way we lived. Our ancestors knew only subsistence living before they discovered that food did not need to be sought, but it could be cultivated instead (Weiss and Bradley, 2001, p.609). The agricultural revolution produced the new phenomenon of surplus yields, which sparked population growth and made trade specialization possible (Weiss and Bradley, 2001, p.609). Civilization was born.

Fast forward to the 19th century, and the discovery of the steam engine and other mechanical technologies kicked off another dramatic shift in the story of surplus: the Industrial Revolution (Mokyr, 1999, p.14). Suddenly, machines could extract and manufacture natural resources faster than the human body could. Increases in productivity brought decreases in price, opening up mass consumer markets in developed societies (Matsuyama, 2002, p.1066). Goods, like kitchen and cleaning appliances, that were once luxury products became seen as necessities (Matsuyama, 2002, p.1038). Industrialization brought down, if not completely, the price barriers to buying things, and digitization has likewise struck a blow to the logistical barriers. The technological revolution has collapsed the purchasing process to mere seconds, making it possible for people to acquire goods without even having to leave their homes.

The ratcheting up of production and consumption surpluses has come at a price, however. The modern capitalist economic system is driven by the primary goal of increasing companies' share values, growth that traditionally requires taking ever more from the environment (Stubbs and Cocklin, 2008, p.103). For many types of natural resources, the rate of extraction has surpassed the rate of renewal, if they renew at all. Using scarce, non-renewable and slowly renewable resources at even moderate rates can be considered 'overconsumption', even when those resources are being used for purely subsistence purposes (Brown and Cameron, 2000, p.29).

The problem of overproduction and overconsumption goes beyond just the pace of resource extraction, however. In the late eighteenth century, the massive material volumes required by
newly industrialized factories broke the two-way flow of materials between producers and consumers, thereby creating the new, and largely urban, problem of trash (Knowlton, 2001, p.1945). Municipal governments, driven by the idea that disease came from ‘filth’, then began developing sanitation services that took trash far from cities, absolving citydwellers of responsibility for their waste and its impacts on the natural environment (Knowlton, 2001, p.1946). Once trash is collected by the municipal truck, the items we choose to acquire are dumped or incinerated, and therefore they no longer feel like our problem. This distance from the sprawling landfills and massive incinerators makes it easier to continue the cycle of buying things and throwing them away, unencumbered by the unpleasant reality of where these things will end up when they break down or lose their appeal.

Our planet is now facing dire natural resource constraints as we continue to consume and discard at a rate beyond that which the planet can handle. According to the planetary boundaries framework, which dictates the safe operating zones for nine planetary indicators, the earth has surpassed the safe zones for both land-use change and climate change, both of which are impacted by the industrial production of physical goods (Steffen et al., 2015, p.736). These changes come at a real cost. The value of all of the life-sustaining activities carried out by the biosphere has been estimated to be at least $33 trillion USD every year (Lovins, Lovins and Hawken, 1999, p.146). This is an old estimate, but the number is still undoubtedly in the trillions of dollars, and as such, there is a long way to fall if we continue stripping the biosphere of its capacity to sustain life. Reducing the use of virgin natural resources can help slow the resource depletion and land-use change that can irreparably damage the ecosystems that keep us alive.

Despite the need to reduce resource consumption, however, the production and consumption of goods is at the heart of the capitalist economic system. Through the years, there have been a variety of frameworks developed to reconcile the need to cut resource consumption with the need to continually grow companies’ shareholder value. These include ecological modernisation, natural capital and triple bottom line (Mol and Sonnenfeld, 2000; Lovins, Lovins and Hawken, 1999; Elkington, 2008). One of the most recent is circular economy, a system in which natural resources are kept in productive use in the economy for as long as possible (Lacy and Rutqvist, 2015, p.xvii). A central element of circular economy is the closing of material loops by using waste materials as inputs in new products (Bocken et al.,
2016, p.309). In their first life cycles, these materials may or may not have ended up in actual products; they may have ended up as byproducts from the manufacturing process.

A key means of keeping resources in productive use for as long as possible is through the use of products and materials for more than one use life. *Multiple life cycle products* are defined by Suhariyanto, Wahab and Rahman as products that 'can experience more than one life cycle', which may have been designed for multiple use lives from the outset (2017, p.678). There are existing design frameworks—such as *cradle-to-cradle, design for disassembly* and *design for recyclability*—that have been the subject of both academic inquiry and guides for implementation in practice (McDonough and Braungart, 2008; Kuo, Huang and Zhang, 2001).

An alternative framework is the concept of *cascading*, which refers to the reuse of a single natural resource over multiple life cycles. According to Fraanje, cascading is 'the sequential exploitation of the full potential of a resource during its use' (Fraanje, 1997, p.21). The inclusion of the word 'sequential' aligns this definition, on the surface, with the definition of multiple life cycle products. The key difference between the cascading and multiple life cycle frameworks is that the former is designed to maximize the use lives of individual raw materials, whereas multiple life cycle maximizes the lifespan of the recoverable materials without prioritizing a particular resource (Suhariyanto et al., 2017, p.693).

An important issue in the viability of using recovered materials in consumer goods is the question of material quality. Suhariyanto et al. posit that technological advancement can improve the quality of each product in a series (2017, pp.679-680). However, this does not take into account the fact that use and reuse can degrade the quality of raw materials, so incorporating reuse and/or remanufacture into the progression of a product series may negate the expected rise in quality brought about by technological improvements. Fraanje's model for cascading is that the cascading process should aim to minimize the negative change in quality during the material's use ($\Delta Q$) and maximize the lifespan per application ($\Delta T$) and overall lifespan ($\Sigma \Delta T$) (1997, p.22). This assumes that the quality of a material can, at best, stay the same between use lives, though it is likely that the quality will get worse.

As companies explore ways to reduce their material use, innovations in design, operations and measurement are essential. However, finding the right business models is of equal
importance. Without an adequate business model, even the best innovation can only generate limited value (Teece, 2010, pp.184-186). Chesborough goes so far as to state that 'it is probably true that a mediocre technology pursued within a great business model may be more valuable than a great technology exploited via a mediocre business model' (2010, p.355).

As Bocken et al. assert, new business models will be an essential part of the circular economy shift because it requires a radical change, and 'the more radical the technical or product innovation, the more challenging and the greater the likelihood that changes are required to the traditional business model' (2016, p.312). The aim of circular economy is to no less than upend the linear flow of resources from extraction to disposal that drives the capitalist economic system, which is indeed a radical change. For traditional, product-based businesses whose growth is built on linear material flows, they need to continually sell more and more goods. In this model, increasing sales requires increasing the input of virgin materials. In a circular economy model, businesses need to divorce their ability to grow their profits from the need to increase their input of virgin materials. This requires business model innovation.

Institutions within Europe, particularly in Finland, have made circular economy a priority. In 2015, Luxembourg, the European Commission and the European Investment Bank opened €24 billion in financing for 'higher-risk, yet innovative sustainable business models and plans', including ones that enable the transition to circular economy (European Investment Bank, 2015). The European Union also has over €6 billion in funds available for circular economy initiatives, with a special focus on closing material loops and extracting value from waste (European Commission, 2018). Finland was the first country in the world with a national circular economy plan, entitled National Road Map for the Circular Economy 2016-2025, developed by the Finnish Innovation Fund Sitra and honored at an event held in conjunction with the 2018 World Economic Forum in Davos, Switzerland (Sitra, 2018a). The Finnish Ministry of Economic Affairs and Employment has set aside funds, €2 million for 2018 and €2 million for 2019, for discretionary government transfers to fund company circular economy initiatives (Finland Ministry of Economic Affairs and Employment, 2018).

1.2. Research Objective

The objective of this study is to find out how companies create economic value from waste materials in practice. Specifically, I will be examining how the construction of circular
economy business models differs between theory and practice, with an aim of uncovering what specific *drivers* (internal motivations for change) and *gatekeepers* (internal or external phenomena that can serve as either enablers or barriers) exist in the implementation of those business models. I chose to combine enablers and barriers into the singular unit of 'gatekeepers' to avoid redundancy, because the presence of every element X that enables business model transitions has a corresponding barrier, the absence of element X. Additionally, I will analyze how the business logic for circular economy models differs from that of conventional business models.

1.3. Research Questions

To fulfill the research objective, I will be examining the following research questions:

- Research question: What are the components of circular economy business models in practice, and how do they differ from conventional business models?
- Empirical research question: What are the main drivers and gatekeepers, both internal and external, that influence the case companies’ ability to create value from waste materials?

1.4. Research Gap and Limitations

Practice is often ahead of the academy in sustainable business model innovation, of which circular economy business models are a subset, so studying real-life cases is a valuable means of contributing to academic discourse (Bocken et al., 2014, p.47). Although this topic is a growing and quickly evolving area of inquiry, 'little effort has been spent' studying how sustainable business models are actually implemented (Evans et al., 2017, p.605). The recurring use of the same companies (i.e. Interface Inc., which sells office carpet tiles) over and over again in sustainable business model literature illustrates the need for new examples from practice to ground theory in practice (Stubbs and Cocklin, 2008, p.104; Bocken et al., 2014, p.49; Boons and Lüdeke-Freund, 2013, p.12).

As Zink and Geyer state, the 'economy' aspect is often missing in circular economy discourse (2017, p.596). As a variety of scholars point out, business models require more than financial considerations in order to be successful (Osterwalder, 2004; Johnson, Christensen and Kagermann, 2008). Studying a company’s holistic business model can give a clearer picture
behind the inner-workings of the company than could a financial analysis alone. There is a particular need for the study of business models of companies that put circular economy concepts into practice to illustrate how these models may differ than those of companies that use linear resource flows. Thus, this study will focus on how Osterwalder's *business model canvas* framework framework is impacted by the implementation of circular economy business models (Osterwalder, 2010). It also builds on Boons and Lüdeke-Freund's normative requirements for sustainable business models (2013, p.13).

Additionally, this study will contribute to the understanding of how and why companies adopt circular economy business models. Shedding light on what drives companies to close material loops, in this case by creating financial value from waste materials, can contribute to understanding what conditions and incentives can drive other companies to make similar decisions to adopt circular economy business models in the future. By analyzing how and why five companies chose to close material loops and what comprises their business models, this study contributes to filling the gaps identified above.

The main limitation of this study is that the use of heterogeneous sampling makes it impossible to isolate specific variables that impact particular industries or companies of a specific structure. Additionally, the lack of quantitative data about material and financial flows prevents the validation of the impact the companies' circular economy initiatives have on their profitability and on actual environmental systems.

2. Literature Review

The following literature review was conducted using the databases Web of Science, Aalto Finna and Google Scholar. The search terms used were 'business model', 'sustainable business model', 'circular economy', 'circular economy business model' and linguistic variants of the same terms (i.e. 'sustainability business model'), with and without wildcard characters. Additional literature was drawn from the bibliography of reviewed literature.
2.1. How do companies build business models that create financial value from waste materials?

2.1.1. Conventional Business Models

The concept of the *business model* began to gain prominence in academic literature in the 1990s during the rise of internet enterprises (Zott, Amit and Massa, 2011, p.1022). In the past decade, business model research has been a growing field of academic inquiry (Zott et al., 2011, p.1022). A search in EBSCOhost’s Academic Search Elite and Academic Search Ultimate databases, which span from 1985 to 2017, for 'business model*' conducted in December 2017 yielded 21,189 results in academic journals, of which 14,415 were published between 2008 and 2018. Despite the explosion of literature in recent years, there is still no clear consensus on what a business model actually is (Zott et al., 2011, pp.1022-1023).

The most cited paper about business models that does not exclusively deal with e-businesses, which are not relevant for the purposes of this study, is Teece’s 2010 paper 'Business models, business strategy and innovation'. Teece defines business models as 'organizational and financial "architecture"' that is designed to meet a certain customer need, outline the revenue-generating mechanism and identify a market entry approach for a particular offering' (2010, pp.173-174, 192). In addition to these essential elements, Teece argues that the other critical factor in a business model’s success is making it as difficult as possible for competitors to imitate (2010, p.192).

Teece’s focus is primarily on the role of business models in facilitating the value capture of firms’ innovations. He asserts that without the proper business model, the value capture potential for even the best innovations is limited (Teece, 2010, pp.184-186). Designing products that use waste materials as inputs necessarily requires innovation, and by Teece’s logic, the business models that will bring those innovations to market are essential. Additionally, Teece’s assertion that businesses should always be innovating on their business models supports the notion that companies can, and should, look at new business models (like business models that involve using waste as an input) even when their existing models seem to be working just fine (2010, p.187)

While Teece focuses on business models holistically and their ability to drive innovation, other scholars have focused on breaking the business model into a standardized set of
component parts. The business model framework that has had perhaps the greatest influence on both research and practice has been Osterwalder’s business model canvas. The business model canvas is a mapping tool that gives companies a visual snapshot of how the various elements of their business models work together to form a cohesive whole. The business model canvas framework asserts that there are nine elements that make up a business model, as visualized in Figure 1: 'customer segments', 'value propositions', 'channels', 'customer relationships', 'revenue streams', 'key resources', 'key activities', 'key partnerships' and 'cost structure' (Osterwalder and Pigneur, 2010, pp.16-17).

<table>
<thead>
<tr>
<th>Key partners</th>
<th>Key activities</th>
<th>Value propositions</th>
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<th>Cost structure</th>
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Figure 1: Visualization of Osterwalder and Pigneur’s business model canvas (2010)

This business model framework was first introduced in Osterwalder’s Ph.D. dissertation in 2004, and the business model canvas mapping tool was popularized in the 2010 practitioner guide Business model generation: A handbook for visionaries, game changers, and challengers (Osterwalder, 2004; Osterwalder and Pigneur, 2010). According to Google Scholar, Osterwalder and Pigneur’s 2010 Business model generation has been cited in 6,372 books and papers (Google Scholar, 2017). Despite the influence of the business model canvas both inside and outside of academia, however, it is not without critique. Chesborough stated that business model mapping tools can visualize business models but cannot themselves drive experimentation or innovation (2010, p.340). However, since this critique was in a 2010 paper, it does not include Osterwalder’s business model canvas specifically.
Johnson, Christensen and Kagermann consolidate Osterwalder's elements, along with several additions, into a framework that identifies four central components of business models: 'customer value proposition', 'profit formula', 'key resources' and 'key processes' (2008, pp.60-61). These categories are comprised of the following sub-elements:

- 'Customer value proposition: target market, job to be done, offering'
- 'Profit formula: revenue model, cost structure, margin models, resource velocity'
- 'Key resources: people, technology, products, equipment, information, channels, partnerships, alliances, brand'
- 'Key processes: processes, rules and metrics, norms' (Johnson et al., 2008, pp.60-61)

While many of these elements overlap with the elements identified by Osterwalder, of particular interest to the question of how companies decide to use waste materials as an input is the inclusion of 'resource velocity' in this framework. Johnson et al. define resource velocity as 'how quickly resources need to be used to support target volume' (2008, p.62). The availability of adequate-quality waste materials may be less reliable than that of virgin materials, so resource velocity is an element that may be particularly impacted by the decision to use waste as an input.

Resource velocity was identified as a source of business model lock-in in Chesborough’s study of innovation at Xerox, which produces heavy office equipment like copy machines. However, Chesborough never actually uses the term 'resource velocity' itself. At the time of the study, Xerox primarily generated its profits through the sale of ink and toner rather than the sale of the copy machines themselves. It was therefore in their best interest to invest in faster and faster machines that could churn out more copies in less time, which would increase the rate of toner and ink sales. This was in the early days of the internet and personal computing, however, and this locked-in bias toward a certain resource velocity prevented them from seeing opportunities for tech that would require different business models (Chesborough, 2010, pp.355-356). Additionally, the locked-in business model had clear negative sustainability implications since it relied on the rapid and relentless consumption of raw materials.

Doganova and Eyquem-Renault question the utility of business models as objective representations of reality, positing that by contrast, they cannot be viewed through such an
essentialist lens, particularly in the case of new enterprises (2009, p.1560). Instead, Doganova and Eyquem-Renault see business models as 'market devices' that guide the 'socially-situated practices of calculation and decision-making' (2009, p.1561). They posit that business models are largely demonstrational tools, like scale architectural models, whose primary functions are 'narrative' and 'calculative' (Doganova and Eyquem-Renault, 2009, pp.1568-1569). They assert, though, that while business models are largely performative, they are not merely 'passive representations' (Doganova and Eyquem-Renault, 2009, p.1568). Although Doganova and Eyquem-Renault’s study predates Osterwalder’s business model canvas, that particular tool (and the related spinoffs that have since emerged) can be seen as a visual platform on which the performative function of business models can be executed.

2.1.2. Sustainable Business Models

Academic discourse on market-based solutions to environmental problems has developed its own strain of business model literature. Use of the term 'sustainable business model' to describe business activities that have positive environmental and/or social impacts was coined by Stubbs and Cocklin in their 2008 article 'Conceptualizing a "Sustainable Business Model"'. This article is comprised of two case studies, one of multinational carpeting company Interface Inc. and the other of Australian Bendigo Bank. Both companies were selected because they were seen as leaders in sustainability at that time. Interface was viewed as being a leader in transitioning core business activities to advance sustainability goals. Bendigo was deemed Australia's 'Most Sustainable Company' in 2001 and 2002 by Ethical Investor Magazine (Stubbs and Cocklin, 2008, p.107).

