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Designing out waste:
an exploratory study of circular business models

MSc program in Management and International Business

Master's thesis

Paige Swaffer Poutiainen

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Department of Management Studies
Aalto University
School of Business

Aalto University
School of Business

Aalto University, P.O. BOX 11000, 00076
AALTO
www.aalto.fi

Abstract of master's thesis

Author Paige Swaffer Poutiainen

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Abstract

The circular economy is an emerging model that experts believe is able to resolve the conflict between resource constraints, environmental degradation and economic growth. In short, it is a model for an economy designed to work in harmony with the environment by designing out waste, relying on renewable energy and embracing diversity and systems thinking. Many have claimed that companies will lead the transition to a circular economy. However, much is still not understood about how companies can prosper in a circular economic system. In this study, I first review the literature to propose a definition for a circular business model. I define it as the rationale of how an organization creates and delivers value to customers and captures value for itself while it simultaneously designs out waste, relies on renewable energy, thinks in systems, and embraces diversity to build organizational resilience. A thorough review of the literature reveals that the elements of circular business models are often discussed by isolating one business model element such as *product as service systems* as revenue models. Since isolated elements alone cannot effectively design out waste, I argue that a more holistic, systems thinking perspective is needed. In the empirical part of this study, I explore how companies use the business model to design out waste and operate in a circular economic system using a more holistic framework. I investigate the business models of four companies—Patagonia, Rype Office, Splosh and Desso—and analyze them using the business model canvas as a research lens. My analysis shows that all of the cases studied need at least seven (of nine) business model elements to design out waste. The results indicate that to support circularity companies must design the business model holistically, focusing on several business model elements simultaneously. This explorative study takes the first steps in the long journey to understanding circular business models. It provides support for a holistic approach and clues for further research. Yet, in the domain of circular business models, many opportunities remain for future research.

Keywords circular business model, circular economy, business model canvas

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List of abbreviations

BM	business model
CBM	circular business model
CE	circular economy
EMF	Ellen MacArthur Foundation

1. Introduction

1.1 Introduction to the study

Our prevailing economic model is predominately a linear system. Most materials are extracted from the earth, processed, manufactured into products, sold to customers, and thrown away to landfills or incinerators. Although this system has fueled two centuries of economic growth (Pauli, 2010), many (EMF, 2012, 2013; McDonough & Braungart, 2000, 2010; Pauli, 2010; Benyus, 1997; Stahel, 2010) have highlighted and criticized its weaknesses. For example, both McDonough and Braungart (2010) and Murray, Skene and Haynes (2015) proclaim that the endless pursuit of economic growth in a linear system depends on an endless supply of virgin resources and energy and produces copious amounts of waste. Because of this, the linear economic system has contributed to a myriad of environmental problems, including soil degradation, water acidification, air pollution, waste generation and carbon emissions, in the last 150 years (Accenture, 2014). A host of environmental scientists (Rockström et al., 2009) warn that we have already exceeded 3 of 9 essential planetary boundaries: biodiversity loss, climate change, and disruption of the nitrogen and phosphorous cycles.

World resource demand is growing but resource stocks are dwindling. At current global population levels, world demand for resources has already grown beyond the earth's ability to provide basic necessities (Pauli, 2010). The WWF (2014) reports that we already use 1.5 planets' worth of resources every year. To worsen matters, the world population is predicted to grow by two billion in the next 35 years (EMF, 2012, 2014). This implies a huge rise in future resource demand. Likewise, experts (in EMF, 2012) predict that stocks of gold, silver, indium, and tungsten among others may be depleted in five to 50 years. Thought leaders (McDonough & Braungart, 2010; EMF, 2013) argue that radical resource efficiency will not

be enough. Furthermore, resources are becoming more expensive. Historically, decline in the real price of resources has made economic growth possible, according to Accenture (2014). Since 2000, however, resources prices and volatility have increased dramatically, ending a century of real price decline (EMF, 2012).

Why do companies care?

The Ellen MacArthur Foundation (hereafter EMF) reports that many companies are beginning to realize that a linear economic system increases their exposure to business risks. Potential dangers include unpredictable resource prices, stagnating demand and supply disruptions (EMF, 2012) which translate into revenue reductions, cost increases, and weakening (in)tangible assets (Accenture, 2014). The combination of tremendous population growth, rising demand for resources, increases in resource prices and volatility and inevitable future shortages lead many to a dire conclusion: the situation is only getting worse. Following a linear growth model does not appear to be an attractive option. To paraphrase Accenture (2014), the linear economic growth model is living on borrowed time and so are companies that depend on it.

Towards a circular solution

It is widely acknowledged that our global patterns of production and consumption are dangerously unstable (Preston, 2012). Resource scarcity, tightening environmental standards, developments in information technology, and changes in consumer behavior are weakening "linear lock-in" and creating opportunity for change (EMF, 2012).

A circular economic model has been proposed as a solution to the conflict between industry, economy and environment. In short, a circular economy (hereafter CE) is a model for an economy that is designed to work in harmony with the environment where biological materials are designed to return safely to ecological cycles and technical materials are designed to continuously circulate in the economic system. The ultimate goal is to delink

economic growth from resource consumption (EMF, 2012; Preston, 2012; Yuan, Bi & Moriguichi, 2006; European Commission, 2014a). This assumes that continued economic growth will be possible in the face of resource constraints while avoiding additional environmental harm.

Although the core idea behind the CE has been around for decades, it has recently gained significant traction in Asia and Europe. Governments and researchers have recognized it as an environmental strategy as well as a growth and development strategy (Geng & Doberstein, 2008; Su et al., 2013; European Commission, 2014b; Yuan et al., 2006; Naustdalslid, 2014; Mathews, Tang & Tan, 2010). They believe a CE will greatly reduce the extraction of virgin materials, eliminate the production of useless and toxic waste, and save billions of dollars in valuable materials overtime (McDonough & Braungart, 2010; Andersen, 2007). Economies can benefit from job creation, climate protection, improved economic competiveness, a more secure material supply, reduced dependency on virgin resource markets, less exposure to price shocks and volatility, and improved environmental impact (EREP, 2014; EMF, 2014). The monetary estimates vary, but both Accenture (2014) and EMF (2014) conclude that a CE can be worth trillions of dollars globally.

Many (e.g. Preston, 2012; EMF, 2012, 2013, 2014; European Commission, 2014b) believe that the CE will be ripe with business opportunity. Nevertheless, companies today are not built to take full advantage of them (Accenture, 2014). Without putting circularity at the heart of their business models, they remain trapped in linear system. This justifies the importance of studying, understanding, and operationalizing circular business models at the firm level.

1.2 Research gaps & intended contributions

Research on the CE, itself, is relatively nascent. Many studies focus on the macro- and meso-levels (e.g. Geng et al., 2009; Shi, Chertow & Song, 2010; EMF, 2014; Liu et al., 2009). The

firm level has received less attention, although there have been some studies (e.g. Zhu, Geng & Lai, 2010, 2011). If companies are to take the lead in the transition like some believe, then they need to be able to translate the CE model into successful business models. Nevertheless, research on circular business models is sparse. By studying how circularity impacts the business model, my study provides insights into how companies can put CE thinking at the core of their business and break the chains of linear lock-in. By using the business model canvas (a tool which is well-known globally among practitioners) as a research lens, my study contributes to the awareness and operationalization of the CE at the company level. The resulting circular business model canvas is a framework that managers can use to design their own circular business models.

1.3 Research questions & methodology

With the goals of contributing to the circular business model discussion and of operationalizing the CE at the company level, my research questions are:

1. What is a circular business model?
2. How does the circular economy principle "design out waste" influence business models?

I have chosen a qualitative, multiple case study design. I define a circular business model and its characteristics (questions #1) in the theoretical framework in section 2.3. How the circular principle "design out waste" influences business models is explored in the theoretical framework and in the empirical part of this study by analyzing the circular business models of Patagonia, Rype Office, Splosh and Desso through the lens of the business model canvas.

1.4 Structure of the thesis

This study is divided into six chapters. Chapter 1 introduces the study and gives a brief background to the need for a CE. Chapter 2 consists of three sections. Section 2.1 introduces

the CE concept. Although a full review of the macro-level multidisciplinary concept is beyond the scope of this study, I do introduce the elements that form a necessary foundation and context for circular business models. I define the concept, trace its development, and present a model. Section 2.2 focuses on the nexus of the CE and business model by reviewing the basic business model concept and analyzing prior research on circular business models. Section 2.3 builds the theoretical framework by conceptualizing a circular business model canvas. Chapter 3 gives an introduction to and justification for the research method choices in this study. In Chapter 4, I present the data analysis of each of the four cases. In Chapter 5, the cases are compared to each other and the findings are discussed against the backdrop of prior CE research. Finally, Chapter 6 summarizes this study in its entirety.

2. Literature review

The two main literature streams that serve as the foundation for this thesis are the circular economy and business model literature. This chapter analyzes the discussion surrounding circular business models (hereafter CBM) and is divided into three sections. Section 2.1 introduces the CE concept. Section 2.2 narrows the study by focusing on one niche within the larger CE phenomenon, CBMs. Finally, section 2.3 sets the theoretical framework for the empirical part of the study.

2.1. Circular economy

Defining a circular economy

There is currently no commonly accepted definition for a CE (Yuan et al., 2006; Accenture, 2014; Mentink, 2015). Preston (2012) has observed that the term is used quite inconsistently by governments and companies. Whereas Murry et al. (2015) observe that the term has been linked with a range of meanings and associations by different authors. China's Circular Economy Promotion Law, for example, defines it as a generic term from reducing, reusing, and recycling activities conducted in the process of production, circulation, and consumption (Preston, 2012; Naustdalslid, 2014); while, the EMF (2012) describes it as an industrial economy that is intentionally restorative; relies on renewable energy; minimizes, tracks, and eliminates the use of toxic chemicals; and eliminates waste through purposeful design. Most discussions (e.g. Yuan et al., 2006; EMF, 2012; Geng & Doberstein, 2008; Mathews et al., 2010; Mathews & Tan, 2011; Murry et al., 2015), though, share a core idea: a system of circular (or closed) flows of materials and energy.

Although it is tempting to follow authors before me and settle by defining the CE as they do, I find flaws in this definition. As McDonough and Braungart (2010) have discussed, the products that move through the economic system are made up of two types of materials:

biological materials that can decompose and be reabsorbed by the planet and *technical materials* which cannot. (Of course, most often products are made up of a combination of biological and technical materials.) Technical material loops, which cannot be reabsorbed into earth's systems, should be closed. Biological materials, on the other hand, can return safely to the biosphere and should be designed to do so. Therefore, by looking at the economy as an isolated unit of analysis, the biological material loop is an open one. Haas et al. (2015) likewise echo this sentiment that biomass cannot be regarded as a circular flow. Therefore, a CE (again regarding the economy as an isolated unit of analysis) as it is interpreted in this study contains both closed and open loops. EMF (2012) and Haas et al. (2015) have both proposed definitions reflecting this added complexity.