Stubbs and Cocklin's case studies are rooted in ecological modernization, which, according to Mol and Sonnfeld, is characterized by a focus on technological innovation as a means of environmental improvement, criticism of the bureaucratic state, belief in the role of market dynamics and actors in environmental change, a systems thinking perspective with a limited view of individual human agency, and a disposition toward analyses at the level of the nation-state (2007, pp.4-5). Stubbs and Cocklin do not themselves define ecological modernization so clearly in their paper, and seem to compensate for not doing so by acknowledging the lack of consensus among various researchers on what ecological modernization means. However, their analysis reflects Mol and Sonnfeld's definition,
particularly the aspects relating to system thinking and the belief in market dynamics as positive environmental change agents.

This methodology for this paper is rooted in abductive reasoning, which, according to Blaikie, aims to draw 'expert accounts' from the everyday experience of social actors by assembling hidden fragments of meaning (2007, p.107). They conducted 24 interviews with staff members from across functionalities at both companies, and coded the interviews using grounded-theory coding methods, both 'in vivo' codes and the consolidation of words into concepts (Stubbs and Cocklin, 2008, pp.107-109). From there, they aimed to develop 'ideal types', which, according to Weber, allow social scientists to construct abstract concepts from actual events, though Weber acknowledges that ideal types are not perfect representations of phenomena in practice (Blaikie, 2007, pp.91-92).

While Stubbs and Cocklin were the first to use the term 'sustainable business model', the most cited paper on the subject is from Boons and Lüdeke-Freund. Their 2013 paper 'Business models for sustainable innovation: State-of-the-art and steps towards a research agenda' takes a different approach than Stubbs and Cocklin by examining business sustainability through an innovation lens rather than through an ecological modernization lens. However, echoes of ecological modernization come through in Boons and Lüdeke-Freund's study, particularly in their belief in technological innovation and market actors as potential drivers of positive ecological change. Boons and Lüdeke-Freund divide the literature into three innovation streams: technological, social and organizational (2013, p.10).

In comparing Boons and Lüdeke-Freund, the most influential paper on sustainable business models, with Stubbs and Cocklin, the first to use that term, it is clear how the discourse evolved in the five years between the two articles' publications. Stubbs and Cocklin do not cite a single piece of literature explicitly on business models. Although some of the business model research that is today seen as seminal—including highly cited publications by Teece, Chesborough, Zott and Amit and Osterwalder—were not released until after 'Conceptualizing a "Sustainable Business Model"', some of these authors, notably Chesborough and Osterwalder, had published works explicitly about business models before 2008.

Boons and Lüdeke-Freund, by contrast, draw heavily from business model literature, and indeed posit that their study fills a gap in the existing sustainability innovation literature,
which they claim generally does not incorporate business model elements but rather treats companies as 'black box[es]' (2013, p.11). On the methodological front, it is interesting that the Interface case reappears over and over again in the literature. Along with the two studies mentioned above, it also appears in Bocken et al.'s seminal study on business model archetypes (discussed below), which references Interface founder Ray Anderson's 2011 book, co-written with Robin White, *Business Lessons from a Radical Industrialist*. The use of the same case example over and over suggests that there may be limited options to choose from in practice, which is one a gap the present study intends to fill.

Nonetheless, Bocken et al. assert that practice is ahead of the academy, which is why their study – the second-most cited sustainable business model study after Boons and Lüdeke-Friedrich's – is anchored around examples found in practice (2014, p.47). Indeed, even in the case of Interface, their decision to cite Anderson's own book rather than academic studies of the company (such as Stubbs and Cocklin's) reinforces this preference of drawing from industrial practice instead of from scholarly work.

Although they aim to develop a set of typologies, Bocken et al. do not adopt a similar use of Weber's ideal type framing in assembling the archetypes. Bocken et al.'s literature and practice review used a grounded theory coding methodology like Stubbs and Cocklin's (2014, p.47). Without the interview component, however, Bocken et al. do not have the social data necessary for abductive reasoning and, by extension, for adopting a Weberian approach to constructing ideal types.

The definitions of each individual archetype and the reasoning for inclusion are limited, with only a few paragraphs dedicated to each. Bocken et al. offer four suggested strains for future research on this topic: 'technology and innovation', 'the importance of taking a system-wide perspective', 'introducing innovative approaches to collaboration' and 'the role of education and awareness' (2014, p.55). Interestingly, none of these particularly lend themselves to the expansion of the individual archetypes using social data from practitioners, despite their assertion that practitioners are ahead of the academy and therefore an important subject of study.

Bocken et al.'s study uses a literature and practice review methodology to develop sustainable business model archetypes, which their literature review found was missing in scholarly
discourse at that time (2014, p.47). In the literature review phase, they already began identifying emerging themes, such as 'creating value from waste' and 'social enterprise solutions', which informed the final archetypes resulting from the study (Bocken et al., 2014, p.46). In exploring conceptual frameworks, they looked at sustainability frameworks like Elkington's triple bottom line, business model frameworks like Osterwalder's business model canvas, and Stubbs and Cocklin's stakeholder perspective (Bocken et al., 2014, pp.46-47). However, the authors found that these frameworks did not 'provide a framework for guiding future innovation activities' (Bocken et al., 2014, p.47). Instead, they adopted Boons and Lüdeke-Freund's three innovation streams: technological, organizational and social (Boons and Lüdeke-Freund, 2013 cited in Bocken, 2014, p.47).

Bocken et al. present eight different sustainable business model archetypes divided into Boons and Lüdeke-Freund’s three innovation categories. The archetypes are:

- Technological: 'Maximise material and energy efficiency', 'Create value from waste', 'Substitute with renewables and natural processes'
- Social: 'Deliver functionality rather than ownership', 'Adopt a stewardship role', 'Encourage sufficiency'
- Organizational: 'Repurpose for society/environment', 'Develop scale up solutions' (Bocken et al., 2014, p.48)

Each archetype includes examples pulled from literature and practice, though none of the archetypes is developed robustly. Additionally, they leave room for fluidity, mentioning in the end that some archetypes may need to be combined in practice (Bocken et al., 2014, p.54). In leaving room for new configurations and focusing on innovation more than on business model literature, Bocken et al. seem to be following the thought of Boons and Lüdeke-Freund, built on Doganova and Eyquem-Renault's questioning of the usefulness of business models, that it 'doesn't make sense to try and pin down the exact business model' of a firm (Boons and Lüdeke-Freund, 2013, p.17). Curiously, though, Bocken et al. do not cite Doganova and Eyquem-Renault directly despite the influence of their 2008 paper.

This fluidity of the archetypes also potentially negates the concern raised by Teece about ensuring that business models are not imitable, since presenting archetypes publicly could hurt the competitive advantage of businesses using them. Although Bocken et al. include
Teece in defining what business models mean, they do not address this particular point. However, the creation of new markets, as the *blue ocean* framework suggests, can be more profitable than competing in crowded existing markets (Kim and Mauborgne, 2008).

### 2.1.3. Circular Economy Business Models

Since the publication of Bocken et al., more sustainable business model frameworks have emerged, particularly around circular economy. The management consulting company Accenture has its own framework for circular economy business, which is comprised of five business models: 'circular supply chain', 'recovery and recycling of waste', 'product life extension', 'sharing platforms' and 'product as a service' (Lacy and Rutqvist, 2015, pp.xxii-xxv). These frameworks align closely with Bocken’s archetypes and the subcategories within those archetypes, and they even use some of the same terminology, like 'product as a service'.

![Diagram](image.png)

*Figure 2: Circular economy business models are a type of sustainable business model, which in turn are one subset of the broader business model framework.*

Nussholz attempts to reconcile the disparate definitions of circular business models by offering a new definition in the paper 'Circular Business Models: Defining a Concept and Framing an Emerging Research Field'. Nussholz evaluated literature with an explicit focus on circular economy business models, found using the search terms 'circular business model', 'business models for circular economy', 'business models for remanufacturing', and 'closed-loop business models' (2017, p.2). Other related search terms were omitted to manage
the scope of literature, though, as acknowledged in the paper, with this decision came the risk of missing other relevant research.

**Material-oriented models**

In reviewing circular business model literature, Nussholz makes the observation that even the definition of 'closing the loop' – a central concept in circular economy that refers to using waste materials as inputs for new products – differs from researcher to researcher. Bocken et al. distinguish between 'slowing resource loops' and 'closing resource loops'. They define *slowing resource loops* as slowing the input of resources in the product development process by extending product life spans which, at least in theory, would reduce the frequency with which consumers would purchase new replacements (Bocken et al., 2016, p.309). *Closing resource loops* is defined by Bocken et al as the process of inputting 'post-use' materials into the production process, which would reduce (or ideally eliminate) the extraction and input of virgin materials (Bocken et al., 2016, p.309). Additionally, these two concepts can be combined, and they offer four different representations for the flow of materials through the product life cycle: *linear flows*, the conventional flow of materials from production process to disposal without being used as inputs for new products; *circular flows* that close resource loops; *life extension – linear*, which slows resource loops without closing them; and finally *life extension – circular*, in which resource loops are both slowed and closed (Bocken et al., 2016, p.309).

Bocken et al.’s definition of closing material loops as simply inputting post-use materials into the production process does not clarify whether materials should be returned to the primary production process to be used in the same products they were used in during their first use lives, or if the flow of post-use materials to other types of products can also be considered 'closing the loop'. The latter definition overlaps with Fraanje’s description of *cascading*, begging the question of how the concepts of cascading and closing material loops relate to one another. Using Bocken et al.’s loose definition of closing material loops, the concept of cascading could be seen as a sub-concept of closing material loops. Alternatively, closing material loops could be defined as returning materials into the primary production process from which they came, and cascading could be defined as inputting post-use materials to production processes for different product types.
Willskytt et al. take a more nuanced approach to defining 'closing the loop', which addresses the question of cascading versus closing material loops. They offer five different categories for what closing material loops can look like: closed-loop reuse, giving a product another use life with minimal interventions between use lives; open-loop reuse, the use of a product for another use life in a completely different context, likely because of material degradation during the first use life; remanufacturing and repair, the return of a product's original functionality through reassembly, exchanging components and/or aesthetic upgrades; functional recycling, extracting the materials from a product and using them for the same purpose in the materials' second use lives; and non-functional recycling, the use of materials for different purposes in their second use lives, generally because the materials no longer retain their original functional properties (Willskytt et al., 2016, pp.7-8). Non-functional recycling can either mean downcycling to uses with lower value or upcycling to uses with higher value.

Because the present study focuses specifically on the flow of materials and not that of whole products, I will use an adaptation of Bocken et al., Fraanje and Willskytt et al.’s frameworks to define material flows in the scope of this study, as outlined in Figure 3.

**Figure 3: Definitions of five types of material flows, arranged from most sustainable to least** (Adapted from Bocken et al., 2016 and Fraanje, 1997). The most sustainable flows replace virgin inputs into the product lines from which they came since this guarantees the reduction of virgin material use, and for everything else, the priority is keeping the material in use for the highest-value purposes.

**Product-oriented models**

Whereas Bocken et al., Fraanje, and others take a material-centric approach to categorizing material flows, Wells and Seitz take a product life cycle approach. They offer four different flows of waste from various stages in a product’s use life back into production processes,
illustrated in Figure 4. The four flows are: internal flows of a company’s production waste back into its own production process, post-business flows of a company’s production waste into a second company’s production process, post-consumer flows from users into a company’s production process, and post-society flows of materials from disposal systems (such as household recycling collection services) into production processes (Wells and Seitz, 2005, p.250). For the latter three flows, reverse logistics systems are necessary to transport used materials to the manufacturer. Materials input at any of these stages may need an additional reprocessing step to alter the material state before being entered into production processes.

Figure 4: The four flows of waste products (Adapted from Wells and Seitz, 2005).

Circular Economy Components

A variety of frameworks have emerged in academic discourse outlining necessary components for business models that facilitate the adoption of circular economy principles.
Table 1: A selection of circular economy definitions from academic literature.

<table>
<thead>
<tr>
<th>AUTHOR</th>
<th>CIRCULAR ECONOMY DEFINITION</th>
<th>CIRCULAR BUSINESS MODEL COMPONENTS AND STRATEGIES</th>
</tr>
</thead>
</table>
| Ellen MacArthur Foundation (ReSOLVE framework) | 'The circular economy is defined as an economy that provides multiple value-creation mechanisms which are decoupled from the consumption of finite resources' (Ellen MacArthur Foundation, 2015, p.23) | 1. **Regenerate:** Use renewable energy and materials, return biological materials to the biosphere  
2. **Share:** Create long product loops by facilitating product reuse, designing for durability, and offering maintenance services  
3. **Optimize:** Make products material efficient and remove waste from the supply chain  
4. **Loop:** Close material loops through remanufacturing (recycling is seen presented as a 'last resort')  
5. **Virtualize:** Transition to selling digital products instead of physical ones  
6. **Exchange:** Switch to more advanced materials (including non-renewable ones), new manufacturing tools like 3D printing, and new products and services (Ellen MacArthur Foundation, 2015, pp.25-26) |
| Bocken et al.                                | 'Circular business models thus can enable economically viable ways to continually reuse products and materials, using renewable resources where possible' | 1. **Access and performance model:** Offer product capabilities without requiring ownership  
2. **Extending product value:** Extending value of products throughout the product’s life |
<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td><strong>Classic long-life model:</strong> Product designed for durability with complementary repair and/or maintenance services.</td>
<td>(Bocken et al., 2016, p.308)</td>
</tr>
<tr>
<td>4.</td>
<td><strong>Encourage sufficiency:</strong> Aim to reduce end-user consumption through design, service, sales, and marketing techniques.</td>
<td>(Bocken et al., 2016, p.313)</td>
</tr>
<tr>
<td>5.</td>
<td><strong>Extending resource value:</strong> Collect and create value from waste materials.</td>
<td>(Bocken et al., 2016, p.313)</td>
</tr>
<tr>
<td>6.</td>
<td><strong>Industrial symbiosis:</strong> Use residual materials from one production process as input for another process, aided by geographic proximity.</td>
<td>(Bocken et al., 2016, p.313)</td>
</tr>
<tr>
<td>1.</td>
<td><strong>Sales model:</strong> Shift to selling services and adding product take-back</td>
<td>(Laubscher and Marinelli, 2014, p.1)</td>
</tr>
<tr>
<td>2.</td>
<td><strong>Product design/material components:</strong> Design to maximize high-quality reuse.</td>
<td>(Laubscher and Marinelli, 2014, p.1)</td>
</tr>
<tr>
<td>3.</td>
<td><strong>IT/data management:</strong> Ability to track product, component and material data</td>
<td>(Laubscher and Marinelli, 2014, p.1)</td>
</tr>
<tr>
<td>4.</td>
<td><strong>Supply loops:</strong> Gain additional value from material flows by recovering own assets and using recycled assets.</td>
<td>(Laubscher and Marinelli, 2014, p.1)</td>
</tr>
<tr>
<td>5.</td>
<td><strong>Strategic sourcing from own operations:</strong> Build long-term partnerships with suppliers and customers.</td>
<td>(Laubscher and Marinelli, 2014, p.1)</td>
</tr>
<tr>
<td>6.</td>
<td><strong>HR/incentives:</strong> Implement company culture shift and</td>
<td>(Laubscher and Marinelli, 2014, p.1)</td>
</tr>
</tbody>
</table>
| Mentink  
*Business Cycle Canvas framework* | 'A circular economy is an economic system with closed material loops'  
*(Mentink, 2014, p.14)* | **Components:**  
1. **What** (value proposition)  
2. **Who** (key partners and customer segments)  
3. **How** (key resources and key activities)  
4. **Why** (revenues and costs)  
**Flows:**  
1. **Material**  
2. **Information**  
3. **Financial**  
*(Mentink, 2014, p.61)* |
| Lewandowski | 'The transition to the circular economy entails four fundamental building blocks—materials and product design, new business models, global reverse networks, and enabling conditions'  
*(Lewandowski, 2016, p.1)* | 1. **Partners:** Cooperative networks, types of cooperation  
2. **Activities:** Optimizing performance, product design, lobbying, remanufacturing, recycling, technology exchange  
3. **Key resources:** Better-performing materials, regeneration and restoring of natural capital, virtualization of materials, retrieved resources  
4. **Value proposition:** Product-service system, circular products, virtual service, incentives for customers in take-back system |
There is a clear divide between the design-oriented definitions and business-oriented definitions of circular economy business models. The Ellen MacArthur Foundation and Bocken et al. use definitions that focus primarily on the role of product design in facilitating the implementation of circular economy principles. Laubscher and Marinelli, Mentink and Lewandowski, in contrast, present definitions that are all rooted primarily in business operations. Lewandowski and Mentink both use Osterwalder’s business model canvas to examine the implementation of a circular economy business models. Lewandowski’s circular business model canvas offers a breakdown of how implementing circular economy business
models impacts each of the business model canvas elements (2016, pp.20-21). However, a limitation of Lewandowski’s model is that it is constructed entirely from theory, and given the scarcity of empirical studies on implementation of circular economy business models in practice, building a model entirely from theory risks having very little grounding in practice.

2.2. What are the main drivers and gatekeepers, both internal and external, that influence the case companies’ ability to create value from waste materials?

2.2.1. Conventional Business Model Drivers and Gatekeepers

Adopting new business models can require substantial investments of time and capital (Amit and Zott, 2012, p.41). Therefore, the transition to new business models has become an area of interest for both scholarly and practitioner-oriented study. In a 2012 article in MIT’s Sloan Management Review, Amit and Zott posit that business model innovation can happen through three different avenues: new activities, novel linkages of existing activities and changing which parties carry out certain activities (2012, p.44). Using these frame, there are four 'value drivers' that they have identified for business model innovation: 'novelty', 'lock-in', 'complementarities' and 'efficiency' (Amit and Zott, 2012, pp.45-46).