Building upon prior studies (EMF, 2012; McDonough & Braungart, 2010, Haas et al., 2015), I definite a circular economy as follows:

> **A circular economy is a model for an economy designed to work in harmony with the environment by designing biological materials to return safely to ecological cycles and technical materials to continuously circulate through the economic system.**

Murray et al. (2015) emphasize the importance of the word *restorative.* From this perspective, the CE is not a preventative approach (often identified through words like reduce, minimize, and eliminate). Instead, it aims to repair damage, design stronger systems, and rebuild natural capital. Therefore, a key element is having a positive impact, not only having a neutral effect on the environment.

CE proponents (EMF, 2012; Preston, 2012; Yuan et al., 2006) believe that it can resolve the conflict between economy and environment by delinking economic growth from resource consumption. Therefore, the circular economy can be considered an environmental

management strategy as well as a growth and development strategy (Geng & Doberstein, 2008; Su et al., 2013; European Commission, 2014b; Corporate Citizenship, 2014; Yuan et al., 2006; Mathews et al., 2010). The focus is on creating a win-win relationship between the environment and economy, according to Naustdalslid (2014). By reusing resources, economies can reduce their dependency on virgin resource markets and thus reduce their exposure to price shocks and volatility (EMF, 2014) as well as reduce negative environmental impacts. Although the economic estimates of the benefits vary, Accenture (2014) and EMF (2014) both conclude that a circular economy has the potential to become a trillion-dollar opportunity globally – one that will create material cost savings, smooth price volatility and supply risk, create jobs, reduce negative environmental externalities, and ultimately build a more resilient economy (EMF, 2012).

Circular economy research & development

It is difficult to identify a single body of literature in which CE originates. The core ideas behind it have been discussed for decades already, often spanning multiple disciplines. In the 1960's, Boulding (1966) wrote about the "spaceman economy"—managing our resources as if we were stranded on a ship isolated in space. Years later, Frosch & Gallopoulus (1989) coined the term "industrial ecosystem" in *Strategies for Manufacturing* to describe the idea of using natural ecosystems as guides for remodeling industrial production systems (Lifset & Graedel, 2002). In other words, we would manage our resources as the natural environment manages its own. The first researchers to use the term 'circular economy' during my research were two environmental economists in *Economics of natural resources and the environment* (Pearce & Turner, 1990).

Industrial Ecology and the circular economy share much overlap (Murray et al., 2015). Because of this shared linage, some authors claim that the CE originates from the field of Industrial Ecology (e.g. Preston, 2012; Andersen, 2007). However, the leading model for a

CE (EMF, 2012) is not rooted in Industrial Ecology alone. In fact, it draws inspiration from Industrial Ecology in addition to Biomimicry (Benyus, 1997), Cradle to Cradle (McDonough & Braungart, 2010), Performance Economy (Stahel, 2010) and Blue Economy (Pauli, 2010).

Governments and business alike are recognizing the CE business case due to mounting environmental pressure and rising and volatile resource prices (EMF, 2012, 2013). The CE has gained significant momentum in China and Europe during the last decade. Both Japan and Germany have taken steps toward a circular economy by passing rigorous recycling and waste management legislation (Preston, 2012; Corporate Citizenship, 2014). China was the first country to enact specific legislation (i.e. Circular Economy Promotion Law in 2009) to promote the CE nationwide. In 2015, the European Union adopted its own Circular Economy package (European Commission, 2015a) with targets to increase recycling and reduce landfill waste (European Commission, 2015b).

Despite corporate and government engagement with the CE concept, there has been little theoretical development. Murray et al. (2015) observe that the CE as a school of thought has largely emerged from legislation rather than from academia. CE literature is more established in China than in Europe, which is undoubtedly due to China's early adoption of a CE as a development goal. In both arenas, the vast majority of papers study the CE at the macro- and meso-levels (e.g. Geng et al., 2009; Geng et al., 2013; Shi et al., 2010; EMF, 2014; Liu et al., 2009; Mathews et al., 2010; Wen & Meng, 2015). Discussion of the CE and its policy implications has been given the most attention thus far. (e.g. Yuan et al., Su et al., 2013; European Commission, 2014a, 2014b). Other reports (e.g. Hislop & Hill, 2011) focus on specific sectors or regions. The micro-level, i.e. individual firm perspective, has been given considerably less attention. Studies at this level have looked primarily at the supply chain (e.g. Park, Sarkis & Wu, 2010; Zhu et al., 2010; Zhu et al., 2011; Wei, 2005; Ying & Li-jun, 2012;).

As a final note, the approach to the CE in Asia and Europe at the firm level take very different forms. The Chinese perspective puts emphasis on cleaner production and eco-efficiency (Su et al., 2013; Geng & Doberstein, 2008), which as Naustdalslid (2014) points out, are rather unremarkable in isolation and have been practiced in many countries. In stark contrast, the European perspective emphasizes a design approach and draws inspiration from the Cradle to Cradle methodology (McDonough & Braungart, 2010). This study reflects Europe's design approach.

Models for a circular economy

Few early CE models exist. Industrial ecologists have used a type III ecosystem as a metaphor and simple model (see figure 2, Lifset & Graedel, 2002). In a type III ecosystem, all materials continuously circulate within the ecosystem. No virgin resources are added and no wastes are produced. The only input to the cycle is energy (e.g. sunlight on earth). In contrast, in a type I ecosystem (or a purely linear economy) resources enter the ecosystem and exit as wastes.

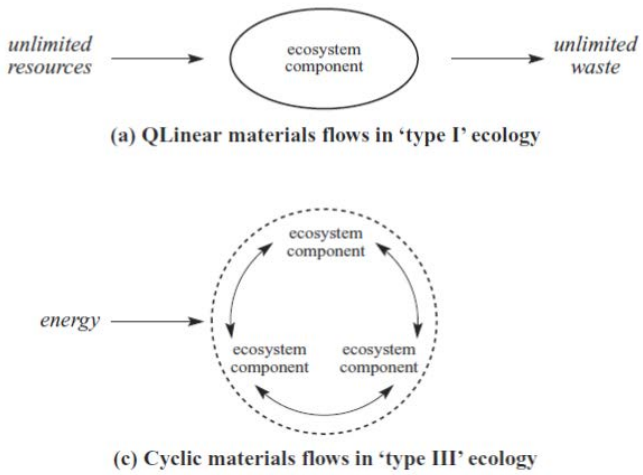


Figure 1: Type I and III ecosystem (Lifset & Graedel, 2002)

In figure 3 environmental economists Pearce and Turner (1990) build a more complicated model. They create circularity by adding a recycling loop [r] and by setting usage constraints

for renewable and nonrenewable resources. Nonrenwables are not to be used; whereas, renewables should be used at a rate less than or equal to the earth's regeneration rate.

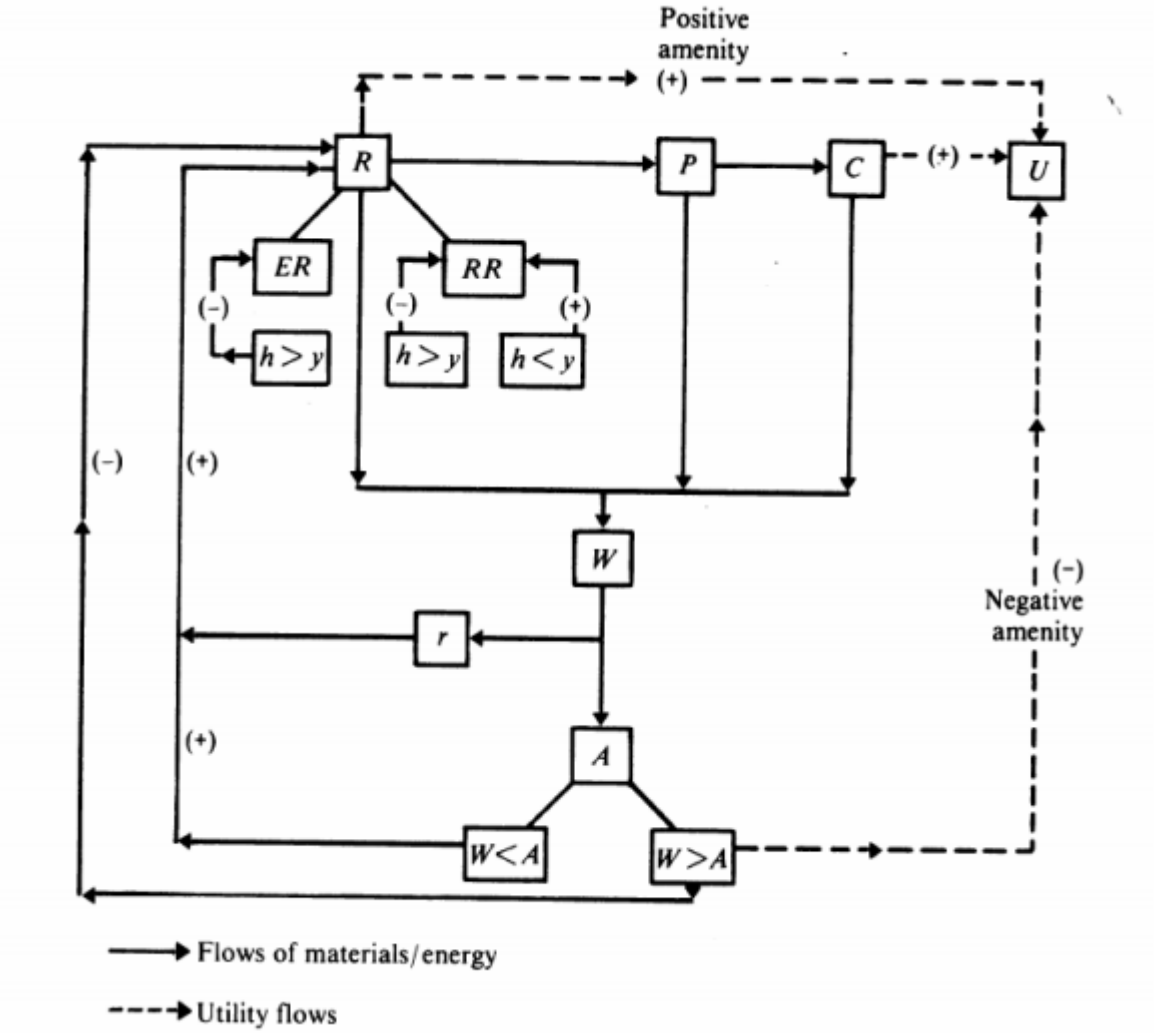


Figure 2: Circular economy model (Pearce & Turner, 1990)

Both Industrial Ecology's type III ecosystem model (Lifset & Graedel) and Pearce and Turner's (1990) models are too simple, and therefore, not reliable models for operationalization. For this reason I have chosen to use a model proposed by the Ellen MacArthur Foundation (EMF, 2012). It is currently the most detailed and most popular model referenced by researchers, companies and governments alike as ***the*** model for a circular economy. The beauty of the EMF model is that it can be operationalized at any scale, from the world economy to the individual firm. The EMF model is presented in figure 4.

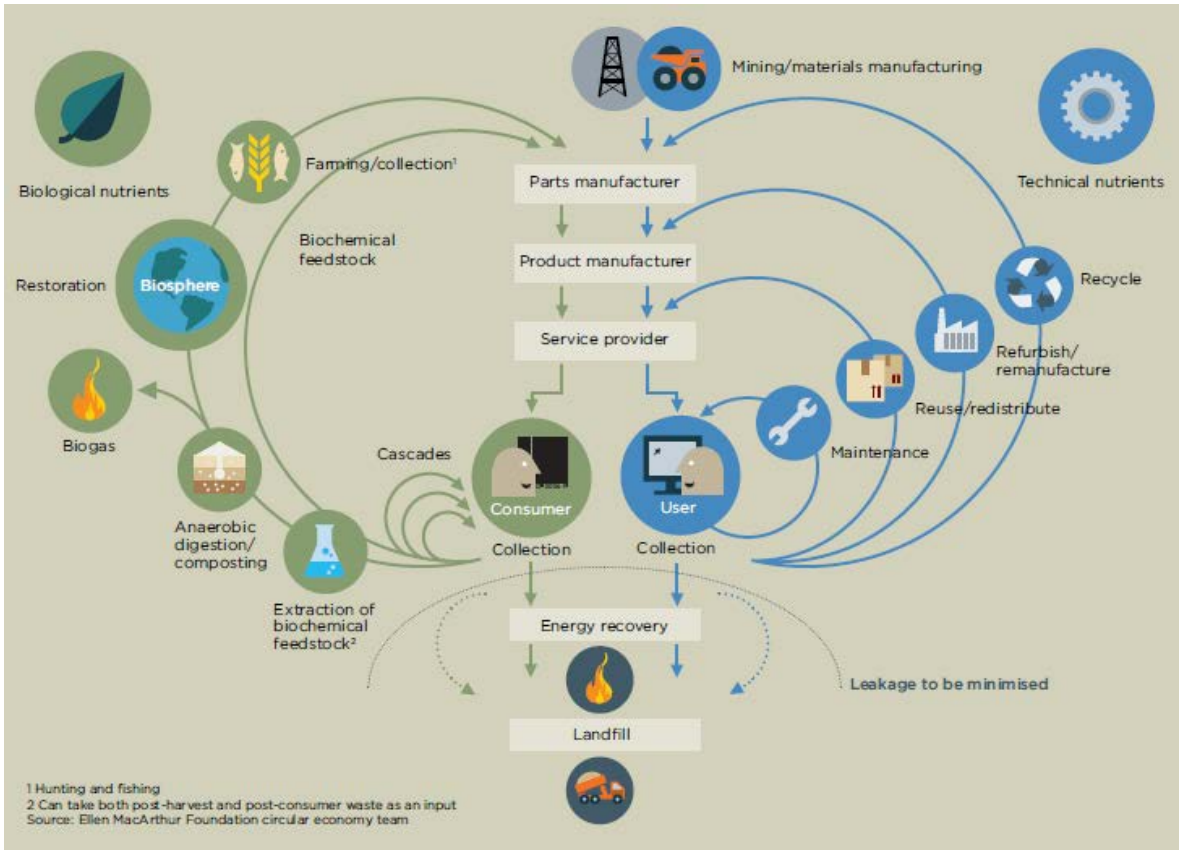


Figure 3: Model of a circular economy (EMF 2012)

As can be seen in figure 4, the EMF model divides materials and their metabolisms into two distinct types: biological and technical materials.

- *Biological materials* are biodegradable and should be designed to re-enter natural ecosystems safely and build natural capital where they become valuable inputs for new cycles. McDonough and Braungart (2010) often refer to this as the "waste equals food" principle.
- *Technical materials* do not degrade easily and may contaminate the biological nutrient flow. These materials should be designed to circulate in industrial cycles at high quality without entering the biosphere.

In a circular economy, waste is eliminated through careful design. This implies an attentive management of material flows. The EMF (2012) model likewise outlines various strategies to

create circular loops. On the biological side, materials can be cascaded as much as possible to new uses before energy is recovered through biochemical extraction, anaerobic digestion, composting, or other 'last resort' energy recover methods (see energy recovery in table 1). Technical materials are designed to be reused, repaired, refurbished, remanufactured, and recycled. Which loops materials (and products) pass through is likely to vary from product to product. The guiding principle is to keep materials circulating as long as possible at as high a quality as possible with minimal energy added. For example, a washing machine should be repaired for reuse if possible before being recycled into something else.

Although recycling should be the least desirable option for technical materials, it is unfortunately the most widespread strategy used to achieve a CE (Haas et al., 2015). I have observed from candid discussions with companies that the circular economy is sometimes wrongly referred to as a recycling economy. Haas et al. (2015) point out two important downsides of recycling: it can require larger amounts of energy, for example, than with reuse, and it can produce a lower quality secondary material which can lead to demand for more virgin materials to increase quality. I agree with the authors when they claim that "circularity cannot be achieved on the basis of recycling alone" (Haas et al., 2015, p. 10). Table 1 describes how the EMF defines each element in its CE model.

Table 1: Circular economy model definitions (EMF, 2012, p. 25)

Circular economy model definitions	
Anaerobic digestion	A process in which microorganisms break down organic materials, such as food scraps, manure, and sewage sludge, in the absence of oxygen
Biochemical extraction	Applying biomass conversion processes and equipment to produce low-volume but high-value chemical products, or low-value, high-volume liquid transport fuel—and thereby generating electricity and process heat fuels, power, and chemicals from biomass
Cascading	Putting materials and components into different uses after end-of-life across different value streams and extracting, over time, stored energy and material 'coherence'.

Composting	A biological process during which naturally occurring microorganisms (e.g., bacteria and fungi), insects, snails, and earthworms break down organic materials (such as leaves, grass clippings, garden debris, and certain food wastes) into a soil-like material called compost
Downcycling	Converting materials into new materials of lesser quality and reduced functionality.
Energy recovery	The conversion of non-recyclable waste materials into useable heat, electricity, or fuel through a variety of so-called waste-to-energy processes, including combustion, gasification, pyrolysis, anaerobic digestion, and landfill gas recovery
Functional recycling	Recovering materials for their original purpose or for other purposes, excluding energy recovery.
Landfilling	Disposing of waste in a site used for the controlled deposit of solid waste onto or into land
Refurbishment	A process of returning a product to good working condition by replacing or repairing major components that are faulty or close to failure, and making 'cosmetic' changes to update the appearance of a product, such as cleaning, changing its fabric, painting or refinishing it.
Remanufacturing	A process of disassembly and recovery at the sub-assembly or component level. Functioning, reusable parts are taken out of a used product and rebuilt into a new one.
Reuse	The use of a product again for the same purpose in its original form or with little enhancement or change
Upcycling	Converting materials into new materials of higher quality and increased functionality, also by improving on a downcycling process.

Practical limitations for 100 percent circularity

A 100 percent circular economy is practically and physically impossible (Lifset & Graedel, 2002; Andersen, 2007; Stahel 2010; EMF, 2012; Pearce & Turner, 1990; European Commission, 2014a). The European Commission (2014a) reports that some degree of linearity will still exist in a CE. Stahel (2010) and Pearce and Turner (1990) acknowledge that a certain part of material and energy is lost in each technical process due to the second law of thermodynamics. Mentink (2015) further adds that to be 100 percent circular either every tiny spec of technical material would have to be collected or all materials would have to be biodegradable. Neither of which are feasible in a global society. Nevertheless, EMF (2012) adds that at the moment we do not make use of a product's fully value because of

some form of premature obsolescence. Haas et al. (2015) find that the global economy was between 6 and 37 percent circular in 2005. Six percent is the estimate for only technical materials. This is due to the fact that small elements of circularity, e.g. recycling, are already present in our predominately linear economic system. The estimate increases to 37 percent if biological materials are included. Though, biological cycles, which are designed to be reabsorbed into natural ecosystems, are not actually closed circular loops. Although a 100 percent CE may not be possible, there is much room for improvement.

Taking this into perspective, I interpret the goals of this CE model as follows:

- to minimize (or even eliminate) the use of virgin nonrenewable materials
- to extract a level of virgin renewable materials at a rate equal to or less than what the earth can regenerate,
- to minimize waste going to landfill and incinerators, and
- to provide for continued economic growth and basic necessities for a growing world population.

Criticisms against a circular economy

Support for a CE is strong, and criticisms are few. Three strong critiques stand out. First, the CE economy ignores social issues. Both Murray et al. (2015) and Mentink (2015) have recognized the lack of social dimension in the CE discussion. The focus on environment and economy mean that CE can be considered an environmental/ecological sustainability strategy but not a sustainable development strategy which requires the balance of people, planet and profit. Second, CE initiatives can result in untended negative consequences. Murray et al. (2015) further criticize the CE for its unintended consequences and over-simplistic goals, e.g. the drive for biofuel has led to the clearing of Borneo forests to plant palm oil. I argue, however, that these consequences result from a lack systems thinking. Therefore, they are an

execution issue and not necessarily a flaw in the concept. Murray et al. (2015) also criticize the pursuit of longevity in product design. They argue that longer-lasting products consume more energy and release more entropy than one designed for a more natural outcome, e.g. a high specialized plastic fork versus a bamboo chopstick. Third, the term circular economy exists in other domains with different meanings. Murray et al. (2015) raise the issue of semantics. Before the current conceptualization, the term *circular economy* was used to reference the economic principle of the circular flow of income. With regards to the EMF (2012) model there is also confusion between circular strategies and their definitions. For example, what is the difference between *functional recycling* and *reuse*? Plastic bottles are ***recycled*** to be used for the same purpose in its original form or with little enhancement or change (the definition for ***reuse***). This is, though, a question of semantics. I do not see the confusion as a hindrance to implementation. Although these criticisms deserve attention in future research, they will not be addressed further in this study.