Since this article was published in the Sloan Management Review, a publication aimed at practitioners, Amit and Zott offer actionable advice for companies thinking about business model change. They suggest that companies looking to transition to new business models ask themselves the following six questions first:

1) 'What perceived needs can be satisfied through the new model design?'
2) 'What novel activities are needed to satisfy these perceived needs?'
3) 'How could the required activities be linked to each other in novel ways?'
4) 'Who should perform each of the activities that are part of the business model?'
5) 'How is value created through the novel business model for each of the participants?'
6) 'What revenue model fits with the company’s business model to appropriate part of the total value it helps create?' (Amit and Zott, 2012, p.47)

These questions are particularly useful because they go beyond the simple dissection of a business model into its component parts, as is done with Osterwalder’s business model
canvas, and instead help companies assess the linkages between those parts and the actors that carry them out.

2.2.2 Sustainable Business Model Drivers And Gatekeepers

Stubbs and Cocklin analyze their findings by categorizing sustainability-related attributes of each business as either 'structural' or 'cultural'. Structural elements are processes, structures and practices, while cultural elements are norms, values and behaviours (2008, p.113). After coding and classifying, the result is several tenets about what constitutes a sustainable business model. These are:

- The inclusion of social, economic and environmental aspects of sustainability
- The use of triple-bottom line performance indicators
- The consideration of all stakeholders rather than just shareholders
- The inclusion of nature as a company stakeholder
- The leadership of 'champions' to push sustainability initiatives and restructuring
- The use of both systems-wide and company-level views (Stubbs and Cocklin, 2008, pp.121-122)

In their analysis, they define 'business models' as having four distinct elements, in contrast to Osterwalder's nine. Boons and Lüdeke-Freund's business model components, drawn from Osterwalder and Doganova and Eyquem-Renault, are: 'value proposition', 'supply chain', 'customer interface' and 'financial models' (2013, p.10).

Boons and Lüdeke-Freund identify normative requirements for each of these elements that can facilitate the transition to more sustainable business models. For the value proposition, they posit that sustainable business models must have measurable environmental, social and economic impacts (Boons and Lüdeke-Freund, 2013, p.13). They also acknowledge the tension that companies must negotiate between the market's desire for optimally functioning products at low prices with the potential concessions that may be necessary to make the product more sustainable (Boons and Lüdeke-Freund, 2013, p.16). After this tension is negotiated, companies must look at supply chain 'dependencies and locked-in infrastructures' to see how they can align with suppliers to achieve their sustainability goals without passing off their sustainability 'burdens' (Boons and Lüdeke-Freund, 2013, pp.13, 16).
For the customer interface, they state that sustainable business models should encourage customers to take responsibility for their consumption (Boons and Lüdeke-Freund, 2013, p.13). They also acknowledge that companies can either maintain existing 'linear mass-production' models or that they can transition to co-creation approaches (Boons and Lüdeke-Freund, 2013, p.16). However, because customer interest in being involved in production can vary greatly across product types and user groups, it is essential that companies understand how involved their customers want to be in the design and/or production process before switching to co-creation models. Finally, they posit that companies need to switch their financial models from selling products ('price-per-unit') to selling value ('jobs-to-be-done') (Boons and Lüdeke-Freund, 2013, p.16).

Boons and Lüdeke-Freund draw on Doganova and Eyqæm-Renault's insight about the performativity of business models to assert that not defining business models so rigidly can in fact be a good thing because business model 'lock-in' can be a barrier to innovation (2013, p.17). They even go so far as to say that the ambiguity around what 'sustainability' actually means can be an asset for the same reasons (2013, p.17). However, this opens a question: Can a patchwork of disparate sustainability definitions, or non-definitions, collectively add up to the sort of global change needed to keep consumption within the limits set by the planetary boundaries framework?

Schaltegger, Lüdeke-Freund and Hansen adapt an evolutionary economics approach to market transformations toward more sustainable ways of doing business. They build their framework on the three steps of the biological evolution process, which have been adapted to social evolution as well: variation (the process of innovation), selection (the success or failure in the market) and retention (the survival of selected models over time) (Schaltegger, Lüdeke-Freund and Hansen, 2016, pp.273-274). They assert that of these three, the most important phase for sustainable business is retention, which evolutionary economics states can be driven by growth, replication, mimicry or mergence (Schaltegger et al., 2016, p.275).

In the variance phase, the most relevant phase to the present study on the drivers of business model change to create economic value from waste materials, the innovation process can be abetted by business model mapping tools, which lets teams quickly visualize different options for business model change. However, Chesborough’s critique of mapping tools applies to sustainability mapping tools as well, so they can only be viewed as an accessory to
innovation rather than the catalyst of innovation. One business model mapping tool that explicitly builds off of Osterwalder’s business model canvas is Joyce and Paquin’s *triple layered business canvas*. The triple layered canvas adds environmental and social sustainability dimensions to Osterwalder’s original canvas (Joyce and Paquin, 2016). Their framework proposes utilizing a joint set of three canvas documents – Osterwalder’s original business model canvas, the environmental canvas and the social canvas – each of which contains related elements in the same places on the canvas visualization. The environmental canvas, which is the most relevant of Joyce and Paquin’s three canvases for the scope of the present study and is visualized in Figure 5, consists of nine elements: ‘supplies and out-sourcing’, ‘production’, ‘materials’, ‘functional value’, ‘end-of-life’, ‘distribution’, ‘use phase’, ‘environmental impacts’ and ‘environmental benefits’ (Joyce and Paquin, 2016, pp.1477-1479).

<table>
<thead>
<tr>
<th>Supplies and outsourcing</th>
<th>Production</th>
<th>Functional value</th>
<th>End of life</th>
<th>Use phase</th>
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<td>Materials</td>
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<td>Distribution</td>
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<td>Environmental impacts</td>
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<td>Environmental benefits</td>
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*Figure 5: Visualization of Joyce and Paquin’s environmental business model canvas (2016, pp.1477-1479).*

Schaltegger, Lüdeke-Freund and Hansen offer their own framework for what pathways companies need to consider in the variance phase to get to one of the four drivers of retention. They state that businesses need to look for:

- ‘Scalability: BMs [business models] that can be scaled without rebound effects’
- ‘Replicability: BMs that can be replicated without cannibalization’
- ‘Integrability: BMs that can be merged with existing organizations’
• 'Imitability: BMs that can be imitated and adapted by others' (Schaltegger et al., 2016, p.275)

It is important to note that because their focus is on market-level transformation toward sustainability rather than firm-level, they include imitability even though, as Teece points out, on the firm level imitability can hurt competitive advantage (2010, p.192). The other three elements, though, can potentially be used in conjunction with business model mapping tools to provide the strategic 'how' to complement the mapping tools' 'what'. However, it is also important to note that their market-level focus on replication without cannibalization is not meant to be extended to the firm level, where a company's sustainable business model should ideally overtake its non-sustainable models to avoid the latter negating the positive impacts of the former.

2.2.3. Circular Economy Business Model Drivers and Gatekeepers

In a study that draw on both theoretical and 'grey literature' sources (primarily from institutions such as the United Nations Environment Programme, United Nations Department of Economic and Social Affairs, World Economic Forum, European Commission and Ellen MacArthur Foundation) de Jesus and Mendonça present four categories of enablers and barriers in the adoption of circular economy business models (2018, pp.77-79). The first are 'technical factors', which impact companies' ability to make the chemical and/or mechanical changes necessary to reuse waste materials as product inputs (de Jesus and Mendonça, 2018, p.81). The next is 'economic/market/financial factors', which are the elements that influence whether a company can actually make money off of circular economy initiatives (de Jesus and Mendonça, 2018, p.81). Third are the 'institutional/regulatory factors', which set the larger operating environment in which companies are positioned (de Jesus and Mendonça, 2018, p.82). Last are the 'social/cultural factors' which determine how customers will see the circular economy initiatives and whether they derive value from them (de Jesus and Mendonça, 2018, p.82).

Zink and Geyer offer two main barriers to circular economy initiatives having a real impact. The first is 'insufficient substitutability', meaning that products from waste materials are not of high enough quality for customers to choose them (Zink and Geyer, pp.597-598). The second is price, which can cause 'circular economy rebound', discussed below, when products
from waste materials are priced lower than their 100% virgin counterparts and increase overall consumption rather than shift market share to products from waste (Zink and Geyer, pp.598-599). Allenby and Richards identified three main barriers to extracting value from waste: limited data on how waste materials can be used, the need for a 'reliable market', and the need for information on potential and existing markets and supply (1994, p.18).

Table 2: Circular economy drivers and gatekeepers from academic literature, as positioned within Boons and Lüdeke-Freund’s four business model elements (2013, p.13). Some elements can function as both drivers and gatekeepers, being potential sources of motivation for change while also being necessary enablers of successful circular business model implementation.

<table>
<thead>
<tr>
<th>VALUE PROPOSITION</th>
<th>SUPPLY CHAIN</th>
<th>CUSTOMER INTERFACE</th>
<th>FINANCIAL MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Driver: Satisfying growing demand for sustainably produced goods (de Jesus and Mendonça, 2018, pp.82-83)</td>
<td>-Gatekeeper: Engagement with suppliers on companies’ sustainability values without companies passing 'socio-ecological burdens' to supply chains (Boons and Lüdeke-Freund, 2013, p.13)</td>
<td>-Gatekeeper: Motivation for customers to 'take responsibility for their consumption' without companies 'shift[ing] its socio-ecological burdens to its customers' (Boors and Lüdeke-Freund, 2013, p.13)</td>
<td>-Driver or gatekeeper: Reliable markets for the products (Allenby and Richards, 1994, p.18)</td>
</tr>
<tr>
<td>-Gatekeeper: Measurable impact on ecological, social and financial systems (Boons and Lüdeke-Freund, 2013, p.13)</td>
<td>-Gatekeeper: Data on how waste materials can be used (Allenby and Richards, 1994, p.18)</td>
<td>-Gatekeeper: Education about how customers can participate in new circular models, such as product-service systems (de Jesus and Mendonça, 2018, p.83)</td>
<td>-Driver or gatekeeper: Even spread of financial benefits and costs throughout supply and value chains (Boons and Lüdeke-Freund, 2013, p.13)</td>
</tr>
<tr>
<td>-Gatekeeper: 'Substitutability' for products without recycled materials (Zink and Geyer, 2017, pp.597-598)</td>
<td>-Gatekeeper: Technologies that can enable material recovery and reuse (de Jesus and Mendonça, 2018, p.81)</td>
<td>-Gatekeeper: Shifting to services as a driver of new revenues rather than sales of physical products alone (Bocken et al., 2016)</td>
<td>-Gatekeeper: High enough price points to avoid circular economy rebound (Zink and Geyer, 2017, pp.598-599)</td>
</tr>
</tbody>
</table>
2.2.4. Circular Economy Limitations and Evaluation

Despite circular economy's potential for reconciling the need for companies to grow their profits with the need to reduce virgin resource consumption, Zink and Geyer caution that circular economy implementations run the risk of triggering a rebound effect. This view takes a systems thinking approach in acknowledging that circular economy solutions could have unintended consequences beyond the direct value chain of the product. They suggest, for example, that a rise in the use of refillable water bottles could lead to an increase in the production of water filling stations, or that an increase in product recyclability can trigger a rise in guilt-free consumption (Zink and Geyer, 2017, p.599).

Additionally, Zink and Geyer stress that while end-of-life solutions are important, the most important metric in circular economy systems is the reduction of virgin resource inputs (Zink and Geyer, 2017, p.600). They observe that even when waste materials end up as inputs for new products, they might not necessarily be replacing virgin material inputs. Instead, waste materials may be used for new product lines or they might drive an increase in consumption when they are sold for lower prices because they use recycled materials (Zink and Geyer, 2017, p.594). The inability of waste materials to compete with virgin resources and the rise of consumption through discounted pricing can 'grow the "pie"' rather than give a share of the existing 'pie' to products made from waste (Zink and Geyer, 2017, p.600).
The position that circular economy systems need to capture existing markets rather than create new ones provides an interesting complication to the discussion about whether replicating business model archetypes, such as those offered by Bocken et al., hurts the ability for a company to compete, or whether these innovations can create *blue oceans* that render competition irrelevant. Following Zink and Geyer's argumentation, companies that want to adopt circular economy approaches should not aim to create new markets, but should rather ensure that products that use waste as an input are of high enough quality that they can compete with products made from virgin resources.

While this is the ideal goal to maximize the positive environmental impact of circular economy systems, presenting circular economy as a zero-sum game where circular products must displace all virgin material consumption out the gate or not be considered 'circular' may discourage companies from even attempting to shift to more circular modes of production. Additionally, as Rogers' theory of innovation adoption posits, the uptake of innovative products or ideas (which can include the idea that products made from waste material can be high quality) begins with a small group of 'early adopters' and slowly grows until the adoption hits an inflection point, at which point it achieves a 'critical mass' of adoption (Rogers, 1995, p.22-23).

Zink and Geyer observe that circular economy is often viewed as a purely engineering system, which ignores economic realities of resource use and product manufacture (Zink and Geyer, 2017, p.596). They posit that closing material loops will not inevitably produce a positive environmental impact, though that fails to acknowledges that resource extraction is not the only environmental harm from linear systems of production and consumption. The disposal of waste in a linear system means that materials end up either polluting the land and water, in landfills or as litter, or polluting the air through incineration.

**2.3. Summary of the Literature Review**

In sum, the literature indicates that business models are important and relevant units of scholarly inquiry, including in the field of sustainable business. Although technological and organizational innovation are at the core of the sustainability shift, appropriate business models are of equal importance in driving the maximum possible value capture of new innovations. Various frameworks exist for defining sustainable business models, including
circular economy models that can facilitate the reuse of materials and the overall extension of material lifespans. There is an emerging field of inquiry into what drives business model changes, which include tools for visualizing a business model in its totality and specific strategic pathways for evolution to more sustainable business models.

There are also theories about what drives business model change in conventional business models, sustainable business models and the circular economy subset of sustainable business models. The drivers and gatekeepers identified in the literature span various layers, from conditions within the company and its supply chain, conditions within the industry and regulation and broader conditions in society. The present study will use Boons and Lüdeke-Freund's four business model elements – value proposition, supply chain, customer interface and financial model – and their subsequent normative requirements for each as the theme for identifying and analyzing drivers and gatekeepers for companies to create economic value from waste. From there, I will position the results within Osterwalder's business model canvas to contextualize these drivers and gatekeepers in a more holistic business model representation.

3. Methodology

3.1. Ontological and Epistemological Frameworks

This study seeks to understand what comprises a circular economy business model in practice, what drives a company to adopt these models, and what gatekeepers impact their implementation. I chose to study this topic using qualitative methods because as Creswell states, qualitative research is a 'means for exploring and understanding the meaning individuals or groups ascribe to a social or human problem' (2009, p.4). The 'social or human problem' underlying my research is the challenge of companies trying to reduce their contribution to ecological degradation. The factors that drive companies to make that reduction are embedded with meaning about what companies and individual employees value. Likewise, the gatekeeping forces, which can act as either barriers or enablers, are open to interpretation and can be embedded with subjective judgements as to the intensity of their impact on company processes.

This study uses a critical realist ontology and epistemology. Taking a critical realist approach to understanding the meaning behind business decisions offers a richer, more realistic picture
of what drives business model creation and evolution beyond solely the impact on the company’s top and bottom lines. The interviews have been conducted and analyzed on the assumption that the information conveyed reflects an objective reality with the awareness that that information may have been 'interpreted through social conditioning', either mine or the interviewees' (Wahyuni, 2012, p.70). My study is built on the premise that resources are being extracted and waste produced at unsustainable speeds and that companies have an obligation to reverse the damage commerce has done on ecological systems, even if that has an impact on profitability. A researcher taking the perspective that companies only have the obligation of increasing shareholder value would likely interpret the same data analyzed in this study in a different manner. Additionally, using a critical realist approach makes it possible to draw meaning that was not explicitly stated and make connections between phenomena interviewees mention that they may not recognize themselves.

The critical realist epistemology also entails 'explaining within a context or contexts' (Wahyuni, 2012, p.70). The five case companies each have unique sets of circumstances, so while there are some overlaps in the drivers and gatekeepers, each driver and gatekeeper manifests differently in each company context. Since I have never worked for any of the case companies, the study was undertaken from an entirely etic perspective. Although being an outsider comes with the disadvantage of not understanding the inner workings and hidden processes that may not be communicated in an interview, being an outsider has the advantage of having an unbiased view of the context within which the company operates.

3.2. Research Design

I chose to use a multiple case study design because there is a dearth of cases in the literature on circular economy business models although practice is ahead of the academy, according to Bocken et al. (Bocken et al., 2014, p.47; Evans et al., 2017, p.598; Lewandowski, 2016, p.23). Evans et al. go so far as to say that despite the rapid rise of academic inquiry into sustainable business models, 'little effort has been spent exploring their successful adoption' (2017, p.605). This lack of empirical study has in turn left theory on sustainable business models ungrounded in practice (Evans et al., 2017, p.598). Without theory grounded in practice and illustrated by case studies, the impact of sustainable business model theory on practice is limited at best (Evans et al., 2017, p.598).
Using a multiple case study design makes it possible to 'reveal complementary aspects' of the phenomenon being studied, which leads to more 'in-depth understanding' and 'robust, generalizable' theory (Lewis-Beck, Bryman and Liao, 2004, p.684; Mills, Durepos and Wiebe, 2010, p.582). Because there are so few case studies on the successful implementation of sustainable business models, using a single case study would bring a risk of inferring generalizable tenets from what could be an anomalous case. Additionally, multiple case studies provide a means for examining the conditions in which certain phenomena occur since the findings of single case study cannot necessarily be generalized (Mills et al., 2010, p.582).