2.2. Circular business models

Since the advent of the internet, business practitioners and researchers have shown a growing interest in the business model concept (Zott, Amit & Massa, 2011; Osterwalder, Pigneur & Tucci, 2005; Teece, 2010; Hedman & Kalling, 2003). In business and strategy research, it has been recognized for its usefulness in explaining firms' value creation, performance, and competitive advantage (Zott et al., 2011). Osterwalder (2004) and Osterwalder et al. (2005) add that it aids in understanding, sharing, analyzing, measuring, and comparing the business logic of a firm. Because of this, Osterwalder says, companies can react faster to changes in the business environment as well as improve the alignment between strategy, business organization, and technology.

In the CE discussion, business models have been recognized as a key element in a successful transition to a circular economy (Accenture, 2014; EMF, 2012, 2014; European Commission, 2014a; Preston, 2012; Schulte, 2013; Murray et al., 2015). EMF (2012) suggests that circular business models will improve innovation, technological development, and material/labor/energy efficiency across the economy as well as provide more profit opportunities for companies. Preston (2012) claims that putting closed-loop thinking at the heart of business models is essential. This means completely rethinking the way we do business. Accenture (2014) emphasizes that firms can no longer focus on profits generated by driving volume and cutting cost through greater efficiency. Instead, the focus will be on rethinking products and services throughout the value chain to prepare for a future of resource constraints. In short, the CE at the firm level entails creating new value chains driven by new business models that decouple economic growth from the use of scarce resources.

Opportunity in circular business models

Researchers (Preston, 2012; EMF, 2012, 2013; European Commission, 2014a) propose that the CE is a source of ample business opportunity all along the value chain. CBMs have received attention for their potential to help organizations mitigate risks, retain competitiveness and continue to create value despite resource constraints (EMF, 2012, Preston, 2012). Put simply, circular business models enable companies to make more money by valuing products differently. EMF (2014) predicts that companies employing circular business models will gain significant competitive advantage over linear companies because they create more value from each unit of resources.

In the literature, researchers (EMF, 2012, 2013; Preston, 2012; European Commission, 2014b) claim that with a CBM a company can reap strategic, operational and environmental benefits. Strategically, new revenue streams can be created along the reverse cycle value

chain. A circular competitive advantage can be built by developing core competencies in circular design, building reverse cycles, driving business model innovation, exploring new service models and moving away from ownership-driven consumption. A company can become more resilient by creating circular resource flows and reducing reliance on virgin materials. Additionally, a firm can get an innovation boost from rethinking current products and services. Finally, stronger customer relationships can be established under new types of ownership models. Operationally, a company can reduce its costs and exposure to price volatility as well as create a more secure supply of materials. Above all, operating circularly can help reduce negative environmental impact.

Redesign and rethinking in the pursuit of circular products and services can also create new business spaces. Micro businesses and entrepreneurs might be able to find niche market opportunities, e.g. remarketing and reselling products (EMF, 2013). Some new models, materials, and products will need to come from startups (EMF, 2012) – which are driving circular market disruption, according to a study by Accenture (2014).

Though, as Accenture (2014) aptly points out, firms today are not built to take full advantage of circular economy opportunities. Instead, their business models, strategies, structures and operations remain trapped in a linear system. I propose that the study of designing circular business models is essential to break free from the constraints of linear thinking. Understanding how to design CBM will put companies on track to taking advantage of opportunities in a CE.

Circular business model research

There are 4 distinct ways that researchers discuss a circular business model:

1. as a set of principles or guidelines
2. as typologies

3. as a presentation of a real world model
4. as a transformational process

Each category is reviewed below.

Circular business model as a set of principles or guidelines

Schulte (2013) and Roos (2014) discuss circular business models at the conceptual level. These studies both develop their own general guidelines or principles. However, none arrive at a concrete definition nor do they strengthen their claims with empirical study. Table 2 lists the sets of principles proposed by each author. I have included here also the general principles of a CE put forth by the EMF (2012). Although these are general CE principles, they can be applied to the business model level as well.

Table 2: Principles of a circular business model

PRINCIPLES OF A CIRCULAR BUSINESS MODEL
Schulte (2013): • Minimize waste in product and system design by selecting adequate materials (e.g. fewer composite materials); design for disassembly to facilitate recycling; and strive as much as possible for standardization of solutions. • Understand the "total ecosystem" of a business and ensure this is reflected in the business model, for example, through higher transparency of the interactions between the various phases of the product life cycles; and strive toward better collection and cycling systems. • Maximize flexibility through design. This applies to product design for ease of repair and later modifications, as well as to product usage where different modules can be assembled in different ways to accommodate changing requirements without rendering a solution obsolete. • Use renewable energy sources instead of wasteful exploitation of mineral oil, gas or coal. • Maximize energy (exergy) efficiency by minimizing the total energy content of products or services.

Roos (2014):

- Maximize efficiency – all inputs are minimalized for one unit of output
- Minimize losses of energy, water, materials, and information in operations
- All by products and waste should be captured and value is added to maximize their profit potential
- Profit potential in value added waste products is realized

EMF (2012):

- Eliminate the concept of waste through product, process and service redesign. Technical materials are designed to continuously circulate in the technosphere, retaining as much embedded value as possible. Biological materials are to return safely to the biosphere through composting or anaerobic digestion and to rebuild natural capital by eliminating the use of toxic chemicals.
- Embrace systems thinking. It looks at the whole big picture and the relationships between the different parts of the whole. The organization is considered in relation to environment and social contexts. Taking a systems perspective helps an organization understand more about the trade-offs between efficiency and resilience.
- Embrace diversity in order to build resilience in the face of external shocks like resource prices and volatility. Supply chains and product systems, for example, can be flexibly designed to use many different inputs and supplies.
- Run on renewable energy.
- Think in cascades and use waste as food for another process. An organization can extract additional value from biological materials by cascading them through multiple cycles before returning to the biosphere. For example, the cloth of an old t-shirt becomes furniture stuffing, then wall insulation before decomposition.

From table 2 we can see that Roo's principles focus on efficiency improvements and monetizing by-product and waste streams; whereas Schulte's and the EMF's principles share similarities. They both address the issue of creating circular flows of materials by minimizing or eliminating waste. The EMF divides this into two separate strategies: through product and service design and through cascading. Schulte focuses wholly on technical materials and improvements in product design. They likewise address the issue of building resilience by embracing diversity. Schulte's principle represents an example of how a manufacturer can do this: designing components so that they can be used in different ways to accommodate changing requirements. EMF also gives an example: building a strong diverse network of suppliers. However, these are by no means the only way to embrace diversity. Both studies emphasize the importance of using fully renewable energy sources. Both agree a systems

thinking approach is desirable. Schulte alludes to a starting point for systems thinking, although it is unclear what "understanding the total ecosystem of the business" actually includes. For this principle to reflect true systems thinking, a company must think beyond the borders of its supply chain to encompass the parts of society and ecosystem that it affects. Although not explicitly stated, Schulte's use of terms like *design for disassembly*, *ease of repair*, and *modules* imply a focus on technical or mixed materials.

Circular business model as typologies

A white paper produced by Accenture (2014) identifies five typologies of CBMs from an analysis of over 120 case studies. Each typology is described in table 3. The c*ircular supplies* model describes a firm that supplies only fully renewable, recyclable or biodegradable resource inputs which phases out scarce resources, cuts waste and removes inefficiencies. The *resource recovery* model describes the recovery of embedded value at the end of one product lifecycle to feed into another product lifecycle which helps a firm eliminate material leakage and turn waste into additional value. In the case of anaerobic digestion, resource recovery can also create a source of renewable, clean energy. The *product life extension* model describes a firm that extends the lifecycle of its products and assets through, for example, repairing, upgrading, remanufacturing, or remarketing products. Extending usage helps a company generate additional revenue and minimize the amount of waste generated. The *sharing platform* model facilitates the sharing of overcapacity or underutilization of products among users. Probably the most familiar example is car sharing services. Finally, the *product as a service* model sells the usage of a product to a user instead of ownership.

Table 3: Accenture's five circular business models

Typology	**Description**	**Example**
Circular supplies	supplying fully renewable, recyclable, or biodegradable resource inputs that underpin circular production and consumption systems	bio-fuel

Resource recovery	recovering embedded value at the end of one product lifecycle to feed into another	industrial symbiosis, anaerobic digestion
Product life extension	extending the lifecycle of products and assets	repairing, upgrading, remanufacturing, remarketing
Sharing platforms	facilitating the sharing of overcapacity or underutilization among product users	car-sharing
Product as a service	selling usage of a product instead of ownership for one or many users	leasing, renting, pay-per-use

Circular business model as a presentation of a real world model

Hopkinson and Spicer (2013) present UK-based manufacturer Ricoh as an example of a company that successfully implements a CBM. Using a simple case study approach, the authors illustrate remanufacturing as a viable business model for the circular economy. In the study, remanufacturing is defined as "returning a used product to at least its original performance with a warranty that is equivalent to or better than that of the newly manufactured product (p. 160)". It involves the activities of disassembling a product, restoring and replace components, and final testing to ensure that the remanufactured product is within its original design specifications. Hopkinson and Spicer (2013) show that through remanufacturing Ricoh was able to increase profitability, extend the life of their products, reduce CO2 impact, and retain and reuse approximately 80 percent of their original product materials. However, this study is significantly limited by its reliance on one interview and cannot be regarded as a rigorous scientific study.

Circular business model as a transformational process

Mentink (2015) departs from the others' static approaches and looks at CBM from a business model innovation perspective. This study is the first in this literature review to propose a basic definition and discuss CBM holistically. The author further builds and tests a new

business model innovation analysis tool called the business cycle canvas, which is derived from Osterwalder and Pigneur's (2010) business model canvas. Although the Master's thesis is built around a scientific methodology, the study is not a peer-reviewed publication.

Gaps in the literature on circular business models

I have identified several research gaps based on my analysis of the existing CBM literature. First, CBM lacks a concrete definition. Several researchers (Roos, 2014; Schulte, 2013; EMF, 2012) put forth some guiding principles. However, with the exception of Mentink (2015), none of the studies reviewed propose a concrete operational definition. Second, studies lack a rigorous scientific methodology. Accenture (2014)'s 120+ company case study appears to be the only scientifically rigorous study in this analysis. On the other hand, I do not consider Hopkinson and Spicer's (2013) 1-interview study or Roos (2014) and Schulte (2013)'s conceptual papers as scientifically rigorous. Third, the CBM discussion lacks a holistic perspective. For example, Hopkinson and Spicer (2013) focus on the aspect of remanufacturing but dismiss the leasing revenue model that supported the remanufacturing activities. Furthermore, when researchers (e.g. EMF, 2012) talk about the need for CBMs at the general level, they refer to the revenue model. Yet, as Teece (2010) points out, the revenue model is only one component of a complete business model. In the following section, I address these gaps by proposing a concrete definition for a CBM and developing a more holistic framework using the business model canvas.

2.3 Theoretical framework

Defining a circular business model

With one exception, no studies have developed a concrete definition for a CBM. Mentink (2015) describes it as "the rationale of how an organization creates, delivers and captures value with and within closed material loops (p. 24)". This definition, however, is inadequate

when using the EMF's (2012) CE model as a starting point. Closed material loops represent only one of the core pillars of the circular economy. Mentink's (2015) definition ignores other important aspects, including using systems thinking, embracing diversity, and relying on renewable energy. In this subsection, I build on BM and CE literature to propose a definition that reflects all of the core pillars of the CE. CBMs can be seen as a subcategory of general BM, much like sustainable, green, or e-business BM. As a starting point, we must first define a general BM.

Every organization has a business model (Casadesus-Masanell & Ricart, 2010). Researchers, though, often disagree about what a business model is (Morris, Schindehutte & Allen, 2005). Zott et al. (2011) show that business models have been described as a statement, a description, a representation, an architecture, a conceptual tool or model, a structural template, a method, a framework, a pattern, and a set. Both Morris et al. (2005) and DaSilva and Trkman (2014) find that the concept is often confused with other similar terms in management literature, including strategy, business concept, revenue model, economic model, or business process modeling. Due to these varying perspectives, Zott et al. (2011) recommend that researchers clearly define which business model perspective that they will use a basis of study. Table 4 lists a number of different BM definitions used by researchers.

Table 4: Business model definitions

Business model definitions	
Teece (2010)	• A business model articulates the logic and provides data and other evidence that demonstrates how a business creates and delivers value to customers. It also outlines the architecture of revenues, costs, and profits associated with the business enterprise delivering that value. In short, it's about the benefit the enterprise will deliver to customers, how it will organize to do so, and how it will capture a portion of the value that it delivers. In short, a business model defines how the enterprise creates and delivers value to customers, and then converts payments received to profits.

Casadesus-Masanell & Ricart (2010)	• A business model, we argue, is a reflection of the firm's realized strategy.
Osterwalder et al. (2005)	• The expression "a company's business model" refers to the way a firm does business. As such, it is a snapshot and description at a specific moment in time. • We understand the business model as a building plan that allows designing and realizing the business structure and systems that constitute the operational and physical form the company will take. • The business model as a system shows how the pieces of a business concept fit together. • A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams.
DaSilva & Trkman (2014)	• Business models describe what a company really is at a given time. • [Business model] paints a picture of the company and reveals how the various elements of the business work together at a certain moment in time.
Zott & Amit (2013)	• A business model is thus a template that depicts the way the firm conducts its business. It is crafted by a focal firm's managers in order to best meet the perceived needs of its customers. To fully address the market opportunity, the focal firm's business model often spans across the firm and its industry boundaries. While it is anchored on the focal firm, it is market centric and designed so as to enable the focal firm not only to enhance total value for all business model participants but also to appropriate a share of the value created.
Demil & Lecocq (2010)	• a [business model] is ultimately a blueprint - even a recipe - that fulfils important functions such as enabling description and classification.
Osterwalder (2004)	• business model as the translation of a company's strategy into a blueprint of the company's logic of earning money. • [business model] as an abstract conceptual model that represents the business and money earning logic of a company

We can see some emerging similarities between BM definitions in table 4. A business model is a conceptual model or plan. It shows the holistic picture of how a company does business. It also describes how the company creates value for its customers and captures some of the value for itself in the form of revenues. Many researchers view it as a snapshot of a single moment in time. However, Demil and Lecocq (2010) identify two different temporal perspectives. One is the static approach, which is clearly shared by many researchers in table 4. In this approach, BMs are used as a blueprint to represent the coherence between core business model components. The other is the transformational approach in which the BM is considered as a concept or tool to address change and focuses on innovation. Although it is not explicitly stated, most CBM literature implies a static perspective of the BM (with the exception of Mentink [2015] who takes a transformational approach). I also adopt the static perspective. As little is understood about CBM, it is important to understand the holistic picture of the final destination (static) before a company can know how to get there (transformational). Demil and Lecocq (2010) recognize the static approach as useful for building typologies and making comparisons between particular BMs and performance. I add that it also useful for comparing business model components across different firms.

As this study uses the business model canvas, I combine elements of Osterwalder and Pigneur's (2010) BM definition with Schulte's (2013) and EMF's (2012) CBM principles. In table 5, I extrapolate four core concepts—design out waste, renewable energy, systems thinking, and diversity for resilience—from those principles to be included my definition.

Table 5: Principles of a circular business model

PRINCIPLES OF A CIRCULAR BUSINESS MODEL		
Concept	**Schulte (2013)**	**EMF (2012)**
Design out waste	• Minimize waste in product and system design by selecting adequate materials (e.g. fewer composite materials); design for disassembly to facilitate recycling; and strive as much as possible for standardization of solutions.	• Eliminates the concept of waste through product, process and service redesign. Technical materials are designed to continuously circulate in the technosphere, retaining as much embedded value as possible. Biological materials are to return safely to the biosphere through composting or anaerobic digestion and to rebuild natural capital by eliminating the use of toxic chemicals. • Thinks in cascades and uses waste as food for another process. An organization can extract additional value from biological materials by cascaded them through multiple cycles before returning to the biosphere. For example, the cloth of an old t-shirt becomes furniture stuffing, then wall insulation before decomposition.
Systems thinking	• Understand the "total ecosystem" of a business and ensure this is reflected in the business model, for example, through higher transparency of the interactions between the various phases of the product life cycles; and strive toward better collection and cycling systems.	• Embraces systems thinking. It looks at the whole big picture and the relationships between the different parts of the whole. The organization is considered in relation to environment and social contexts. Taking a systems perspective helps an organization understand more about the trade-offs between efficiency and resilience.

Diversity for resilience	• Maximize flexibility through design. This applies to product design for ease of repair and later modifications, as well as to product usage where different modules can be assembled in different ways to accommodate changing requirements without rendering a solution obsolete.	• Embraces diversity in order to build resilience in the face of external shocks like resource prices and volatility. Supply chains and product systems, for example, can be flexibly designed to use many different inputs and supplies.
Renewable energy	• Use renewable energy sources instead of wasteful exploitation of mineral oil, gas or coal.	• Runs on renewable energy.

Combining these elements, I define a CBM as follows:

> **A circular business model describes the rationale of how an organization creates and delivers value to customers and captures value for itself while it simultaneously designs out waste, relies on renewable energy, thinks in systems, and embraces diversity to build organizational resilience.**

What does this mean for companies? First, the CBM is designed to create value for customers and capture part of that value for the company in the form of revenue. Second, the CBM is designed to eliminate waste through careful design. Products are designed to fit within either biological or technical cycles (EMF, 2012): biological nutrients are non-toxic and can be easily composted; whereas, technical materials are designed to be used again with minimal energy needed and by preserving as much original quality as possible. Third, a CBM ideally relies on 100 percent renewable energy. Fourth, a CBM is designed to optimize systems over components. The CBM reflects the ability to understand how parts influence one another within a whole and the relationship of the whole to the parts. Finally, a CBM is designed to build resilience by embracing diversity (EMF, 2012) – not only biodiversity but also diversity

of place and culture (McDonough & Braungart, 2010). For example, a CBM can embrace diversity by using local materials, by connecting to natural energy flows (e.g. using windows to provide natural light), and by adapting products and packaging for local tastes and traditions. Despite McDonough and Braungart's (2010) examples, research is vague as to how this principle manifests in practice.

Note that the above introduced definition of a CBM does not include any reference to eco-efficiency which was included by both Roos (2014) and Schulte (2013). This omission is intentional as eco-efficiency can be counterproductive to circularity (McDonough & Braungart, 2000, 2010). Eco-efficiency reduces negative effects and slows down environmental destruction. However, it does not stop it. When eco-efficiency is the focus, there is no fundamental transformation at the heart of the business model – a shift that is needed in the circular economy, according to Preston (2012). In the words of McDonough and Braungart (2000), "it makes people feel they are doing something good for the environment, but the destruction and depletion-more quietly and efficiently-continue" (p. 57).

Furthermore, I agree with Mentink (2015) that a 100 percent CBM does not exist. Therefore, in practice implementation is more about becoming as circular as possible. (For an explanation of why 100 percent circularity is not possible, revisit section 2.1.)

Business model canvas as a design tool

Researchers (EMF, 2012; European Commission, 2014b; Preston, 2012) agree that firms should go beyond waste prevention and reduction to inspire innovation throughout the value chain. Yet, my literature analysis shows that discussions around CBMs have not fully embraced the holistic value chain perspective. One of the goals of this study is to operationalize the circular economy at the firm level and address the gap left in prior CBM research. To accomplish this, the business model canvas is a useful research lens.

As is seen in figure 5, the canvas is a visual one-page blueprint. Using the canvas, an analyst can describe the rationale of how an organization creates, delivers and captures value by mapping business model elements and their relationships. Osterwalder (2004) first developed the concept in his doctoral dissertation. The canvas was later adapted for commercial publication in the worldwide bestseller *Business Model Generation* (Osterwalder & Pigneur, 2010). It is a well-recognized tool among researchers and practitioners alike. Likewise, Mentink (2015) uses the business model canvas as inspiration in his study.