Since there are such scant empirical data on how circular economy business models work in practice, this study is an exploratory case study. According to Yin, the central function of an exploratory case study is to identify the questions, concepts and methods that can be used in future studies on a given topic (2018, ch.13, n.p.). The questions and issues identified in this study can be used to inform future case studies that go into greater depth or use ethnographic approaches to verify how the drivers and gatekeepers described in the interviews play out in the day to day operations in practice.

This study uses a parallel, cross-sectional design, so the empirical research for all of the companies was carried out simultaneously between January and March 2018. Although it examines past decision-making processes as well as current practices, using a hybrid retrospective and prospective orientation, a cross-sectional case study was more appropriate than a longitudinal case study for answering the research questions from an etic perspective. Documenting and analyzing the process of adopting a sustainable business model would likely require emic knowledge that such a change was being planned. Cross-sectional case studies 'should include participants selected from different stages in their trajectories', and the five case companies detailed below all had circular economy initiatives at varying stages of integration into the companies' overall strategy (Mills et al., 2010, p.267).

A combination of purposive and availability sampling techniques were used to select the case companies. All of the companies fulfill the purpose of providing real-world examples of creating economic value from waste materials, but the companies vary in industry, company structure and size, so case companies comprise a heterogeneous sample. The five selected
case companies are all on a list of 'the most interesting companies in the circular economy in Finland' compiled by the Finnish Innovation Fund Sitra, a fund for research and projects on sustainable well-being in Finland (Sitra, 2018b). Additionally, they are all on the sublist of companies with business models that facilitate 'resource efficiency and recycling' (Sitra, 2018b). I had previously met the coordinators of Finlayson and UPM's circular economy initiatives, so I was able to secure interviews with the two companies through these prior connections. I contacted five other companies from the list, and three were willing and available to participate in the study: Durat, Palpa and TouchPoint.

The strength of purposive sampling is that 'findings [are] more generalizable' than in a study that solely uses availability sampling (Daniel, 2012, p.92). Using a heterogeneous sample strengthens the contribution of this study toward circular economy theory building, at least for theories about the situation of Finnish firms, and fulfills Yin's assertion that 'the case study must consider alternative perspectives' (2018, n.p.). The main weakness of heterogeneous, purposive sampling is that the diversity of cases means that I cannot control for individual variables (Daniel, 2012, p.92). The use of availability sampling increased the efficiency of the sampling process, but availability sampling is also seen as 'less reliable' than other sampling types (Daniel, 2012, p.84). However, the use of purposive sampling in identifying the sample population, which was companies on Sitra's list of innovative circular economy companies in Finland, makes the sample more valid than if the study used availability sampling alone.

All of the case companies headquartered in Helsinki, Finland. I conducted one in-depth, semi-structured interview with the person (or one of the people) in charge of the company's circular economy initiative(s). Two of the interviews were with mid-level managers, one was with a director and two were with executives.

Table 3: The companies used in the multiple case study.

<table>
<thead>
<tr>
<th>Company name</th>
<th>Ownership structure</th>
<th>Year of founding</th>
<th>B2B or B2C</th>
<th>Industry</th>
<th>Interview date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Durat (Tonester Oy Ltd)</td>
<td>Privately held</td>
<td>1990</td>
<td>B2B</td>
<td>Solid surface materials for interiors</td>
<td>12 January 2018</td>
</tr>
<tr>
<td>Company</td>
<td>Ownership</td>
<td>Year</td>
<td>Type</td>
<td>Products</td>
<td>Date</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>---------------</td>
<td>------</td>
<td>---------</td>
<td>-----------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Finlayson Oy</td>
<td>Privately held</td>
<td>1820</td>
<td>B2C</td>
<td>Home textiles</td>
<td>16 January 2018</td>
</tr>
<tr>
<td>UPM-Kymmene Oyj</td>
<td>Publicly held</td>
<td>1996</td>
<td>B2B</td>
<td>Pulp, paper, plywood, energy</td>
<td>18 January 2018</td>
</tr>
<tr>
<td>Palpa (Suomen Palautuspakkaus Oy)</td>
<td>Industry-owned nonprofit</td>
<td>1996</td>
<td>B2B</td>
<td>Beverage package collection</td>
<td>18 January 2018</td>
</tr>
<tr>
<td>TouchPoint Oy</td>
<td>Privately held</td>
<td>2008</td>
<td>B2B</td>
<td>Company workwear</td>
<td>3 March 2018</td>
</tr>
</tbody>
</table>

**Durat** is a Finnish company that produces a surface material from 30% pre-consumer plastic waste (Durat, 2018a). Durat’s material is used for countertops, bathroom surfaces and furniture. They have operations in Finland, the U.S. and China, along with retailers in Norway and the Netherlands (Durat, 2018b).

**Finlayson** is a Finnish retailer that sells home furnishings. They have three products made from recycled textiles: rag rugs from customers' old sheets, towels from customers' old jeans and flannel sheets from a suppliers' fabric cutting waste. They also sell clothespins from recycled plastic. In October 2017, Finlayson announced a new service in which customers can return select used Finlayson textiles in exchange for 'significant discounts' on new ones (Euroloan, 2017). As of March 2018, it had been paused for evaluation after the initial pilot phase. This new circular model was being released in conjunction with the company Euroloan, which offered interest-free financing for textile purchases. According to the press release announcing the initiative, Finlayson also plans to develop a secondhand shop to sell well kept used goods back to consumers (Euroloan, 2017).

**UPM** is a biomass and forestry company headquartered in Finland, with a presence in 120 countries across the world (UPM, 2017a, pp.5). The company’s social responsibility plans include a goal to become a zero solid waste company by 2030 (UPM, 2017a, pp.68). UPM has a variety of core activities, including biorefining, pulp and paper, energy generation, and plywood processing (UPM, 2017a, pp.2-3). Many types of biomass refuse come out of these
activities, some of which are reused in UPM products and some of which are sold on to other companies (UPM, 2017b).

**Palpa** is a nonprofit company that operates Finland’s used beverage container collection service. It is co-owned by companies that produce beverages and by retailers that sell them. Palpa uses a complex system of deposit transfers between producers, retailers, end users and Palpa itself to incentivize end users to return containers (Palpa, 2018). The consumer can recoup the deposit they pay, which is built into the prices of beverages, by returning their bottles to a supermarket *pantti*. After their use lives as bottles, the plastic is reprocessed for another use life as a bottle or for use in other plastic products (Palpa, 2018).

**TouchPoint** is a privately owned company that makes company workwear out of sustainable materials. They work with four different materials: rPET from recycled plastic bottles, Tencel from wood, organic cotton and surplus fabrics from the textile industry (TouchPoint, 2018b). They have made workwear for companies such as Viking Line, Robert's Coffee, Hesburger and K-Supermarket (TouchPoint, 2018a).

### 3.3. Data Collection

My interview questions were built on the insights gained from my literature review. I used publicly available company websites, annual reports, press releases, press mentions, and other communications materials to conduct background research on how these companies’ business models work and what language they use to talk about them. I chose to develop semi-structured interview questions because the heterogeneous sampling meant that the differences between the companies would open different courses of inquiry in each interview.

The interviews all lasted approximately one hour, with the exception of Palpa. The interviewee from Palpa booked an hour and a half so there would be time to share their company presentation as well. All of the interviews were conducted at the companies’ Helsinki headquarters. The interviews were all conducted in English, which was not any of the interviewees’ native language. I often clarified the questions after I asked them, and tried not to let this clarifying questions sound like leading questions.

The interviews were all recorded on my iPhone, and I took contemporaneous notes on my laptop. The interview questions were:
• What products in your portfolio use waste as an input?
• How long has waste been used as an input for these products? Will you walk me through the process of making the decision to use waste as an input?
• What criteria does your company use to decide what waste materials to use as inputs? How do these criteria differ from those used to evaluate virgin raw materials?
• Has the introduction of waste materials as product inputs reduced the use of virgin materials as inputs?
• Does your company plan for the end-of-life stage of the products that use waste as inputs? If so, how?
• How has the use of waste as a product input impacted your company financially?
• How have you had to engage with members of your supply and value chains to introduce the use of waste as inputs for your products?
• How has the use of waste as an input impacted your relationship to companies in your supply and value chains?
• How does your company define the success of the product line(s) that use waste as an input? Does your company use any environmental key performance indicators?
• Where do you see the company in five years?

At the end of each interview, I asked the interviewees for any relevant English-language materials that I could analyze for my study, and I received a variety of reports, catalogues, promotional materials and a material impact per service unit report. Some materials were in English, and some were only available in Finnish. I took all of them, however, and used Wiktionary and Google Translate to look up the words that I did not understand in the Finnish materials.

All of the audio files were transcribed in the weeks after the interviews. I am not conducting a sentiment analysis, so I made small edits to the transcript purely for clarity and ease of analysis. I edited out repeated words when interviewees would stutter, filler words such as 'like' and 'umm' and phrases people used when looking for English words (e.g. 'how do you say').
3.4. Data Analysis

My analytical framework employed the six steps of thematic analysis outlined by Braun and Clarke:

1. Collect and transcribe data
2. Identify preliminary codes
3. Begin identifying themes from the codes
4. Review the themes identified
5. Define and name the final themes
6. Write a report conveying the findings (2006, pp.16-23)

Braun and Clarke define a theme as a 'patterned response or meaning within the data set' (2006, p.10). The aim of my research was to identify and analyze themes emerging from data that offer an understanding of what components comprise circular economy business models in practice, what drives businesses to adopt circular economy business models and what the gatekeepers are in the adoption process. I used the deductive theoretical approach to thematic analysis since my research aims to fill a specific gap in sustainable business models literature and as such, my study will need to answer the questions I set out with (Braun and Clarke, 2006, p.12).

To establish the credibility and validity of my research, I used two of the triangulation methods outlined by Ericksson and Kovalainen (2016, p.293). I triangulated the data by collecting empirical data from multiple sources—namely interviews and documents—that allowed me to cross-check for inconsistencies (although it is important to note that inconsistencies do not necessarily mean that the interviewees have been untruthful, as the documents themselves may contain untruths used to portray the company in a flattering light). I also used triangulation of researchers by sharing and discussing my findings with the other scholars in the REwood research project about cascading solid wood resources of which this study is a part.

Finally, I used theory to triangulate my findings by analyzing whether the outcomes of my case studies support the existing theories about sustainable business models. After completing the thematic analysis, I then compared the emergent themes to literature. My analysis of the research question, 'What are the components of circular economy business models in practice,
and how do they differ from conventional business models?, is positioned within Osterwalder's business model canvas (2016, pp.20-21). My analysis of the empirical research question, 'What are the main drivers and gatekeepers, both internal and external, that influence the case companies’ ability to create value from waste materials?', is rooted in a comparison to Boons and Lüdeke-Freund's normative requirements for sustainable business models (2013, p.13).

The five cases were presented in a similar style to the case presentation Stubbs and Cocklin used in their study of Interface Inc. and Bendigo Bank (2008). Like Stubbs and Cocklin, I present an overview of the companies' circular economy activities, then go into greater depth about the cases while discussing each of the themes. Being a cross-sectional, exploratory case study using thematic analysis, combining the way the themes cut across the companies is a clearer way of presenting the findings than outlining the individual themes of each case and then combining the themes into overall themes in the end. This was how I first approached the analysis, but during the process I found that this would cause unnecessary confusion because some of the themes manifest differently in different companies. Discussing these differences under the single unifying umbrella of a theme makes it possible to more effectively communicate their similarities.

4. Findings and Discussion

4.1. Overview of Case Companies' Circular Economy Initiatives

4.1.1. Durat

Durat is a privately held company founded in 1990 and owned by Tonester Oy Ltd. It produces a solid surface material composed of 30% pre-consumer recycled plastic from manufacturers in Finland (Durat, 2018b). In the past, Durat received plastic waste from factories in Sweden as well, although they have switched to exclusively use plastic from Finnish suppliers at the moment. Durat's solid surface materials are used as countertops and in bathroom implements, such as sinks and bathtubs. They are headquartered in Helsinki, Finland and have three divisions: Durat Finland, Durat USA, and Durat China (Durat, 2018a). Additionally, they have retailers in Norway and the Netherlands (Durat, 2018a). Their biggest market is in the Nordic countries, especially Finland. The majority of their sales are to commercial clients, particularly designers and architects. They also have some
residential sales, but the majority of their products end up in commercial buildings and public buildings, such as kindergartens.

Figure 6: Durat's products use linear and upcycling material flows, and the waste materials they use come from post-business flows.

Solid surface countertops were first introduced in 1968 by the American company DuPont. They are resin-based materials mixed with minerals. Solid surface materials have a variety of properties that set them apart from other countertop surface materials. According to the Durat interviewee, they are 'long-lasting, easy to clean, easy to fabricate' (Durat Interview, 2018). They are non-porous, which makes them hygienic since they do not have surface pores that can trap bacteria and dirt. Additionally, they can be 'worked with woodworking tools', and multiple pieces can be affixed together without visible seams where the two pieces come together.

Durat's solid surface material is essentially its only product, which they offer in multiple forms. They offer custom manufacturing as well as premade pieces, such as sinks, bathtubs, and tables (Durat, 2018c). Their material is offered in seven different textures, 63 main colors, and they also have the ability to match 213 RAL colors (Durat, 2018d). The company's relatively small manufacturing operation, compared with that of industry leaders like DuPont, make it possible to customize in a way that the big players cannot. This ability to customize was identified in the interview as one of Durat's key value propositions. The interviewee stated that they create value by 'providing a service that the big players can't because they're set up to make huge quantities and they have their big stocks and they're not flexible in that way. So, that's kind of a niche that we try to fill' (Durat Interview, 2018).
'For us, [sustainability has] always been the number one marketing point.' (Durat Interview, 2018)

The other key value proposition that was identified in the interview was the fact that their product is made partially of recycled materials. Durat has used their custom blend of recycled and non-recycled materials since the company's inception, and the desire to 'create something out of waste' was a key driver in the founding of the company. The founders invented this particular solid surface blend using plastic that they could access from a company that they knew at the time. There are few solid surface companies incorporating waste materials, and the interviewee mentioned a few past competitors that were no longer in business. This dearth of other companies taking an ecological approach is seen as a competitive advantage for Durat. According to the interviewee, 'there would be no point' in making their products without the recycled content (Durat Interview, 2018).

However, the interviewee said that the industry is rapidly shifting toward more sustainable products, though this highlighted a paradox about the changing view of sustainability in the solid surface industry. On the one hand, the interviewee stated that sustainability in the industry is 'moving faster than we've been able to move' (Durat Interview, 2018). The interviewee mentioned competitors, such as Silestone, which has one line of solid surface materials available in one color, a pinkish beige (Cosentino, 2018b). Silestone's eco offering is made using recycled materials, including 'mirror, glass, porcelain, earthenware and vitrified ash' (Cosentino, 2018a). Silestone's website does not indicate where these materials come from, however. The website of another competitor the interviewee mentioned, Eco by Cosantino, redirected to Silestone's eco line (the two are part of the same brand family), confirming the interviewee was correct when stating that the Eco by Cosantino line may have been discontinued.

On the other hand, judging by the lack of clear competitors to Durat's offering, the industry sustainability shift seems less than robust. The interviewee mentioned that the big players in the industry 'don't really try to brand themselves as green. But of course, the only claim for that is that it's a long-lasting product' (Durat Interview, 2018). The claim that the durability of a product over time makes it in line with circular economy principles appeared in the Finlayson case as well, and it speaks to the lack of a cohesive definition of circular economy
that was apparent in reviewing the literature. Extending the time between production and disposal (slowing material loops) is not the same as putting materials back into circulation for a second life (closing material loops), a distinction drawn by Bocken et al. (2016, p.309). However, a long-lasting product may reduce the total number of products purchased over a user's lifetime, which would ultimately reduce the quantity of virgin materials needed to meet said customer's product needs, and meet the standard for circular economy set by Zink and Geyer (2017, p.600).

'I think that's going to be a big part of how competitive we're going to be, being able to get those [LEED] points.' (Durat Interview, 2018)

In Durat's case, sustainability as a competitive advantage is largely driven by the growing importance of green building certifications, such as the Leadership in Energy and Environmental Design (LEED) certification. For commercial interiors—which is where many of Durat's products end up, as the interviewee said that only 'about 10-15% [of their market] is residential'—using materials with recycled content can earn a project extra LEED points (Durat Interview, 2018). According to the U.S. Green Building Council, the agency that administers LEED, recycled materials can earn extra points if 'the sum of postconsumer recycled content plus 1/2 of the preconsumer content constitutes at least 10% or 20%, based on cost, of the total value of the materials in the project' (U.S. Green Building Council, 2018). Project can earn up to two points for recycled materials: one if the recycled content is 10% according to the criteria above, and two if the recycled content is 20% (U.S. Green Building Council, 2018).