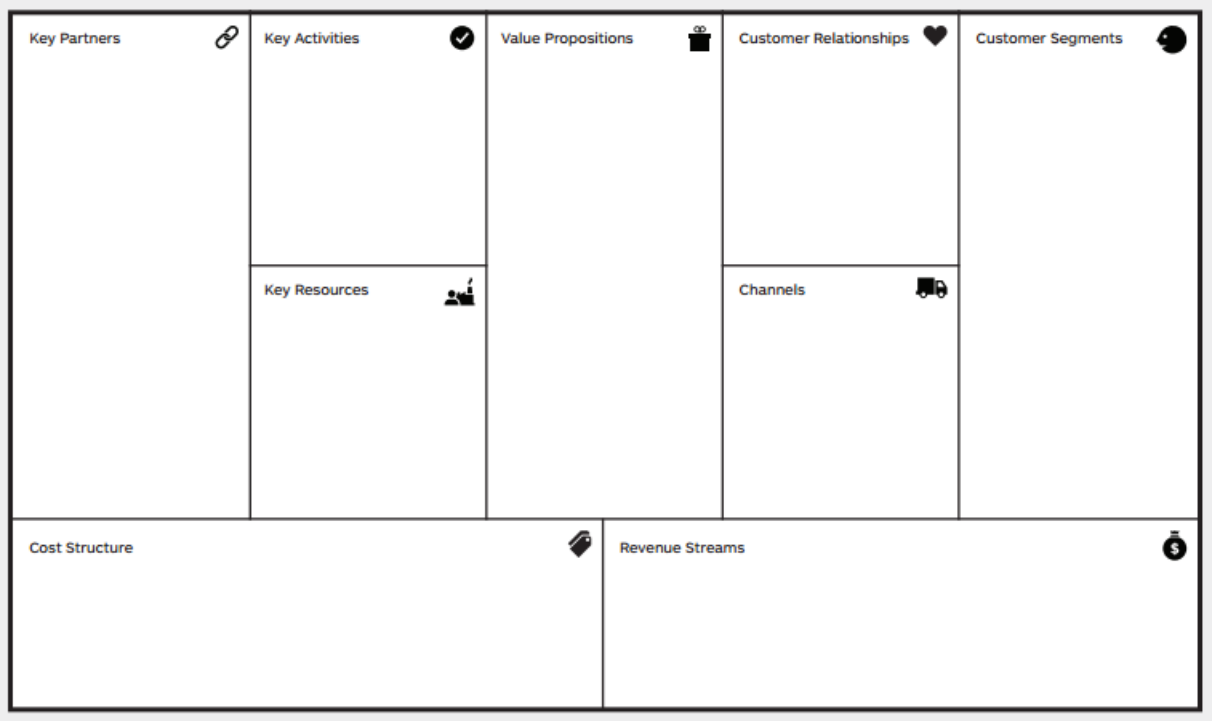


Figure 4: Business model canvas (Osterwalder & Pigneur, 2010)

The business model canvas is divided into nine building blocks which represent the four core areas of a firm (see table 6):

- **Product**: What are the company's products and/or services and the value propositions offered to the market?

- **Customer interface**: Who are the company's target customers, how does it deliver products and service to them, and how does it build strong customer relationships?
- **Infrastructure management**: How does the company efficiently perform infrastructural or logistical issues, with whom, and as what kind of network enterprise?
- **Financial aspects**: What are the revenue model, the cost structure, and the business model's sustainability? (In this case, sustainability refers to the BM's capability to sustain itself through profit, not to be confused with sustainable development.)

As the business model canvas visually illustrates the four core elements of an operating business and their sub-elements it is a suitable method for describing CBMs from a holistic perspective.

Table 6: Business model canvas building blocks

Business area	Building block	Description
PRODUCT	Value propositions	the bundle of products and services that create value for a specific customer segment
CUSTOMER INTERFACE	Customer segments	the different groups of people or organizations an enterprise aims to reach and serve
	Channels	how a company communicates with and reaches its customer segments to deliver a value proposition
	Customer relationships	the type of relationships a company establishes with specific customer segments
INFRASTUCTURE MANAGEMENT	Key resources	the most important assets required to make a business model work
	Key activities	the most important things a company must do to make its business model work
	Key partnerships	the network of suppliers and partners that make the business model work
FINANCIAL ASPECTS	Revenue streams	the cash a company generates from each customer segment

	Cost structure	all costs incurred to operate a business model

I analyzed prior empirical studies on CBMs (Accenture, 2014; Hopkinson & Spicer, 2013) through the lens of the business model canvas. Table 7 shows that most CBM typologies or cases only directly address a singular building block. However, a closer look reveals that multiple building blocks are affected. In Hopkinson and Spicer's (2013) case, for example, Ricoh successfully implemented remanufacturing (a key activity) only when combined with a leasing revenue model that allowed the firm to retain ownership of the equipment. This is a simple example, but it illustrates very easily how multiple areas of the business model need to work together to make circularity work.

Table 7: Prior research through the business model canvas lens

Business model	**Corresponding business model building block**
Circular supplies	Key resources
Resource recovery	Key activities
Product life extension	Key activities
Sharing platforms	Customer segments
Product as a service	Revenue streams
Remanufacturing	Key activities

Circular business model & the business model canvas

In the rest of this section, I look at each canvas building block individually and discuss how they might be impacted in a CBM according to the literature.

Core business area: PRODUCT

Building block(s): value proposition

Value proposition

The *value proposition* building block describes the bundle of products and services that create value for a specific customer group. It solves a customer problem or meets a customer need and explains why customers choose one enterprise over another. One of the biggest changes to the value proposition in the circular economy is the shift from selling product to selling services. Likewise, *products as services* is one of the five CBM typologies identified by Accenture (2014). This switch arises from the need to control products at their end-of-life in order to return them to reverse cycle loops. Tukker (2015) warns, however, that product as services alone will not necessarily enhance circularity. Still, shaping better, longer-lasting product designs into attractive value propositions will be essential to compete with efficient, low-cost, linear BMs, according to EMF (2012). Echoing this sentiment Accenture (2014) claims that the key to circular advantage is innovation of the value proposition.

Core business area: CUSTOMER INTERFACE

Building blocks: customer segments, customer relationships, channels

Customer segments

The *customer segments* building block describes the target customer group(s) of people or organizations an enterprise aims to reach and serve. Customers can be grouped into different segments according to respective needs, behaviors, or other attributes. There is little discussion on how the CE might alter customer segments. However, EMF (2012, 2013) believes that the pursuit of circular products and services can create niche business spaces, e.g. remarketing and reselling products, which implies the creation of new or resegmented customer segments. One example is Hopkinson and Spicer's (2013) case study where Ricoh successfully tapped into a new customer segment that found the cheaper, remanufactured copiers an attractive offer.

Customer relationship

The *customer relationship* building block describes the types of relationships a company establishes with certain customer segments, such as personal assistance, communities, or automated services. In a CBM, the buyer-seller relationship is likely to change. The shift from selling products to services means that manufacturers and producers act more like service providers; whereas, customers become users. Though, the intricacies of this shift in the buyer-seller relationship have not yet been studied in further detail.

Channels

The *channels* building block describes how a company communicates with and reaches its customer segments. Channels can be used, for example, to raise awareness about a product or service or to deliver a value proposition. They can be owned by the enterprise or the enterprise's partners. They also can include direct channels (e.g. sales force, website sales) and indirect channels (e.g. brick-and-mortar stores, wholesalers). How the CBM impacts channels has not yet been discussed.

Core business area: INFRASTRUCTURE MANAGEMENT
Building blocks: key resources, key activities, key partners

Key resources

The *key resources* building block describes the most important assets—whether owned or leased—required to make a business model work. CBMs are likely to require changes in physical, intellectual, and human resources (Mentink, 2015). In the physical resource domain, Preston (2012) writes that more sustainable materials will be needed to design out waste (physical resources). Circular supplies—i.e. fully biodegradable, renewable or recyclable inputs—have been recognized by Accenture (2014) as a CBM typology. In the intellectual domain, manufacturers will need new processes to design circular products and to accompany reverse cycles (EMF, 2012). A manufacturer of technical products, for example, will likely

need to incorporate disassembly lines for product remanufacturing. The need for new processes also suggests that firms seek out and embrace new technologies (e.g. material tracking systems) that enable circular value chains (Preston, 2012). In the human resource domain, employees and leaders will need new skills. EMF (2012) suggests that skills in circular product design and production and skills in building reverse cycles and cascades will be important. In the financial resource domain, there is currently no evidence to indicate alternations.

Key activities

The *key activities* building block describes the most important activities a company must do to create and offer a value proposition, reach markets, maintain customer relationships, and earn revenues. Osterwalder and Pigneur (2010) differentiate between three groups of activities:

- production activities: (e.g. designing, making, delivering)
- problem solving activities: (e.g. knowledge management, continuous training)
- platform/network activities (e.g. platform management, service provisioning, platform promotion)

To this list, I add

- reverse cycle activities (e.g. remanufacturing, disassembly)

Much of the discussion regarding CBMs focuses on production activities. The EMF circular economy model and its Cradle to Cradle origins put strong emphasis on product and service design. The (re)design of products and services is an important starting point for circular business models, according to the European Commission (2014a, b). Manufacturers must reject designing products for premature obsolescence (Accenture, 2014). Instead, products

(both technical and biological) can be designed to be re-used, remanufactured, refurbished, recycled, cascaded, biodegradable, or anaerobically digestible. These reverse cycle loops create a new category for key activities: reverse cycle activities.

Key partners

The *key partners* building block describes the network of suppliers and partners that make the business model work. An enterprise may choose to establish a partnership in order to optimize their business model, create economies of scale, reduce risk and uncertainty, or gain access to assets or activities. Developing partnerships is an important but challenging element in CBMs. Taking advantage of many circular opportunities in a circular economy will require a holistic, value chain approach, and multiple partners will need to collaborate, according to the European Commission (2014b) and EMF (2014). The European Commission (2014b), though, warns that key partnerships can suffer from a lack of trust between partners, a mismatch between partners' goals and cultures, or power relationships in which one partner may not benefit from a circular innovation. Preston (2010) adds that value chains are becoming more complex with activities taking place in different countries and inputs coming from multiple companies around the world. Therefore, some supply chains may have to be completely reorganized in order to design circular material flows. Companies may also need to expand their ideas of who their partners are. Roos (2014) writes that firms should work with customers to increase awareness and acceptance of circular products as well as with regulatory bodies to ensure circular innovations can make money in previously unprofitable domains.

Core business area: FINANCIAL ASPECTS

Building blocks: revenue streams, cost structure

Revenue streams

The *revenue streams* building block represents the cash a company generates from each customer segment. The term business model is most often used in research with reference to the revenue model (Osterwalder et al., 2005). This is true as well in many CBM studies. In this study, the revenue model is recognized as an important component of the business model but not the only element.

As a CBM might call for selling usage (as a service) over ownership (EMF, 2012, 2014; Accenture, 2014; McDonough & Braungart, 2012; Roos, 2014), they very likely require changes to the revenue model, especially if the original BM focused on selling products. EMF (2014) and Accenture (2014) advocate renting, leasing, and sharing. Roos (2014) discusses performance-based models such as Rolls-Royce's power-by-the-hour offering for aircraft engines or Michelin's tires-by-the-kilometer. An appropriate revenue model is important because it enables a manufacturer to control the asset once the customer no longer wants to use it. Therefore, the asset can continue to circulate through any reverse cycle loops.

Cost structure

The *cost structure* building block describes all costs incurred to operate a business model. It may include fixed costs, variable costs, and cost advantages due to economies of scale or economies of scope. In some cases CBMs can reduce costs, for example, through eliminating product waste and extending product life through product as service models. In other cases, however, embracing circularity might increase costs. Preston (2012) acknowledges that companies might face high up-front investment costs in the form of retooling machines, relocating whole factories, building new distribution and logistics arrangements, and retraining staff. Additionally, a company may have to offer incentives (monetary or otherwise) in order to ensure success of product take-back programs (EMF, 2012) if it chooses not to embrace alternative revenue models.

3. Methodology

This chapter details the qualitative research methods used in this study and is divided into three sections. In section 3.1, I describe the multiple case study design, justify the business model as a suitable unit of analysis, and introduce the case companies. In section 3.2, I introduce and justify my data choices as well as describe the data management strategy and data analysis process. In section 3.3, I analyze the trustworthiness of this study.

3.1 Methods

In the previous chapter, I define a circular business model and its characteristics. The empirical part of the study explores how circularity impacts the business model, focusing on only one of the CBM characteristics: designing out waste. To explore this question, I use a multiple case study design to analyze business models using the business model canvas.

Multiple case study design

Case studies are suitable for new research areas (Yin, 2009; Eisenhartdt, 1989), for simplifying complex and hard-to-grasp business issues (Eriksson & Kovalainen, 2008), and for providing illumination and understanding of contemporary issues (Hays, 2004). The topic of CBMs is both a new research area and a complex idea that needs to be operationalized. Therefore, a case study method is suitable for this study. However, this case study departs from traditional case study research (e.g. Yin, 2009; Stake, 1995).

A traditional case study is based on primary data (e.g. interviews, observations) which is collected on site in attempt to capture a "contemporary phenomenon in depth and within its real-life context" (Yin, 2009, p. 18). However, a business model is a conceptual model of how an organization works and thus it cannot be observed directly. As such, my analysis relies on secondary data which is capable of exploring the research question.

Examining multiple cases is necessary because CBMs are likely to differ according to firm, sector, product and value chain, according to the European Commission (2014b). Therefore, the use of multiple cases is preferred in order to more fully explore my research questions, reach more compelling conclusions (Yin, 2009), and provide a greater degree of generalizability (Dooley, 2002). Additionally, a major strength of case study research is the ability to use multiple sources and techniques (Dooley, 2002).

Business model as unit of analysis

An important part of case study research is establishing the unit of analysis, which serves as the case boundary (Yin, 2009; Hays, 2004; Stake 1995). I have selected the business model as a unit of analysis for this study. This implies that the case companies themselves are not the subject of analysis – only the companies' business models (referred to as an embedded case study by Yin, 2009). The business model has been recognized as a new unit of analysis that is a system-level, holistic approach to explaining how firms create and capture value (Zott et al., 2011). Although its development as a new unit of analysis for organization and strategy research is still in the early stages (Zott & Amit, 2013), the business model approach is necessary to understand how to translate circularity into value and ultimately profit (Roos, 2014). Therefore, it is suitable to study the intricacies of circular business models.

Case selection

The number of cases necessary for a successful multiple case study design is a debated subject. I have included four cases, which is within the recommendations of qualitative researchers (4 to 10 cases, Eisenhardt, 1989; small sample, Miles & Huberman, 1994). Likewise, considering that CBMs are a new phenomenon and research area, I argue that four cases are enough to provide insight to the CBM phenomenon, given the goals and scope of the study and limitations of available study subjects (Yin, 2009; Eriksson & Kovalainen, 2008; Miles & Huberman, 1994).

I have chosen the cases based on theoretical sampling, which is helpful when studying small samples (Miles & Huberman, 1994). This means each case company was purposefully selected based on its ability to illustrate how biological and technical loops can be closed inside a business model. Since well-developed CBMs are unique and not utilized by most companies, a theoretical sampling method is preferred over statistical sampling.

My original four choices included Patagonia, Inc., Rype Office, RePack, and Splosh. During the data collection phase, more information was needed to from RePack to do a complete analysis of the business model. I sent follow up emails to the company and tried to reach them through networks at Aalto University. Unfortunately, I received no responses from the company and had to replace it with a new case, Splosh. As such, the final selection of cases included Patagonia, Inc., Rype Office, Splosh, and Desso. Each company is briefly introduced below:

Patagonia, Inc. is a global producer of high-quality environmentally friendly outdoor apparel. Since its founding in 1973, Patagonia has embraced a socially and environmentally-friendly attitude towards doing business. Patagonia stands out as an exceptional company in an industry characterized by quick fashion cycles. On patagonia.com the company describes its mission to “build the best product, cause no unnecessary harm, use business to inspire and implement solutions to the environmental crisis”. According to a Harvard Business Review study, Patagonia is able to maintain a larger gross margin than its competitors (Reinhardt, Casadesus-Masanell & Kim, 2010) in spite of a strong commitment to environmentalism and social responsibility.

Rype Office is a UK-based furniture producer which specializes in remaking office furniture that launched in 2014. For traditional office furniture, iron ore, timber or oil is sourced in a foreign country, sent for refining and processing, shipped to a manufacturer for shaping then

to another for assembly. The furniture is finally transported to the final country to a warehouse and then to a distributor. Therefore, the traditional supply chain costs much in money, resources and transportation distances.

Rype Office remakes furniture by using a mixture of modern technology and traditional upholstery craftsmanship. In Rype Office's own words, by remaking furniture it can save money, create local (UK) jobs, reduce landfill waste, reduce biodiversity damage, preserve finite resources, and lower GHG emissions. The company has won a number of awards for the business concept in the UK.

Splosh is a Wales-based firm that sells re-fillable, environmentally-friendly home cleaning supplies. The company has innovated the traditional cleaning product by removing the water (which makes up approximately 90 percent of the liquid) from the cleaning product. Instead, Splosh sells the cleaning liquid as concentrate in dissolvable sachets and allows the customer to add his or her own tap water at home. This prevents repeated sales of 1-time-use cleaning bottles. Splosh sells plastic bottles only with its starter pack and eliminates the need for bottles with subsequent refills. By eliminating the water, Splosh reduces transport C02 emissions up to 95 percent. Reusing container bottles likewise means that plastic waste is greatly reduced. By reducing water and packaging, Splosh claims to be the first economical brand of eco-cleaning products.

Desso is a European carpet and sport surfaces manufacturer. In 2009, the company began to internalize Cradle to Cradle concepts in its core business model. This means its carpets are safe, nontoxic and designed to be disassembled and remade into new carpets. In September 2015, Desso became the first carpet tile manufacturer in the world to achieve Cradle to Cradle Gold level certification for a new carpet tile collection. Desso claims that Europe dumps about 1,600 kilo tons of post-consumer carpet material every year. About 60 percent

goes to landfill and the rest is incinerated. The traditional carpet industry is an unsustainable one that produces ample amounts of waste that clogs up landfills and pollutes the air. In an effort to keep carpet waste out of landfills and incinerators, Desso set up a European-wide Take Back program for its carpets and those of its competitors.

Patagonia and Desso were chosen as cases based on prior personal knowledge of the companies and their practices. Splosh and Rype Office were both located through the Ellen MacArthur Foundation's case study archives.

3.2 Data

Data collection

It is ideal to rely on multiple sources of data in a case study, i.e. data triangulation, which increases the data's reliability (Yin, 2009). Because the business model is a conceptual model, secondary data provided enough information to answer the research questions. When necessary, additional information was requested from the companies.

Tables 8 and 9 list the types of secondary data collected. For Patagonia, I collected data from the company website, company publications, and third-party articles. I also contacted the Patagonia PR department for more information, but the company representative only directed me back to the website. For Rype Office, I collected data from the company website and the Ellen MacArthur Foundation case study archives. Rype Office has not yet published any other materials. I also emailed Rype Office for more information, and I was directed back to the website and the EMF case study archive. For Splosh, I collected data from the company website, blog and third-party sources. For Desso, I collected data from the company website and company publications. I did not contact Splosh or Desso for further information.

Table 8: Data sources collected

Case	Company website	Company blog	Company publications	Third-party articles	Contacted company
Patagonia, Inc.	x	x	x	x	x
Rype Office	x			x	x
Splosh	x	x	x	x	
Desso	x		x		

Table 9: Data sources by case

Case	Data sources
Patagonia, Inc.	Website: www.patagonia.com, www.patagoniaworks.com Blog: www.thecleanestline.com/ Publications: Environmental Initiatives 2012, 2014 Third-party: • www.cdtech.org/eco-friendly-businesses/ • www.theguardian.com/sustainable-business/2015/may/28/sustainability-leaders-report-unilever-patagonia-ikea-nestle YouTube videos uploaded by Patagonia
Rype Office	Website: www.rypeoffice.com Third-party: www.ellenmacarthurfoundation.org/case_studies/rype-office
Splosh	Website: www.splosh.com Blog: www.splosh.com/blog/ Third-party: www.ellenmacarthurfoundation.org/case_studies/splosh
Desso	Website: www.desso.com Publications: guides on desso.com

Collecting secondary documentation data has several advantages (Yin, 2009). The data is stable and unchanging so it can be revisited for clarification throughout the research process. It was not created for the purpose of the study and can be regarded as having less bias regarding the specific research questions. Furthermore, it often contains more exact

information (e.g. names, references, dates and details) and can provide a broader coverage of the phenomenon under study.

Reliance on documentation, though, has disadvantages (Yin, 2009). It might be difficult to find the necessary information if the phenomenon is new or under development in an organization. The researcher's findings, interpretations and conclusions can be based on unknown biases without sufficient data triangulation. For example, findings can be biased if the researcher only looks for certain types of documented information. In interviews, on the other hand, other perspectives may surface from the interviewee regardless of what the interviewer asks.

Data management

Following Yin's (2009) recommendation, I maintained a case database. All data was stored in an online folder on my private Dropbox account. Dropbox was selected for stability. For example, the data would not be lost in case of a computer crash. Company publications, third-party references and articles, and screenshots of online content were stored in individual company folders. All coded textual data was maintained in an Excel spreadsheet.

Data analysis

The textual data was analyzed in a four step process, including coding, writing a within case analysis, mapping the business model canvas, and cross analyzing each business model canvas. Each step is discussed in more detail below.

1. Coding

Coding was the first step in the data analysis process. Codes are helpful in data organization and later for data retrieval because they allow the researcher to assign meaning to chunks of text – words, phrases, or whole paragraphs (Miles & Huberman, 1994; Stake, 1995). As this study relies on textual data, coding is a suitable choice.

In table 10, I list the set of descriptive codes used to classify text samples. These codes are derived from the theoretical framework developed in Chapter 2, and each refers to a specific building block on the business model canvas.