The interviewee was optimistic about the growing importance of environmental certifications, stating that 'the fastest-growing sector of construction is green building' (Durat Interview, 2018). In the interviewee's perspective, Finland is 'maybe two or three years behind [on LEED]. It hasn't really been as widely accepted as in other European places' (Durat Interview, 2018). In the U.S., the interviewee thought that green building was 'growing like 10-15% per year or something like that. It's huge' (Durat Interview, 2018). Durat is currently expanding its operations in the U.S., which will help them capture this growing market. On this side of the Atlantic, the interviewee stated, 'I think we're going to be
more and more in accredited green buildings in Europe, and the traditional materials will of course not be competing so well in those' (Durat Interview, 2018).

'It also complicates the casting process, so it makes it more difficult. It's much more straightforward to make solid surface without the recycled content.' (Durat Interview, 2018)

As with every company that manufactures physical products, a key component of Durat's business is sourcing materials to use as product inputs. Right now, the main source of Durat's waste material is pre-consumer plastic waste from plastics factories. Over their history, they have used suppliers in both Sweden and Finland, though currently all of their pre-consumer plastic waste comes from Finland. This plastic was an integral part of the original product design. The interviewee stated that the founders knew about this particular type of plastic and that it would be possible to get it from a local supplier, and the development of their solid surface material using this plastic grew from there. The interviewee thought that the original supplier was the Finnish company KeraPlast.

The use of waste materials makes their production process more expensive and more complicated. They need to clean the materials, even though they are pre-consumer plastics. This particular material is also more complicated to mix with the resin that serves as the base for all solid surface materials. They are currently running tests to see if other types of waste could be used in their production process as well, but the interviewee stated that the other waste materials they have been testing make the chemical production process 'even more complicated' (Durat Interview, 2018).

Durat is in the process of planning to add another stream of waste material acquisition: a take-back service for their products that are currently in the market. The interviewee stated that their materials are quite easily renewable. They can cut up large pieces, re-sand them, and form them into new pieces. With just a 'little work' they can produce 'second-cycle products' that are 'good as new' (Durat Interview, 2018). The interviewee said that all solid surface companies could use each others' products as fillers, but 'no one does' because the big players all have 'one-track production systems' (Durat Interview, 2018). The interviewee stated that the target customers for this kind of take-back service would be the developers of
large commercial projects, such as hotels (Durat Interview, 2018). This take-back service would help their clients save the time, and potentially some of the costs, that they spend getting rid of large solid surface implements from their buildings (Durat Interview, 2018).

'We don't have to work. We have to re-sand it, and basically it's going to be as good as new.' (Durat Interview, 2018)

In discussing the origins of Durat's solid surface material and the genesis of their nascent take-back program, the idea of responsibility came through multiple times. The interviewee stated, 'We of course see the problem with it, you know...' (‘it' seeming to be, from the context of the interview, the conventional linear model of production, consumption and disposal) (Durat Interview, 2018). The tension between the desire to not do ecological harm and the inherent realities of being a company that manufactures a physical product were echoed when the interviewee continued the thought, stating, '...we want our product of course to be as ecological as possible. Our input to be as ecological as possible' (Durat Interview, 2018). The repetition of the phrase 'of course' in both phrases suggests the necessity of contending with this tension as a company that has sustainability as a key value proposition.

The only explicit mention of the word 'responsibility' came as a continuation of the response above. The interviewee stated, '...we can take everything back, and we can do something about it, so I think we should, it's our responsibility as well in a way to, to not waste...' (Durat Interview, 2018). Along with again emphasizing the feeling of responsibility toward the materials the company manufactures and sells, this quote offers a glimpse into another important dimension of the company's approach to sustainability. The interviewee said that the company 'can take everything back', meaning that it was possible to take everything back with the technology already at their disposal. The ease of processes was a theme that appeared again and again throughout the interview, both in reference to Durat's internal processes as well as to the way their activities make their customers' and partners' work easier. This suggests that ecological values are not enough for clients to necessarily buy into sustainability value propositions – they also have to make financial and logistical sense.
4.1.2. Finlayson

Finlayson is a privately held home textile company founded in 1820. They sell a variety of textile products for bedrooms, bathrooms and kitchens (Finlayson, 2018b). They have three textile products made from waste materials: rag rugs with 90% recycled materials from customers' old sheets, towels with 40% recycled materials from customers' old jeans, and 'Jesus' flannel sheets with 90% recycled materials from a suppliers' cutting scraps (Finlayson, 2018a, pp.47, 103, 176). Additionally, they have clothespins made from recycled industrial plastic from Finland. Starting in the autumn of 2018, their semi-annual catalogue includes a separate section for rag rugs, pillows and log carriers from the same rag rug materials, and another forthcoming product made from 100% recycled materials (Finlayson, 2018a, pp.170-177).

![Diagram](attachment://diagram.png)

Figure 7: Finlayson’s products use linear flows (including in the recycled products), upcycling flows (in the flannel from cutting scraps) and ambiguous second-use material flows (in the rag rugs from sheets and towels from jeans). The waste materials they use come from post-business flows and suppliers’ internal flows, a new category that was not identified in the literature.

Rag rugs are a traditional Finnish handicraft, one that has largely died out over the years (Finlayson Interview, 2018). They are made with strips of fabric, often from sheets, woven together. Finlayson wanted to revive this tradition, and at the same time the CEO learned about the problem of textile waste in Europe and felt the company had to do something. He realized that these two things would work well together (Finlayson Interview, 2018). They could collect sheets of customers and make them into rag rugs, so they did.

They held the first collection in the spring of 2016 and received 11 tonnes of old sheets from customers (Finlayson Interview, 2018). As the interviewee from Finlayson put it, 'We were a bit surprised, because we didn't know how much people would bring them to us. And people
do have a lot of leftover materials in their closets, so it was kind of successful in that way' (Finlayson Interview, 2018). In exchange for the sheets, customers were given discounts on their next purchases, as it was important to the company to show that 'the old sheets have value' (Finlayson Interview, 2018). Additionally, they wove a storytelling component into the initiative, encouraging customers to come back when the rag rugs were for sale to see if they could find their old sheets.

"With the rag rugs, the main message was "buy your old sheets back". So in a way, maybe you could even find your old sheets in a rug, because you can see the different colors there, so you could maybe even identify your old sheets. So that's the story, like the closed-loop kind of thing."' (Finlayson Interview, 2018)

They held another collection in autumn 2016, and they received about 19 more tonnes of sheets. Despite the large volumes of old sheets, they were not all usable in the rag rugs. Sheets with large holes are unusable because the weft of the fabric can break. All of the sheets must be checked and sorted, which was done in Finlayson's internal warehouse. Using their internal warehouse staff lowered costs, since they did not calculate the labour costs into the price of running the take-in program. If they outsourced the sorting and logistics, they 'probably...wouldn't be doing this, at this scale' (Finlayson Interview, 2018).

Another challenge they faced when starting the rag rug product line was finding a producer to weave the old sheets into the rugs themselves. Because rag rugs had waned in popularity, it was no longer common for rag rugs to be industrially made at that point. They thought about purchasing the machinery themselves, but they ended up finding a supplier in western Finland. It was a small company run by a couple that had a half day's work at best on most days because rag rugs were such an 'unpopular thing to make' (Finlayson Interview, 2018). Now, because of the Finlayson contract, the company is working full time and has hired new employees.

Finlayson also ran collection campaigns for the towels made from customers' old jeans, but the production processes for the two products was very different. Whereas the rag rug initiative was completely driven in-house, the towels from jeans began with one of their suppliers in Belgium. One of the Belgian company's yarn suppliers had developed a way to make towels from jeans and 'were looking for customers to commercialize it' (Finlayson
Interview, 2018). Finlayson wanted to do the collection themselves, but the rest of the production is handled externally. The interviewee said that 'it was really easy project for us, because in the rag rugs process we had to build everything in Finland by ourselves. Find the suppliers and do the whole product development and testing and everything here' (Finlayson Interview, 2018).

'I think the fact that they are so innovative and thinking [about] things in a new way has deepened the relationship.' (Finlayson Interview, 2018)

In the case of the Jesus flannel sheets, the material development and production process was completely handled by a supplier. Finlayson learned that one of their suppliers had developed this flannel from cutting scraps quite by chance. On a call with one of Finlayson's purchasers, the sales representative made an offhand comment about this new waste fabric, and the Finlayson purchaser instantly caught on and asked to learn more. For the Jesus sheets, Finlayson only sells the products – there is no customer collection involved because the waste materials come entirely from the supplier's internal flows. Working with forward-thinking innovation, supply and production partners has been key to Finlayson's ability to launch product lines that contain recycled waste materials. The suppliers in the jean and Jesus flannel cases were struggling to find partners to take these innovations to market, a role that Finlayson eagerly agreed to fill.

'But that's the key to the success of the products, that it's a really, really good product and then it's also recycled. So it's not taking anything away from the qualities or anything, the fact that it's recycled.' (Finlayson Interview, 2018)

The sustainability of the rag rugs, jean towels and Jesus flannel sheets is not the only value proposition, or necessarily even the primary one. The Jesus sheets have been a particularly popular product because they are 'really soft and warm', and they have 'been a sales success now in the autumn when it's cold' (Finlayson Interview, 2018). Many bloggers 'loved the sheets and presented them in their blogs', and they did not even realize that the sheets were made of recycled materials (Finlayson Interview, 2018). Selling attractive products is the central value proposition, and the interviewee stated that 'there's no point in making more
sustainable products if people don't want them' (Finlayson Interview, 2018). They also consider the fact that all of their products are 'quality' and 'long-lasting' to be another aspect of their circular economy value, which fits in with the finding in the literature that the definition of circular economy is quite multifaceted and open to interpretation (Finlayson Interview, 2018).

'It's because of our new owners. They are really driven to do things in a different way, and we have 200 years of data showing that the old way of doing things is not working.' (Finlayson Interview, 2018)

According to a January 2018 article in Finnair's Blue Wings magazine, Finlayson had long been seen as a 'very traditional textile company' until it 'reinvented itself' in the years since being purchased by Jukka Kurtti, Petri Pesonen and Risto Voutilainen in 2014 (Isalo, 2018). It had also been unprofitable, and the company had been for sale for 14 years when they bought it (Isalo, 2018). The new owners brought a culture of risk taking to the company. They have had several high-profile campaigns in recent years, including launching a line of products featuring the homoerotic art of Tom of Finland and an advertising campaign offering discounts for female customers in proportion with the gender pay gap. The culture of risk taking has paid off, and the company now has an annual profit of over a million euros (Isalo, 2018)

'I think that is the key, to be brave enough to test these kind of things, and not everything has been a success, but you don't know if you don't do it.' (Finlayson Interview, 2018)

Finlayson launched a new concept, the circular economy account (kiertotalonstili), in the fall of 2017. The goal was to 'question the whole buying process' and challenge the idea that home textiles need to be owned by customers (Finlayson Interview, 2018). As of March 2018, it had been paused for reconfiguration. In its original iteration, customers could join the circular economy account when they purchased at least 200 euros worth of qualifying items. The purchase had to be financed using Euroloan's payment platform Mash to make monthly payments over a select period of time, either 12, 24 or 36 months. Using this financing platform was intended as a means of tracking the materials within the account. Once the
payment period ended, the customer could either keep the purchased items or return them to Finlayson and receive 25% off a future purchase. Items that were returned would eventually be sold in a secondhand shop, though Finlayson had not yet decided what format that will take. The interviewee mentioned during our January 2018 interview that it could be a permanent part of their stores, a separate pop-up store, or part of one of Finlayson's general pop-up stores.

To develop the concept, Finlayson pitched the idea to members of their F-klubi loyalty program in August 2017 (Finlayson, 2017). They sent a questionnaire to 5000 members and received 143 responses (Finlayson, 2017). Survey participants were sent a video explaining the concept and asked 1) if they thought the circular economy account would benefit them and 2) if so, which message spoke to them most. For the first question, 49% of respondents said that the concept 'sounds good' and that it would be beneficial for them, 37% said that they did not believe it would be beneficial for them, and 14% said that they did not understand the circular economy account idea (Finlayson, 2017). For the second question, 65% of the respondents who said the circular economy account would benefit them were most drawn to the message 'A new responsible way of buying and replacing textiles. You pay for use, return and we recycle everything' (translated from the original Finnish with the aid of Google Translate and Wiktionary) (Finlayson, 2017). 17% were most drawn to a message emphasizing the low minimum monthly payment of 10 euros, and the remaining 17% chose a message emphasizing that customers can update their home textile look for a low monthly payment and Finlayson will recycle their old textiles (Finlayson, 2017).

This was the only opportunity for customers to contribute to the development of the circular economy account concept. At the time of the January 2018 interview, participation in the account had been low, and the interviewee believed that to be in part because consumers may have difficulty understanding the concept. The interviewee also mentioned that in their user feedback survey for circular economy account participants, it became clear that customers would prefer to have the option to take shorter lease terms, though Finlayson had chosen the initial lease lengths largely because shorter lease terms could put too much strain on their warehousing personnel.
4.1.3. UPM

UPM is a publicly held company with businesses in the pulp, paper and energy industries. As part of their Responsibility 2030 Agenda, they have launched a goal of making their factories 'zero solid waste' by 2030. The goal focuses specifically on select side streams: ash, sludge, dregs, wood 'fraction[s]' and landfill operations (UPM, 2016b). In practice, the zero solid waste goal means that their factories cannot send 'a single tonne' of waste to landfills, though less than that is allowed (UPM Interview, 2018). Additionally, waste that is burned for energy is considered complying with their zero solid waste goal (UPM, 2017a, p.19). As of now, 90% of the side stream waste from the company's mill is 'reused in other processes' (UPM, 2016b). The ultimate goal is for all of the mills in Finland to be zero solid waste in a few years, and for the rest of their mills around the world to reach the goal by 2030 (Sustainable Brands, 2017). They have already reached zero solid waste at their Central Europe mills (UPM, 2017a, p.8).

![Diagram](image)

**Figure 8:** UPM's solid waste side streams are downcycled to be burned as energy and upcycled into biocomposites, fertilizers, soil stabilizers and so forth. The upcycled products also use materials from linear flows, as waste alone cannot create new products. These flows come from their internal production side streams.

Along with the zero solid waste activities, which are the focus of the present study, UPM RafiTec, the company's package labelling unit, has joined the Ellen MacArthur Foundation's Circular Economy 100 program and was the specific branch named to Sitra's innovative companies in circular economy list (UPM, 2018, Sitra, 2018b). These initiatives, along with the company's work in renewable energy, have made UPM the first paper company listed in the Dow Jones Sustainability Indices and the first forestry company in the UN Global Compact LEAD program (Sustainable Brands, 2017).
'So, if you look at the share value of these [UPM] companies today...let's say 10 cents is caused by this sustainability and zero solid waste....If 10 cents come out of that to that share price, that's 50 million in company value.' (UPM Interview, 2018)

UPM's zero solid waste goal is part of its corporate strategy, and sustainability is listed as one of their growth drivers in the March 2017 investor presentation, the most recent one available on their website (UPM, 2017c, p.5). The other growth drivers listed are private consumption, population growth, urbanization, e-commerce, construction and transportation (UPM, 2017c, p.5). They also see sustainability as a risk mitigation strategy through 'responsible value chain and production' (UPM, 2017c, p.20). The focus on sustainability has positively impacted the company, with 25% of its investment coming from 'Sustainable and Responsible (SRI) investors' (UPM, 2017c, p.23).

They claim in a post in their stakeholder magazine that the zero solid waste initiative will 'have a clear impact on UPM's EBITDA' by lowering costs and driving new income streams (UPM, 2017b). However, according to the interviewee, the financial impacts are not the main driver. The costs of dealing with waste, while in the 'millions and millions', is 'nothing [they] can't live with' (UPM Interview, 2018). Revenues are not a main driver either, as the material volumes are too low to drive large revenues and 'business at this company starts at 100 million revenue. That has to be the minimum, not like 10 million or 7 or 8 or something like that' (UPM Interview, 2018). Instead, 'the real driver is the value proposition, what [UPM] can offer to the planet', particularly if they can be the 'first company in this industry' that sends no solid waste to landfills (UPM Interview, 2018). The interviewee mentioned that this value proposition is widely communicated, and that this could be a driver for increasing the company's share price.

'If you only produced the parts in the volume that you have in these side stream materials, then we don't have enough to create a real, I mean a global, business out of it.' (UPM Interview, 2018)

The biggest barrier to getting revenues from products made from side streams materials is that according to the interviewee, no pulp and paper company has enough side stream waste alone. All of the pulp and paper companies in Finland have the same waste materials in the
same amounts and there is therefore 'nothing to hide and there's nothing to keep' (UPM Interview, 2018). However, because they have seen each other as stiff competition for so long, there is a mindset of 'this is my ash' and 'this is your ash' that prevents companies from aggregating their resources. The interviewee found this attitude 'ridiculous', illustrating the differing mindsets among the pulp and paper industry.

One solution to the material volume problem is for companies in the pulp and paper industry to aggregate their materials so that at least 'somebody gets enough' (UPM Interview, 2018). The interviewee went so far as to state that 'we have a lot together, but not enough alone', illustrating that circular economy solutions require intra-industry collaboration, necessitating a change from a century of seeing one another as rigid competition (UPM Interview, 2018). The interviewee had been advocating the idea of a 'circular economy cluster', where all of the companies in the industry can bring their waste fractions and business operations can be aggregated. Additionally, research institutions like the Finnish universities and VTT could be involved to support innovation. The cluster would be started by the companies who know the market well, because 'you have some kind of platform to actually do it, to somehow productize and get it to the markets' (UPM Interview, 2018). The cluster concept could then be copied and pasted in other places around Finland, and the interviewee had begun floating the idea in industry networks.

Although revenues are not a main driver for UPM's circular economy activities right now, biocomposites are listed in their most recent investor presentation as one of their 'new business opportunities' (UPM, 2017c, p.53). It is unlikely that this referred specifically to biocomposites from waste materials, but it shows that there could be a market if high enough volumes can be aggregated. They have engaged in innovative research and development on uses for biocomposites, such as a project with Metropolia University to develop a car out of biocomposite materials. In the car, which is only used as a showpiece at this point, 20% of the plastic normally used was replaced by biocomposites in the bumper, dashboard and so on. One of the main ecological benefits UPM identifies of the 'Biofore Concept Car' is that it is made from renewable materials rather than from plastics (UPM, 2016a). It remains to be seen whether biocomposites from waste could be used in products like this, but the focus on biocomposite innovation could lead to new circular product categories.
To verify the success toward their zero solid waste goal, UPM assesses the flows of their waste materials even after the materials leave their gates. Being a large, publicly held company, they would receive media scrutiny if it turned out that the 'service providers put it somewhere in the ditch' (UPM Interview, 2018). They 'assess the whole practice and where does it go now and who is bringing that and what happens to that' (UPM Interview, 2018). However, the company's overall environmental impacts, at least on the materials front, are obscured by the fact that the company's growth is driven by a growing demand for natural resources (UPM, 2017c, p.12).

4.1.4. Palpa

Palpa is a nonprofit company that manages Finland's beverage container take-back system. It is co-owned by beverage producers and retailers, like grocery stores and kiosks, that sell disposable beverage packages. It has a small staff to administer the whole system of collection points, material transfer, material processing and sales, and the flow of deposits. They contract with service providers for the majority of the actual operations. The Palpa network stretches across Finland, with 4,700 collection points for PET plastic bottles, glass bottles and aluminum cans in retailers (Palpa, 2018). There are 4,000 reverse vending machines (RVMs) in the collection points, owned by the retailers, which intake consumers’ beverage containers and return a slip showing the deposit they will get back. The deposits can then be redeemed from the retailer's cash register.

![Diagram of beverage container flow](image)

*Figure 9: The beverage containers that pass through Palpa's system are part of a circular flow back to the same types of beverage containers. A smaller portion are upcycled into*
higher-value products, such as umbrellas. All products from Palpa’s materials also use virgin materials as well. All of the waste materials come from post-consumer flows.

In some countries, it’s mandatory to join all the products in a deposit system. Not in Finland. Because you can pay the tax, or you can join Palpa. You have to.’ (Palpa Interview, 2018)

In 2011, Finland passed a law that every company that sells drinks, from plastic water bottles to glass wine bottles to aluminium soda cans, has to be part of a collection system or pay a tax of 51 cents per container (Waste Act, p.28-29). Participating in the Palpa system costs less than the beverage container tax, and Palpa intends to make it as easy as possible for retailers to participate. The deposit prices that Palpa uses were set in a governmental decree: 15 cents for metal containers, 20 cents for plastic containers between 0.35 litres and one litre, 40 cents for plastic containers of one litre or more, and 10 cents for any other containers (Government Decree, 2013). These deposits flow from beverage producers/importers to Palpa, which pays them forward to retailers to compensate for the deposits the retailers pay out to consumers. Consumers pay the deposits when they purchase beverages, as the deposits are built into beverage prices (Palpa, 2018).

Palpa owns the materials that are collected, and their service providers reprocess them into granules and sheets, which are then sold to manufacturers of new containers. These material sales drive the majority of Palpa’s revenues, which are 70 million euros per year (Palpa, 2018). The other source of revenue is from recycling fees, paid by the material recycler and beverage producers/importers, and membership fees from participating companies. The materials, especially aluminium, are highly recyclable, so there is a consistent market for them. These materials are the only ones in this multiple case study that flow in a true closed loop. Nonetheless, virgin materials (non-aluminium metals, virgin PET plastic) need to be mixed into the new containers, so there is still a linear flow involved in the product life cycles.

'It has to be recognized, because when you buy the package...and when you take it back, you have to get the deposit guaranteed. That’s why they are all checked out.’ (Palpa Interview, 2018)
With such a large network of collection points and with 50-70 new beverage containers being added to the system every two weeks, a well-functioning data system in the RVMs is essential. All of the PET bottles and aluminium cans have special barcodes indicating that they are part of the Finnish Palpa system. These barcodes are input into the network-wide RVM data system, and every two weeks that file is updated as new containers are added. Right now, there are 'more than 17,000' containers in the system (Palpa Interview, 2018). The scanners in the RVMs identify the barcodes and the size and shape of the containers (including for glass bottles, even though they do not have barcodes for reasons discussed below). Using multiple variables is meant to corroborate that the incoming packages are indeed part of the system, and as the interviewee stated, 'If you take this barcode and put it to a different package, it says that no, no, no... you are making fraud' (Palpa Interview, 2018).

'Package take-back is] a service for the consumers, so that means if you don't do it, or you make it difficult, they don't come to your store.' (Palpa Interview, 2018)

According to the interviewee, Finland has very high beverage container return rates, and bringing back bottles and cans has become ingrained in consumer behaviour. Without the system's ease of use and the deposit returns, this would likely not be the case. The interviewee said that the ease of the return system is by design, as customers 'don't have to worry about different machines or anything' when they return different kinds of containers (Palpa Interview, 2018). The deposit is built into the product price, giving the illusion that customers are making money when they return containers instead of just getting back money they have already paid. Collecting other people's bottles and cans from trash cans or littered on the street is a way to actually make money, however, and it is not uncommon to see people collecting this waste on the streets of Helsinki. The deposit is clearly an important incentive for getting containers circulating back into the system.

Despite the high return rates, customers do not know all of the details about what can and cannot be returned. Plastic and aluminium containers have special labels listing the return rate in the Finnish system. Even international PET and aluminium containers are required to have the Finnish return labels to be sold in Finland. Glass bottles, however, are another story. About 95% of the glass bottles sold in Finland come from abroad, so they do not have
Finnish barcodes. The problem is that bottles brought in by travelers, like those that come on the ferry from Estonia, are often returned even though they are not actually part of the Palpa system. No one has ever paid a deposit on those bottles and they may be made from opaque glass, which cannot be recycled. Nonetheless, the RVMs take them in, so Palpa has to bear the costs of dealing with them. Educating customers about what types of glass wine bottles can be taken in would help reduce this problem. Palpa can still sell these bottles, however, so they do make some money off of them.

4.1.5. TouchPoint

TouchPoint was founded in 2008 to provide companies with sustainable workwear. They have several sustainability offerings: RePet fabrics made from used PET bottles, fabrics made from wood-based Tencel, fabrics from organic cotton, fabrics from industrial textile scraps, and producers who can convert TouchPoint's clients' old workwear uniforms into biocomposites (TouchPoint, 2018b). Their client list includes large companies operating in Finland, such as Viking Line, K-Supermarket, Robert's Coffee and Hesburger (TouchPoint, 2018a).

Figure 10: TouchPoint's products use linear product flows, downcycling flows for fabrics turned into biocomposites, and upcycling of PET bottles into garments. The biocomposite textiles come from post-business flows, and the PET bottles come from post-society flows (though they are not collected or converted by TouchPoint, but rather by a supplier).

'As we have been the pioneer to make this...we are the forerunners, so all the time we are one step further than the others, at least. So that's very important.' (TouchPoint Interview, 2018)

According to the interviewee, the company's sustainability value proposition provides 'all the
competitive edge' (TouchPoint Interview, 2018). In the ten years that the company has been operating, the sustainability landscape has changed dramatically. In the beginning, they made one-off upcycled products out of their clients' old uniforms that were used 'for their sales items, for their PR, for business gifts' and so on (TouchPoint Interview, 2018). At the time, technologies such as refibering and making biocomposites from textiles did not yet exist. Now, industrial scalability is a central criterion when choosing sustainable solutions for clients' workwear needs, especially considering that they work with large clients like Viking Line and Hesburger. The interviewee said, 'We look for more industrially scalable solutions so we can make bigger steps. Because otherwise it's a little, you know, handiwork...our vision is how we want to change is to make something bigger, something greater' (TouchPoint Interview, 2018). TouchPoint has now grown to the point where they were recognized by the Nordic Council of Ministers as one of the ten leading Nordic brands in textile recycling (Watson et al., 2017).

Technological advances, such as refibering and the development of Tencel, have made industrial-scale solutions possible. However, the technology is still developing, and TouchPoint is involved in the Relooping Fashion research project to create new garments from old cotton textiles through refibering (Relooping Fashion, 2018). TouchPoint is also keeping tabs on the development of other technologies such as the ability to separate cotton and polyester at the molecular level, which 'is a very typical combination in workwear', according to the interviewee (TouchPoint Interview, 2018). The interviewee sees great market potential in textiles made from waste materials, going so far as to predicting that 'it's going to be a new gold rush...one day' (TouchPoint Interview, 2018).

The main barrier to using entirely recycled, or recyclable, materials at this point is the gap between the needs of the client and the technologies available right now. Every component of the garments' use lives, such as whether they are industrially laundered, must be considered in choosing fabrics. These client needs can prevent TouchPoint from, for example, using 100% polyester even though 'everything [in 100% polyester garments] could be recycled by refibering them' (TouchPoint Interview, 2018). TouchPoint's offerings are continually evolving until there is a 'proven concept' for a new technology, and the road to 100% recycled materials is a 'long journey' (TouchPoint Interview, 2018). Like with Finlayson, the tactile material qualities are another central factor when considering what textiles to use. With the
RePet, for example, they chose to use it both because 'there is this plastic issue in the world' and because it has 'very good qualities' (TouchPoint Interview, 2018). According to the interviewee, it is durable, breathable and easy to care for. Tencel is 'especially good for the healthcare sector' because it is smooth, soft and 'easy to wear' (TouchPoint Interview, 2018).

TouchPoint's relationship with their customers goes beyond just financial transactions. Each client works with TouchPoint as they go through the stages of designing and testing the garments, and TouchPoint pushes them on their clients' sustainability initiatives. The interviewee said that 'in the strategies, if they write down that sustainability is part of the big picture, we challenge a lot' (TouchPoint Interview, 2018). TouchPoint goes so far as to say that they refer to their customers as 'partners' rather than 'clients', building a 'very deep' collaboration in which the customers 'feel that [they] are part of their team' (TouchPoint Interview, 2018).

'There's also a lot of greenwashing, so you have to know where you buy. And that's one of the reasons the Waste2Wear company is one of the leading companies in the world from the sustainability and from the responsibility... We have to be sure that our suppliers don't make any mistakes with this.' (TouchPoint Interview, 2018)

TouchPoint's partnerships with the Dutch company Dutch aWEARness and Waste2Wear, a Shanghai-based company started by a Dutch entrepreneur, are key to sourcing recycled and ecological fabrics (Waste2Wear, 2017a). Dutch aWEARness is a supply chain management company for sustainable workwear, and their Circular Content Management System (CCMS) tracks raw materials and products throughout their use lives to 'make the raw materials available for reuse' (Dutch aWEARness, 2018). The CCMS also includes a database of material life cycle information and a variety of tools to help companies with purchasing, inventory and tracking (Dutch aWEARness, 2018). Waste2Wear collects PET waste 'from all over the world' and makes it into fabrics, which TouchPoint uses in its products (Waste2Wear, 2017b, 2017c). These partners are extremely important to TouchPoint, and in February 2018 they held a special fashion show event called Muovinäyttö (Plastic Show) featuring speakers from Dutch aWEARness and Waste2Wear, along with Sitra, Hesburger and Finnish Fashion & Textile (TouchPoint, 2018d).
'When we get the collection decided and settled, we always have all the certifications to the client to be also delivered forward, that they can communicate to their staff and to their stakeholders what they are doing.' (TouchPoint Interview, 2018)

In keeping with the theme of validating their sustainability work, TouchPoint developed their own ranking system combining nine environmental and social sustainability indicators:

1. Production in Asia that complies with the Business Social Compliance Initiative (BSCI)
2. Nearby production
3. Ethical production
4. Materials produced in an environmentally friendly way
5. Ecological recycled and recyclable materials
6. Long-lasting products, life-cycle assessment and functionality in use
7. Design from Finland® qualification
8. Service awarded Key Flag for services produced in Finland
9. Old garment and waste textile recycling (TouchPoint, 2018c)

Different combinations of these constitute their platinum, gold and silver designations (TouchPoint, 2018c). TouchPoint passes on these certifications to their customers after their collections are finished, and the customers 'want to communicate about what they are doing for the sustainability' (TouchPoint Interview, 2018). TouchPoint's sustainable offering helps them do this. For example, TouchPoint is listed on Hesburger's website under their environmental initiatives. They highlight that their uniforms meet the standards of the Fair Labour Association and EU Ecolabel and that they use Finnish Design (Hesburger, 2018).

'The client who wants to have the quality thing that has a long life cycle, then it's not costly at all. But of course, if they only look at the price tag, they think it's expensive. Then if you add to that, you add that one euro for example for the takeback, it's quite a lot for a t-shirt.' (TouchPoint Interview, 2018)

TouchPoint also offers take-back services for their customers' used uniforms, which is built into the product prices. This cost generally ranges from 5-10%, and covers the cost of collecting the garments and having them 'made into new fiber' (TouchPoint Interview, 2018).
This makes it possible for their customers to 'not have to worry about anything' and 'know they have made it responsible' (TouchPoint Interview, 2018). Sometimes they break down the cost of the take-back for the clients and sometimes they do not 'open' their prices since it might seem high to the customers (TouchPoint Interview, 2018). When customers buy large enough quantities, however, the price including the take-back can be 'almost to the same level as if it was any other production' (TouchPoint Interview, 2018). Additionally, if they see a potential customer as a 'remarkable' company that they want to build a relationship with, they may take a low profit margin to start working together (TouchPoint Interview, 2018).

4.2. Implications for Developing Circular Economy Business Models

4.2.1. Overview of Themes

The thematic analysis of the five cases through the lens of Boons and Lüdeke-Freund's four business model components identified some overlap in themes with the circular economy drivers and gatekeepers from the literature as well as some that the literature missed. Because the sample was heterogeneous, themes had to occur in at least three of the five cases in order for them to be included as one of the overall themes listed below.

Table 4: Themes from the literature and themes from the cases, as positioned within Boons and Lüdeke-Freund's four business model components (2013, p.13).

<table>
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<th>VALUE PROPOSITION ELEMENTS FROM THE LITERATURE</th>
<th>VALUE PROPOSITION ELEMENTS FROM THE CASES</th>
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<tr>
<td>- <strong>Driver</strong>: Satisfying growing demand for sustainably produced goods (de Jesus and Mendonça, 2018, pp.82-83)</td>
<td>- <strong>Driver</strong>: Market leadership using sustainability and/or innovation as a competitive advantage, often driven by desire to satisfy growing demand for sustainable goods</td>
</tr>
<tr>
<td>- <strong>Driver or gatekeeper</strong>: Measurable impact on ecological, social and financial systems (Boons and Lüdeke-Freund, 2013, p.13)</td>
<td>- <strong>Driver or gatekeeper</strong>: Compliance and accreditation under a national, supranational or industry framework, and/or the ability to help B2B customers comply or receive accreditation</td>
</tr>
<tr>
<td>- <strong>Gatekeeper</strong>: 'Substitutability' for products without recycled materials (Zink and Geyer, 2017, pp.597-598)</td>
<td>- <strong>Gatekeeper</strong>: High-quality products that can compete with the non-recycled versions of those products</td>
</tr>
<tr>
<td>- <strong>Gatekeeper</strong>: Alignment of stakeholders' values (Allenby and Richards, 1999, p.18)</td>
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### Supply Chain Elements from the Literature

- **Gatekeeper: Engagement with suppliers** on companies' sustainability values without companies passing 'socio-ecological burdens' to supply chains (Boons and Lüdeke-Freund, 2013, p.13)

- **Gatekeeper: Data** on how waste materials can be used (Allenby and Richards, 1994, p.18)

- **Gatekeeper: Technologies** that can enable material recovery and reuse (de Jesus and Mendonça, 2018, p.81)

- **Gatekeeper: Ability to overcome locked-in 'path dependencies' and inertia** (de Jesus and Mendonça, 2018, p.82)

- **Gatekeeper: Regulatory frameworks** that facilitate research and development as well as new kinds of material reuse (de Jesus and Mendonça, 2018, p.82)

### Supply Chain Elements from the Cases

- **Gatekeeper: Symbiotic networks and partnerships** that go beyond traditional linear supply chain relationships

- **Gatekeeper: Waste material availability** in the volumes and quality required to be used in products

- **Gatekeeper: Technologies** that can enable material recovery and reuse

- **Gatekeeper: Data** on how waste materials can be used and to ensure that circular systems are working properly

### Customer Interface Elements from the Literature

- **Gatekeeper: Motivation** for customers to 'take responsibility for their consumption' without companies 'shifting' its socio-ecological burdens to its customers' (Boons and Lüdeke-Freund, 2013, p.13)

- **Gatekeeper: Education** about how customers can participate in new circular models, such as product-service systems (de Jesus and Mendonça, 2018, p.83)

- **Gatekeeper: Shifting to services** as a driver of new revenues rather than sales of physical products alone (Bocken et al., 2016, p.313)

### Customer Interface Elements from the Cases

- **Driver: Developing services** that can generate new revenue and strengthen customer loyalty

- **Gatekeeper: Ease of using** new customer-facing service models

- **Gatekeeper: Consumer education** about how to participate in circular business models, such as product-service systems

### Finance Model Elements from the Literature

- **Driver or gatekeeper: Reliable markets** for

### Financial Model Elements from the Cases

- **Gatekeeper: Increased costs** and difficulty
the products (Allenby and Richards, 1994, p.18)

- **Driver or gatekeeper: Even spread of financial benefits and costs** throughout supply and value chains (Boons and Lüdeke-Freund, 2013, p.13)

- **Gatekeeper: High enough price points** to avoid circular economy rebound (Zink and Geyer, 2017, pp.598-599)

- **Gatekeeper: Financially accounting for the company's impacts** on ecological and social systems (Boons and Lüdeke-Freund, 2013, p.13)

- **Gatekeeper: Ability to invest upfront**, even though costs may be high (de Jesus and Mendonça, 2018, p.82)

- **Gatekeeper: Ability to withstand market uncertainty** (de Jesus and Mendonça, 2018, p.82)

making circular economy initiatives profitable

- **Gatekeeper: Financial incentives** for external actors to invest money and/or waste materials in the company

The drivers and gatekeepers identified above offer insight for what elements could comprise a circular economy business model. To illustrate this, I have fit the drivers and gatekeepers into Osterwalder’s business model canvas framework since it is a widely used tool that helps business models fulfill the demonstrational function that Doganova and Eyquem-Renault outlined (2009, pp.1568-1569). Additionally, the business model canvas itself is meant to be filled in with gatekeepers for each of the nine components.
<table>
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</thead>
<tbody>
<tr>
<td>-Build symbiotic networks of innovation and supply partners</td>
<td>-Set up a collection service for waste materials or partner with a supplier that has its own</td>
<td>-Target existing customer segments where adding circular models to an existing business</td>
<td>-Use service models to build customer loyalty</td>
<td>-For B2B or B2C customers: high-quality products</td>
</tr>
<tr>
<td>Key resources</td>
<td></td>
<td></td>
<td>-Clearly educate customers about how to engage with new circular models</td>
<td>-For B2B customers and/or partners: compliance and accreditation</td>
</tr>
<tr>
<td>-Data that can verify material flows and customer needs</td>
<td>-Waste materials in sufficient volumes and qualities</td>
<td>-Prioritize the ease and effectiveness of customer-facing activities</td>
<td>-For B2C customers: satisfy growing demand for sustainable goods</td>
<td></td>
</tr>
<tr>
<td>-Technologies that can enable circular flows</td>
<td></td>
<td>Channels</td>
<td>-Integrate into existing channels if possible</td>
<td>-For the company: market leadership</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost structure</th>
<th>Revenue streams</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Be willing and able to absorb increased costs when implementing circular models</td>
<td>-Put financial incentives in place for customers and/or partners</td>
</tr>
</tbody>
</table>

Figure 11: The drivers and gatekeepers identified in the cases positioned within the business model canvas framework. The main driver for the companies was market leadership through circular economy initiatives.

Fitting the driver and gatekeeper findings into the business model canvas also gives a holistic overview of the business logic of circular business models and facilitates analysis, management and prospecting (Osterwalder, 2004, p.20-21). The business logic is often missing in business' sustainability activities when they are undertaken as corporate social responsibility (CSR) initiatives, which make them net expenses for companies. The findings of this study show that the push to identify business models that facilitate sustainability must contend with the continued existence of tension between a company's financial goals and other soft goals, such as customer engagement, that can eventually lead to reaching financial and sustainability goals.

**4.2.2. Financial Models**

The financial logic was one of the most discussed aspects within circular economy literature but one of the least discussed by the case companies. For Durat and TouchPoint, companies built solely around products that use waste materials as product inputs, their continued
existence proves that making products from waste materials can be financially viable. Both of these product categories – solid surface materials and workwear – also tend to be purchased in finite quantities by their customers, all of which are businesses. There are only so many countertops a building can have, and companies only purchase one workwear line at a time, so buying from TouchPoint means not buying from someone else. Thus, these two product categories are particularly well suited to fitting Zink and Geyer's requirement that circular economy products take market share from 100% virgin products rather than simply expanding the overall supply. Palpa was also founded with explicit sustainability goals, and because of the high recyclability of the materials, they have a secure market for the products that pass through their system, which Allenby and Richards identified as a key gatekeeper (1994, p.18).

The financial benefits for Finlayson are not clear, though being at the forefront of sustainability experimentation in consumer goods may position them to be market leaders in this area if current trends continue. However, unlike with Durat and TouchPoint, Finlayson's products can be accumulated in infinite quantity, and the interviewee was not sure whether the products from recycled materials had taken any sales share from their 100% virgin counterparts. Additionally, their collections of used materials have been driven in part by a desire to bring customers into their stores, which would drive customers to likely purchase some 100% virgin products. For UPM, the financial goal is to raise share prices and, perhaps even more importantly, attract sustainability-oriented investments. However, the zero solid waste initiative has not shifted sales of their primary products to replacements made from recycled materials. Also, it is not clear, and perhaps not likely, that funds from UPM's sustainability-oriented investors are being used to further develop their sustainability portfolio. These investments may well be used to fund growth of primary production activities from 100% virgin materials.

The role of financial incentives went beyond just UPM's efforts to attract sustainability-oriented investors. Palpa and Finlayson both use financial incentives – deposits and discounts, respectively – to get end users to bring their waste materials into the companies' collection points. Boon and Lüdeke-Freund identified the 'even spread[ing] of financial benefits and costs throughout supply and value chains' as one of the normative requirements for sustainable business' financial models, but they miss the role of financial
incentives for customers (2013, p.13). However, asking customers to bring in waste materials that the company can use to make new products makes them de facto part of the companies' supply chains, though no one in the literature or practice has explicitly acknowledged this. This shift is discussed in greater depth below.

Additionally, the companies, or at least their customers, also needed to be able to **absorb the increased cost** of buying sustainable products. Durat said that the use of waste materials made the process of producing their solid surface materials more expensive. Finlayson did not calculate the labor sorting costs into the price of the rag rugs, a cost that may otherwise have made the product line more expensive than comparable products on the market. TouchPoint's take-back program adds extra cost to their products, especially when the quantities are relatively low. de Jesus and Mendonça identified the 'ability to invest upfront, even though costs may be high', and the findings from the cases suggest that this is not just necessary for the company launching the circular economy initiative, but also for their customers (2018, p.82). The high price points also decreases the possibility of circular economy rebound, as Zink and Geyer note (2017, pp.598-599).

### 4.2.3. Supply Chain

Perhaps the clearest shift in business logic between conventional and circular models was in the supply chains, which were all characterized by a shift to **symbiotic networks and partnerships** rather than traditional linear supply chain models. Two of Finlayson's waste products, the jean towels and the flannel from cutting scraps of various fabrics, are innovations developed by their suppliers. The suppliers were struggling to find partners to take these innovations to market, a role that Finlayson eagerly agreed to fill. In the case of the Jesus flannel, Finlayson learned that their supplier had developed it quite by chance. On a call with one of Finlayson's purchasers, the sales representative made an offhand comment about this new waste fabric, and the Finlayson purchaser inquired further.

In TouchPoint's case, the materials innovation is also done outside of the company by research institutions and suppliers. UPM stressed the symbiotic relationship between companies and research institutions in collaborative products, such as the car made out of biocomposite in collaboration with Metropolia University. UPM also develops material innovations from their waste products, driven in large part by their zero solid waste 2030
goal, but they need other companies to take the materials to market. Thus, the question of who has the burden of ensuring companies' socio-ecological responsibility cannot be so easily cleaved as to say that 'this is your burden' and 'this is my burden' when considering supply chains, in spite of Boons and Lüdeke-Freund's normative requirement that companies should not pass their responsibility to suppliers (2013, p.13). Some companies explicitly take on their customers' burdens, such as TouchPoint when they discussed that their take-back program is an easy way for them to take care of their customers' environmental responsibility. Additionally, the shifting relationships in supply and value chains in practice proves that it is possible to overcome locked-in relationships, an issue that recurred as a sustainable business model barrier in the literature (Boons and Lüdeke-Freund, 2013, p.16; de Jesus and Mendonça, 2018, p.82).

Another element that Boons and Lüdeke-Freund miss is that aside from innovations, the other most important role of suppliers is simply ensuring waste material availability. The academic discussion of take-back programs is largely discussed through the lens of customer engagement or the technological barriers to material reuse rather than take-back/take-in services as links in a company's supply chain (de Jesus and Mendonça, 2018, p.81-82). Durat, Finlayson and UPM all discussed the importance of material acquisition in adequate volumes and of adequate quality as a gatekeeper to their production processes. Durat has a long-standing relationship with a plastics factory that provides Durat with its waste materials, so the supply of those materials for primary production is quite stable. However, because Durat's solid surfaces can easily be refurbished for second sales, they are trying to increase the input of used products to develop a second-life service. They are in the process of setting up these channels, but they said that it is likely that the second-cycle materials will come from large commercial contracts. Scalability is one of the paths to successful sustainable business model implementation, so the waste material availability issue is a fundamental gatekeeper that can make or break a company's circular economy initiatives (Schaltegger et al., 2016, p.275).

As noted above, the issue of accessing waste materials can shift the relationship of a company and its customers, making customers a part of their supply chains, though companies do not seem to think of them this way. This is a key finding that is not identified in the literature. Boons and Lüdeke-Freund draw a distinction between 'upstream relationships' with suppliers
and 'downstream relationships' with customers (2013, p.10). However, the findings from these cases suggest that the flow is less like a stream and more like a whirlpool. Laubscher and Martinelli come closest by identifying 'supply loops' as an essential element of a circular business model, but they do not explicitly frame customers as suppliers (2014, p.3). A challenge, though, to incorporating customers into supply chains is that they may be less reliable than traditional corporate suppliers, limiting the replicability of the model (Schaltegger et al., 2016, p.275).

Accessing waste materials to use as product inputs is only the first step, however. Companies also need the right technologies to process the waste into new raw materials and producers to make the actual products. Technology is the first barrier listed by de Jesus and Mendonça, and Boons and Lüdeke-Freund also list technological innovation as one of the three innovation streams in sustainable business models (de Jesus and Mendonça, 2018, p.81; Boons and Lüdeke-Freund, 2013, p.14). The cases identified two types of technologies necessary: material and mechanical. Durat, Finlayson, UPM and TouchPoint all discussed how finding innovative uses for waste materials was a gatekeeper for circular business models. On the mechanical side, Finlayson had difficulty finding the right machinery to weave their rug rugs, and they almost invested in their own machine but they found the supplier in western Finland before doing so. Effective, reliable machinery is the key to Palpa's success, as their whole system would break down without the reverse vending machines.

**Data** is the enabler that makes circular economy networks function and that ensures the validity of the circular material flows. It is the lifeblood of the whole Palpa system. Palpa has an extensive network all across Finland, and they need to continually update their data files to ensure the collection points have all of the current containers in the system. UPM uses data to track and validate that their wastes are actually being used the way their partners say they will be. Being a public company, illegitimate circular flows would draw negative media attention that would hurt the company. TouchPoint also uses data to ensure the sustainability of the products through the Dutch aWAREness material management system. According to Allenby and Richards, data on how waste materials can be used is key to circular economy success (1994, p.18). The case examples show that this is true, and that the use of data stretches beyond this to include the entire life cycle of the materials.
4.2.4. Customer Interface

The next normative requirement that Boons and Lüdeke-Freund outline is that a sustainable business' customer interface should 'motivate customers to take responsibility for their consumption as well as for the focal company's stakeholders' (2013, p.13). From the five case companies examined, it became apparent that 'motivat[ing] customers to take responsibility for their consumption' is not the main differentiator in the customer interface between circular economy business models and conventional ones. Changing consumer behaviour does play a role, as discussed in the consumer education section below, but the attempts at behaviour change are intended primarily to instruct customers how to properly engage with services rather than to educate them to change their overall consumption patterns.

The shift to developing services was clear in practice, but not to the extent that the literature would suggest. Finlayson has piloted the most explicit 'product as service' offering with their circular economy account, which is a modified leasing model whereby customers make monthly payments and then decide at the end of the payment period whether they would like to keep the items. The interviewee mentioned that despite the favorable results of the pre-launch survey they did with their loyalty club members, customers have been slow to adopt the circular economy account, and it was paused as of March 2018.

Although it is not a true product as a service model – as customers own the products at the end of the payment period and they need to pay for new eligible products (albeit at a discount if they return the first set of products) – the lack of customer enthusiasm suggests, as de Jesus and Mendoça point out, that a dearth of customer education can make product as service models slow to catch on (2018, p.83). Finlayson's informational about the circular economy account does not connect with any user pain points or use needs, making it difficult to make the case for joining the account (Finlayson, 2018c). It was also mentioned in the interview that one of the reasons people were slow to adopt the service was because it was a difficult concept for users to understand. On the B2B side, the situation seems to be similar. In one anecdote, the interviewee from Durat mentioned having once semi-jokingly floated the idea of 'kitchen tops as a service' to a contractor and said, laughing, that the contractor never called back (Durat Interview, 2018).
However, in spite of the limitations of product as a service in practice at this point, the incorporation of other types of services was mentioned throughout the interviews. Durat, Finlayson and TouchPoint all discussed their burgeoning take-in and/or take-back services for used goods that the companies could use as new product inputs. Durat is in the process of building a take-back service for their products that are currently in the market. Finlayson's take-in services for sheets and jeans and TouchPoint's take-back (or take-in, if the old garments were made by another company) services for old garments are both seen as important drivers of customer engagement and loyalty. Additionally, Palpa's use of services for their operations, which allows them to scale up and down as needed, shows that the service shift can manifest in different ways in different circular companies.

Another insight to emerge is that the companies integrate their circular economy offerings into their existing customer channels, such as their physical stores, which is a key for making the services easy to use. Using existing channels for circular economy activities is important for integrability, one of the four essential elements of business model diffusion identified by Schaltegger et al. (2016, p.275). However, the integrability of circular economy product lines into existing business models opens the question, raised by Zink and Geyer, of whether using waste as product inputs replaces virgin materials in primary production or just creates new product categories, thereby expanding the 'pie' rather than swapping out ingredients (2017, p.600). This was less an issue for Durat and TouchPoint, companies whose products were formulated from the outset using waste materials. In Finlayson's case, the products made with waste materials have not decreased the share of sales from the analogous products made with 100% virgin materials. In one case, the clothespins made from plastic waste, the waste products were completely new product categories to the company.

While Schaltegger, Lüdeke-Freund and Hansen discuss integrability in the context of companies integrating new business models into their existing ones, another key component of integrability emerging from this study is the integrability of new services into customers' lives and the ease of using those services. Throughout the interviews, the ease and effectiveness of of consumer-facing processes came up again and again. In Palpa's case, the effectiveness of the customer interface, the reverse vending machines (RVMs), and the scale of the take-back network are critical components to the success of their operations. If RVMs do not reliably intake all of the beverage packages they are supposed to or output the
appropriate deposit return, end users will not continue to participate in the system. If the end user system breaks down, Palpa's customers, retailers that sell disposable beverage containers, may opt to leave the system and pay the 51 cent tax instead. The network spans retailers across the entire country, so consumers know that any major grocery stores will have an intake point for their beverage packages, which reinforces end users' likeliness to participate in the system. Durat also mentioned that their new take-back service would include transporting used Durat implements from their customers' buildings, which would save their customers the time and money it would take to transport large implements to landfills. Finlayson's sheet and jean take-in service happens right in their stores, making it easy for customers to participate.

The integrability of services into customers' lives raised the importance of customer education in the interviews. Thus, the assertion that sustainability-oriented businesses should 'motivate customers to take responsibility for their consumption' was borne out to an extent in practice (Boons and Lüdeke-Freund, 2013, p.13). The key difference, though, was that the role of customer education in practice was not so much about motivating customers to change their overall consumption habits as it was about teaching them how to engage with the companies' sustainability offerings.

For example, as discussed above, the limitations in customer understanding was seen as a key barrier for Finlayson to get its circular economy account initiative off the ground. Education, or the lack thereof, was a critical gatekeeper for this initiative's success. Palpa discussed how end users do not understand the take-back process for glass bottles, as they do not have the Finnish labels and barcodes that glass bottles and aluminum cans have. The problem is that not all glass can be recycled (e.g. glass that is opaque), but the RVMs cannot distinguish compliant bottles from non-compliant ones. To the machine, a wine bottle is a wine bottle, and non-recyclable packages inevitably end up in Palpa's system. For UPM, the role of education was centered around changing mindsets in the industry so their waste fractions could be aggregated to meaningful levels. Thus, education about how to properly participate in circular economy systems is important for the scalability of circular models, which is one pathway to circular business models' survival (Schaltegger et al., 2016, p.275).
4.2.5. Value Proposition

To Boons and Lüdeke-Freund, sustainable business models' value propositions must have 'measurable' environmental, social and economic value (2013, p.13). This value should be determined in concert with the needs of society and rooted in a particular time and place (Boons and Lüdeke-Freund, 2013, p.13). The cases made it clear, however, is that the value the companies provide is more quotidian than that. The value of the circular economy initiatives are multilayered, with different value propositions for the company, the customers, the company's partners and the environment.

Table 5: Four-part value proposition for case companies' circular economy offering(s), identified through analysis of the case companies.

<table>
<thead>
<tr>
<th>Company</th>
<th>Internal value proposition</th>
<th>Customer value proposition</th>
<th>Partner value proposition</th>
<th>Environment value proposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Durat</td>
<td>Sustainability as competitive advantage</td>
<td>High-quality products that contribute to green building accreditation</td>
<td>Getting rid of suppliers' waste for them</td>
<td>Slowing the flow of plastic to landfills; reducing the use of oil in virgin plastics</td>
</tr>
<tr>
<td>Finlayson</td>
<td>Attracting customers; revitalizing old brand</td>
<td>High-quality products that happen to be sustainable</td>
<td>Bringing suppliers' innovations to market</td>
<td>Slowing the flow of textiles to landfills; laying the groundwork to reduce the use of virgin materials (if products from waste take sales from products from virgin materials)</td>
</tr>
<tr>
<td>UPM</td>
<td>Potential to increase share values; access to sustainability-oriented investment funds</td>
<td>Sustainably-sourced products that can enhance their image of responsibility</td>
<td>Participating in an industry-wide 'circular economy cluster' that would aid</td>
<td>Slowing the flow of industrial by-products to landfills</td>
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</tr>
<tr>
<td>Palpa</td>
<td>Recycling beverage</td>
<td>Customers get money back from</td>
<td>Participating in Palpa’s</td>
<td>Slowing the flow of materials to landfills;</td>
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<tr>
<td></td>
<td>packages is the</td>
<td>their purchases</td>
<td>system is a cheaper way to</td>
<td>reducing the use of oil as virgin plastic</td>
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<tr>
<td></td>
<td>company’s reason for</td>
<td></td>
<td>comply with the waste law</td>
<td>and the use of aluminium and glass</td>
</tr>
<tr>
<td></td>
<td>being</td>
<td></td>
<td>than paying the 51 cent tax</td>
<td></td>
</tr>
<tr>
<td>TouchPoint</td>
<td>Sustainability as</td>
<td>High-quality products that</td>
<td>Bringing suppliers’ innovations</td>
<td>Slowing the flow of PET bottles to</td>
</tr>
<tr>
<td></td>
<td>competitive advantage</td>
<td>provide a visible way of</td>
<td>to market</td>
<td>landfills; slowing the flow of fabric</td>
</tr>
<tr>
<td></td>
<td></td>
<td>showing their sustainability</td>
<td></td>
<td>waste to landfills by making biocomposites;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>commitments and accreditation</td>
<td></td>
<td>reducing the use of oil as polyester and</td>
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<td></td>
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<td>of virgin cotton by substituting</td>
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<td>eucalyptus-based tencel</td>
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For the companies themselves, the prospect of *market leadership* was a central value proposition for implementing circular economy business models. The contrast between companies founded as sustainability-oriented enterprises and older companies trying to shift to more circular material choices is reflected in the differing answers identified in the analysis to Amit and Zott’s question, 'What perceived needs can be satisfied through the new model design?' (2012, p.47). For Durat and TouchPoint, the need was some sort of competitive advantage to set them apart from large, established players. Finlayson also needed market differentiation, but for the opposite reason: to revitalize an old, struggling brand rather than to get a new one off the ground. Their circular economy push was driven by visionary leadership and the leaders’ willingness to experiment, key enablers identified in the literature (Stubbs and Cocklin, 2008, p.122). UPM’s sustainability initiatives gave them access to new
funding sources, such as the Dow Jones Sustainability Indices. For Palpa, the need was to help companies comply with waste law at a lower cost than the waste tax levied by the law.

The role of sustainability as a driver of market leadership was built on the changing consumer mindsets that all of the interviewees identified. Some, notably Finlayson, Durat and TouchPoint, mentioned how quickly sustainability adoption and focus had changed in their industries in the past several years. de Jesus and Mendonça identify demand as a 'decisive' driver for circular economy, and this was borne out by the cases (2018, p.83). Thus, the 'business-society dialog' Boons and Lüdeke-Freund offer as a normative requirement for a company's value proposition is indeed present, though 'society-business dialog' might be a more accurate way of saying it (2013, p.13).

Just as important, if not more so, than the sustainability value proposition is the value of simply selling high-quality products. Durat, Finlayson and TouchPoint all discussed the importance of product qualities that were independent of the sustainability value propositions. Durat mentioned the high quality and price of their solid surface materials, along with the hygienic surface and seamless joints between slabs. Finlayson discussed how the 'Jesus flannel' sheets made from various recycled fibers had become popular in online blogs because of their softness, and that many bloggers did not even seem to know that the sheets were made from recycled materials.

TouchPoint talked about how comfort and material texture are central to their product development and about how they go through a long, iterative testing process with their client companies to get it right. The central role of product quality suggests that despite the consumer mindset shift toward sustainability, product sustainability alone is not enough to drive consumer purchasing choices. They need to compete with virgin-made products on quality and if they do, only then might their sustainability value proposition seal the deal with customers. This emphasis on quality is essential for avoiding what Zink and Geyer refer to as 'rebound attributed to insufficient substitutability' (2017, p.597). If products from waste materials cannot compete on quality with their 100% virgin counterparts, they will not be able to take market share from products with purely linear material flows.

For B2B customers and partners, a distinction that is blurred in cases like that of TouchPoint, which sees all of its clients as partners, the compliance and accreditation that can come from
using the case companies' products and services is an important value proposition. This is also where the clearest connection to a tangible environmental value proposition can be found. Durat said that the ability to use their products to get LEED points will become increasingly important to their company. TouchPoint has developed its own accreditation rating system using a combination of environmental and social sustainability indicators, which includes meeting external sets of requirements, such as that of Design from Finland. Palpa's entire reason for being is to help participating companies comply with Finnish waste law. Finlayson and UPM also mentioned broader UN and EU initiatives as part of the drivers for their circular economy initiatives, though the connections were less explicit than that of the other companies.

The role of compliance and accreditation is where the environmental value proposition comes in, as well as the value proposition for B2B customers and partners. There was no explicit mention in the interviews of 'nature as stakeholder', triple-bottom line, etc., so the rhetoric of the case companies reflected the shift in sustainable business model literature away from a focus on the natural environment, in spite of Boons and Lüdeke-Freund's normative requirement that sustainable business models have measurable impacts on the environment (Stubbs and Cocklin, 2008, p.122; Boons and Lüdeke-Freund, 2013, p.13). With the exception of UPM's zero solid waste goal, which intends to impact its own operations here in Finland, it appeared to be impossible to connect the circular economy initiatives of the case companies with clear benefits to any natural ecosystems. The other four companies are all connected to global supply chains to some extent (as are other verticals within UPM, but that is beyond the scope of this study), even if that just means working with plastic materials made from oil from abroad. As Finlayson pointed out, companies often cannot, or at least do not, track every link in their supply chains.

4.2.6. Limitations of Business Models as Drivers of Sustainability

The quest for business models that facilitate ecological sustainability could be viewed as a search for a deus ex machina ('god from machine'), or more accurately deus ex consilium ('god from strategy'), that can slow, or reverse, the rate of ecological damage without forcing societies to sacrifice the comforts of consumer culture. However, in both literature and practice, the positive impact on the natural environment seems to be tenuous at best, at least
in the case of materials sustainability (as opposed to energy or water usage, for example). It is
telling that in the ten years since Stubbs and Cocklin first introduced the idea of the
'sustainable business model' into academic discourse, their idea of 'nature as a stakeholder',
reflected in the antecedent idea of 'natural capital', has all but disappeared in the sustainable
business model literature (Stubbs and Cocklin, 2008, p.122; Lovins et al., 1999).

Observing the lack of clear information about what impact the case companies' circular
economy activities have had on natural ecosystems and the removal of nature from business
literature on sustainability left one important question: why do sustainable business models
not seem to be delivering on their promise of reconciling environmental sustainability and
consumer capitalism? A systems thinking approach provides one possible answer.

Meadows and Wright define a system as an 'interconnected set of elements that is coherently
organized in a way that achieves something' (2008, p.12). Through the analysis, I observed
that business models operate as systems rather than as a collection of discrete elements, as the
business model canvas' nine distinct boxes would suggest. Each business model component,
which could be each of Osterwalder's nine elements, operates as a leverage point. Changes to
one leverage point can reverberate throughout the system, and the drivers identified in this
study can act as the inputs that trigger system change. Figure 12 shows how this system
change worked for Finlayson's rag rug offering.
Figure 12: A partial system map of how changes in the business model elements of Finlayson's rag rug introduction impact one another. The new value proposition was the trigger for the system change, and the new revenue source is the goal. The arrows represent dependencies between elements. For example, having the key resource of internal warehousing personnel to sort sheets is an essential precursor to engaging the key partner of the weaving company.

All business model systems operate with the intention of reaching a virtuous cycle feedback loop in which investments beget profits which beget larger investments which beget larger profits. Sustainable business models are intended to create two simultaneous virtuous cycles: a financial virtuous cycle of investment and profit and an environmental virtuous cycle of environmental change. But that environmental change is not clearly defined, and it is usually rooted in sustainability rhetoric (such as 'reducing waste' and 'reducing resource use') rather than actual ecosystem impacts. For companies that are engaged with complex, global supply chains, the idea of 'sustainability' risks becoming an empty simulacrum, an empty signifier that no longer refers to anything that exists in observable reality (Baudrillard, 1994, p.2). Sustainability is supposed to be about the ability of a specific ecosystem to sustain life indefinitely, but without referring back to an actual ecosystem, 'sustainability' loses its meaning, at least in the materials sustainability context (more easily measurable and traceable branches of sustainability, such as energy and water, are a different case entirely). The problem is that simulacra can only engender the 'orbital recurrence of models', the diachronic
opposite of a dynamic virtuous cycle (Baudrillard, 1994, p.3; Meadows and Wright, 2008, p.32). The model can copy itself, but without meaning there can be no meaningful change.

For a business model to have a real regenerative and/or damage-slowning impact on the environment, its strategy must ideally be rooted in an actual, specific ecosystem. If this is not possible, the sustainability value proposition should be mapped in a system flow to get from the sustainability rhetoric to theoretical impacts on a specific ecosystem. This can and should include acknowledging what barriers might exist in making the environmental virtuous cycle possible.

![Diagram](image)

**Figure 13:** What the environmental virtuous cycle could look like for Finlayson’s rag rugs, though the leap between normalizing the use of waste materials and taking a meaningful market share from 100% virgin material products requires a large scaling up of products made from waste materials across the company and/or industry. Additionally, the ecosystem end goals tend to get lost in business sustainability rhetoric, including in the language of circular economy.

A key challenge going forward will be identifying how to align the financial and environmental virtuous cycles, especially since the cases illustrated the inherent tensions that often exist between profitability and sustainability. However, only when these two virtuous cycles are aligned will sustainable business models be able to reach their potential to slow and/or reverse environmental degradation within the capitalist economic system.
5. Conclusion

5.1. Summary of Findings

This study identified key drivers and gatekeepers for the implementation of circular economy business models by studying Finnish companies that create economic value from waste materials. The study found that circular economy initiatives bring different value propositions for the company, its customers, its partners and the environment. New networks and partnerships are essential for implementing circular economy initiatives, and these might be new symbiotic relationships with existing members of the supply or value chain. This could mean that customers become suppliers or that suppliers become innovation partners. The role of services is growing in circular economy-minded companies, but those services must make end user participation easy. Consumer education is key to service offerings so that customers know how to participate in them. The financial impacts are ambiguous and affect companies differently depending on their company structures. Increased costs are possible, but there can also be financial benefits, especially for companies that can attract sustainability-oriented investments and/or for companies explicitly founded on offering sustainable products.

This study also found that business models operate as systems, rather than as a collection of discrete elements as the business model canvas representation suggests, that work together to create a virtuous cycle of ever-rising investments and profits. Sustainable business models are intended to also create a second virtuous cycle of positive environmental change. However, for companies that are part of complex, global supply chains, the definition of 'sustainability' becomes ambiguous at best (and empty at worst) because companies cannot always identify what natural ecosystems their materials come from. Finding a way to develop an ecosystem-oriented definition to sustainability is key to bringing environmental virtuous cycles to fruition.

5.2. Theoretical Contribution

This study fills an important gap by offering case examples of companies that have successfully implemented circular economy business models, which have been in short supply in academic literature. It also repositions the conversation to show how quotidienn the drivers and gatekeepers are in practice, in contrast with the focus on new models like
product-service systems that have risen in prominence in the literature. Because the study used a heterogeneous sample, the findings of this multiple case study can be applicable beyond a single industry.

This study also offers specific, empirical clarifications about what drives and impacts circular business model adoption. One key contrast to the preceding literature is that financial models are less critical to adopting circular business models in practice, although there are differences between established firms adopting new circular business models and companies founded as circular enterprises. For the former, circular business models are less a means of driving new revenue streams (at least at present) and are more likely to be implemented because of the value propositions they provide, even if that means financial losses or minimal new revenues. For the latter, the financial model does not necessitate setting up complex value-sharing schemes as some of the literature suggests, but rather it simply requires turning a profit so the company can survive.

Another important contribution to the literature is that the shift to service-based revenue models is more ambiguous than some literature suggests. The study instead confirms de Jesus and Mendonça's finding that services must be easy to use and understand in order to take off and become meaningful revenue sources. The service shift is a key circular business model archetype included in frameworks such as that of Bocken et al., and the ambiguity of the service shift in practice shows that business model archetypes must be grounded in empirical study to avoid advocating models that may not bring about the benefits suggested in the literature.

This study also identifies a component of circular economy business models that seems to be absent from preceding literature: the non-linearity of supply chains and the shifting of roles within supply chains, including that of customers. The availability of waste materials was a key issue for the companies interviewed, and it was clear that new models for material acquisition are important enablers of circular economy transitions. Finlayson has brought their customers into their supply chains by collecting waste materials from them, though the company does not seem to think of customers as suppliers. Durat and TouchPoint also mentioned getting into take-back programs so they could make new products from their customers' waste materials, and Palpa's entire raison d'ètre is to collect waste materials from
consumers. UPM identified the problem of aggregating post-business waste from competitors because alone, no one would have enough material to make a meaningful business from the identical waste streams they all end up with. Finlayson and TouchPoint also mentioned having research and development partnerships with suppliers and customers, another key way supply chains are changing for circular economy.

Finally, this study takes the novel step of combining business model frameworks with systems thinking, which also seems to be missing from the literature. This study reaches the conclusion that business models function as systems rather than as discrete components, as Osterwalder's business model canvas tool suggests. The goal of the business model system for sustainable businesses (including ones focused on circular economy) is to reach two simultaneous virtuous cycles: 1) investments begetting profits and 2) positive environmental impacts. To do the latter, companies need to have a clear connection to the ecosystems of their products to avoid their definition of sustainability languishing as an empty simulacrum. Ideally, companies should have a multi-layered value proposition for their circular business models that include the benefits to the company, its customers, its partners and the specific natural ecosystems it touches.

5.3. Managerial Implications

For companies looking to implement circular economy business models, it is important that they have a clear sense of how sustainability adds value for the company, its partners, its customers and the environment. High product quality is essential, even with sustainability value propositions. B2B companies should also see if they can connect their circular economy offerings to compliance and/or accreditation frameworks, which can provide additional value for their customers. The best practice for the environmental value proposition is to have quantifiable reductions in virgin material usage, which would negate circular economy rebound, or waste materials to landfills. Ideally, they would also be able to connect their activities to regenerative changes in specific ecosystems if at all possible.

They should also build supply and innovation partnerships and be open to symbiotic, nonlinear relationships. Scalability should be considered when establishing these partnerships, though there could benefit in also including partnerships that are not necessarily scalable (i.e. using customers as suppliers, which has the benefit of strengthening
the customer interface even though it may not always be a reliable source of materials). Any new service models added should be easy to use and understand for customers.

5.4. Areas for Future Research

This study raises a question that can be the focus of future research: are these circular economy initiatives actually having a measurable impact on natural resource usage, especially on any kind of meaningful scale? The replacement of virgin materials in these products is limited as best, especially in cases where the products from waste materials are simply additions to conventional product lines. Of course, the limitations in material technologies are one key factor in this, and as the TouchPoint case showed, the technology has been rapidly advancing, making it possible to reduce the usage of virgin materials as waste-sourced replacements become more widely available.

Another area of future research is whether products from waste materials can take a meaningful market share from their 100% virgin counterparts. As Zink and Geyer point out, simply expanding the pie exposes the key limitation of circular economy in practice. In some product categories, where there are limitations to the number of an item that a company or entity can own – countertops, for example, or workwear uniforms – there seems to be greater promise in making meaningful ecological change than in the cases of consumer goods that are relatively small and inexpensive, which can in theory be purchased in unlimited quantities. More research needs to be done to determine whether purchases of consumer goods, such as Finlayson's jean towels, replace the purchases of goods from 100% virgin materials or are simply additions on top of the purchases of their 100% virgin counterparts.

The third area for future research is the non-linearity of circular economy supply and value chains, which has not been explicitly studied in the literature, especially when customers can be framed as suppliers. The fourth area is multilayered value propositions, particularly the role of internal value propositions in driving the shift toward circular economy models. Companies need to understand why they are making this change since there are generally increased costs involved and the financial benefits can be unclear. Finally, the fifth area of future research is the barriers to creating environmental virtuous cycles from sustainable business models. The trackability of supply chains back to specific ecosystems is one
potential subset of this focus area, as is the definition of 'sustainability' that companies use in centering their circular economy offerings.
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