Table 10: Codes

CODES	
CUS	customer segments
REL	customer relationships
CHN	channels
REV	revenue streams
VAL	value proposition
RES	key resources
ACT	key activities
PAR	key partners
COS	cost structure

The coded data was maintained in an Excel file so that codes could easily be sorted. Each case company had its own sheet in the Excel file. I recorded the descriptive code, exact text or summary of the text, and the source URL for the text sample (see table 11).

Table 11: Coding example

CODE	TEXTUAL DATA	SOURCE URL
PAR	a sample of textual data	www.domain.com/folder

2. Within case analysis

After coding, I wrote a within case analysis for each company. This allows the unique patterns of each case to emerge before the cases are compared to each other (Eisenhardt, 1989). Written as a coherent story, the case analysis also helps the reader to see the complete

picture of how each company designs out waste before the different business model blocks are broken down and analyzed. The within-case analysis is presented in chapter 4.

3. Mapping the case's business model canvas

From the information included in the case analysis, I mapped data onto the business model canvas using the descriptive codes from step one. This provided a way to visualize how designing out waste impacts the business model canvas. Once the canvases were mapped, I saved them as PDFs and stored them in the individual company folder in the case database.

4. Cross-analysis of business model canvas

The last step in the analysis process was to compare all the business model canvases against each other. A cross-case analysis helps to generalize patterns across cases (Eisenhardt, 1989). This step allowed any similarities or differences in the CBMs to emerge. The cross-analysis is discussed in chapter 5.

3.3 Trustworthiness of study & findings

The findings of this study are analyzed against Lincoln and Guba's (Eriksson & Kovalainen, 2008) four aspects of qualitative research trustworthiness:

- **Dependability** – is the research process logical, traceable and documented?

The entire research process has been well documented in chapter 3. It is logical, traceable, and if desired, repeatable by another researcher.

- **Transferability** – has the researcher attempted to connect the study to prior research results?

I have discussed this study and its relevance against the background of prior research throughout this thesis. Chapters 1 and 2 connect this study to the wider body of literature on

the circular economy and circular business models. Chapter 5 discusses my empirical findings against other CBM studies.

- **Credibility** – Is the researcher familiar with the topic? Is the data sufficient to support his or her claims? Can other researchers arrive at similar claims based on the study's materials?

In Chapter 2, I have reviewed the CE and CBM literature. I argue that a thorough literature review indicates my familiarity with the topic of circular business models. I have determined the four case studies to be sufficient evidence to support the following claim: to design out waste a company must take a holistic approach to business model design. Based on the data, other another researcher would likely arrive at the same conclusion.

- **Conformability** – has the researcher linked the findings and interpretations to the data so it can be understood by others?

In Chapter 5, I have attempted to clearly illustrate my findings and interpretations with multiple examples from the data as well as with illustrative figures and tables to make the results easily understood by others.

Therefore, in terms of Lincoln and Guba‘s (Eriksson & Kovalainen, 2008) dependability, transferability, credibility, and conformability criteria, this study is a trustworthy piece of qualitative research.

4. Analysis

In the following chapter, I present the within-in case analysis of each company. Because this study focuses on circularity within the business model, the analysis focuses on the business model elements essential to design out waste; whereas, elements common to all business models are not discussed. Selling, for example, is a key activity in all economically-sustainable business models. However, it is not a unique activity necessary for designing out waste. The cases are presented in the following order: Patagonia, Rype Office, Splosh, and Desso.

4.1 How does Patagonia design out waste?

Patagonia sells high quality, environmentally friendly outdoor apparel to outdoor enthusiasts who care about their environmental impact. The company relies on a number of different activities throughout its value chain to design out waste. Finding more ecological materials starts with research that is shared freely on its website. It then sources materials that are durable, traceable, and ecologically sound from suppliers that have good environmental and chemical management processes.

Patagonia uses ethically sourced, recyclable, recycled, and organic materials wherever possible. Its PolarTec line guarantees to contain at least 50 percent recycled materials, such as recycled polyester and nylon. Its recycled polyester is made from used soda bottles, unusable manufacturing waste, and old worn-out garments. Using recycled nylon helps Patagonia reduce dependence on petroleum. Other materials are selected to reduce toxicity. The company uses both organic hemp and cotton. Both of which are exposed to dangerous toxins when grown conventionally. Furthermore, the down used in some Patagonia jackets is only sourced from slaughter houses that produce it as a by-product. In contrast, the company

reveals that much of the apparel industry's conventional down is unethically plucked from live birds.

Patagonia continuously works with its environmental department and vendors to review its products' packaging and to select materials with the lowest ecological impact. The company standardizes packaging across multiple product lines and sales channels. This reduces the need for many types of specialized packaging. Paper and plastic packaging uses the highest possible post-consumer waste content. All types of packaging are either reusable or recyclable.

Patagonia also innovates to create new manufacturing processes. In a special blending process the company can recycle wool, eliminate dyeing, save water and chemicals, eliminate the resulting wastewater, and keep old wool out of landfills and incinerators. Additionally, its Merino wool is slow washed to avoid using chlorine. It has also developed a new dyeing and manufacturing process for making denim that use dyestuffs that bond more easily to cotton. This minimizes the ecological destructive indigo dyeing, rinsing and garment washing process used to create traditional denim.

The materials are then manufactured in various factories throughout the world. It is transparent about what factories it uses and keeps an updated list available on its website. Patagonia continuously works with these partners to ensure they have excellent environmental and chemical management processes and fair labor practices.

Patagonia products are sold through its webstore and physical retailers. In select retailers the company has a resale channel (Worn Wear section) which is unique to its BM. The clothes are shipped in packaging that is reusable or recyclable. Product packaging can be returned to Patagonia retailers where they are recycled. Once purchased, Patagonia clothing is property of the customer (as in a typical fashion retailer). The company, however, encourages

continued use of its clothing through an educational and sometimes activist customer relationship. As products are owned by customers, this element is vital to encourage that customers value ecological materials, use products for a long time (through repair), resell clothing if no longer needed, and return extremely worn pieces for recycling.

Patagonia's Worn Wear campaign encourages customers to extend the life of their Patagonia gear through proper care and repair. In 2011, the company launched a Black Friday campaign "Don't buy this jacket" urging consumers not to buy new clothing. It also publishes a number of educational and promotional website content that educates customers about the materials they wear[1].

Patagonia has partnered with Ifixit, a DIY video tutorial site, to publish its own line of self-repair videos for its clothing. This encourages customers to repair clothing instead of throwing it away and buying new pieces. The company also accepts clothing by mail to be repaired at its Reno Service Center. It employs 45 full-time repair technicians who complete about 30,000 repairs per year. Patagonia promotes Yerdle to encourage customers to buy, sell or trade clothing that is no longer needed with others. The company also will buy back any gently used clothing to be resold in its Worn Wear section in select retailers. The customer is issued a gift card worth 50 percent of what Patagonia will resell the item for. When a piece of clothing is worn out, Patagonia accepts clothing from customers (given voluntarily) to be recycled into new fibers and materials. Patagonia's durable approach to fashion encourages its customers to use their clothing for a long time. It also provides opportunities to return clothing for reuse or recycling, thus reducing the amount of clothing waste that goes to landfill.

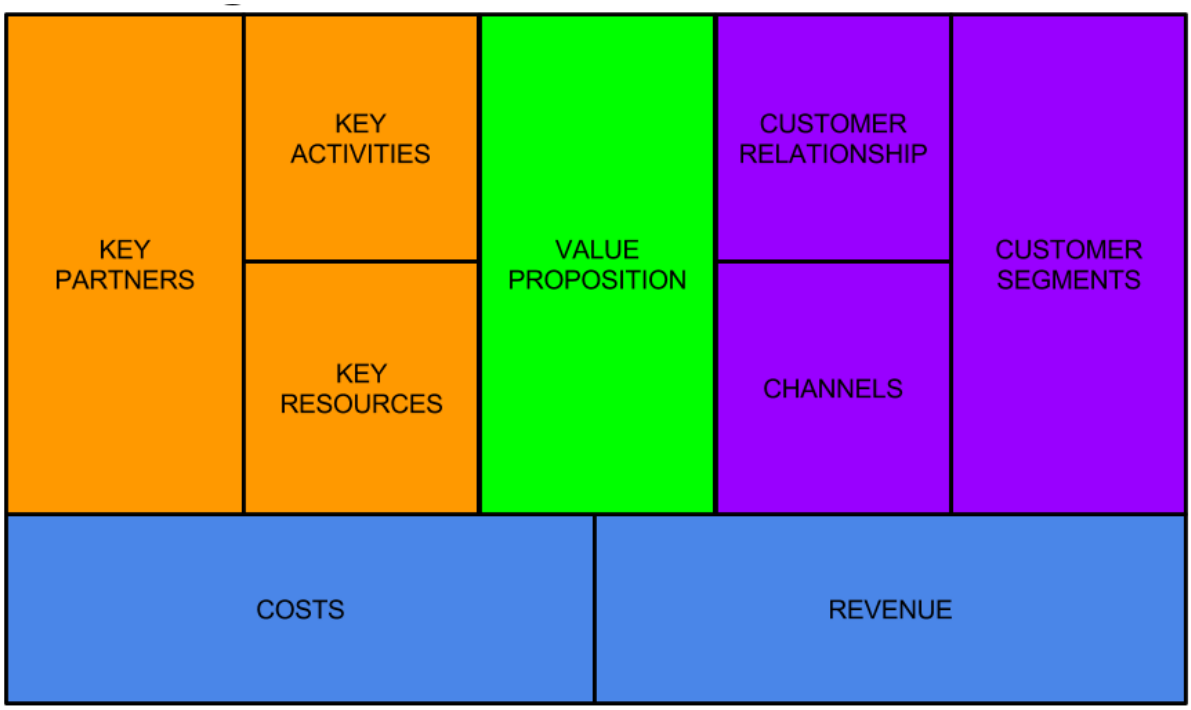
[1] for example, What the pluck – conventional down is a scary business, https://www.youtube.com/watch?v=U7quQcr4H68

The company makes money primarily by selling the ownership of its new outdoor clothing. However, it also receives smaller revenues from the resell of gently used clothing through Worn Wear sections of select retail stores and fees from clothing repairs. Compared to a traditional clothing producer, additional costs to design out waste are few. They include buy back costs, research to find new materials and processes, and employing full-time repair technicians.

Table 12 shows how these elements of Patagonia's business are reflected in the business model canvas. From figure 5, we can easily see that all nine building blocks are essential to design out waste in Patagonia's circular business model. The green block indicates the PRODUCT building blocks, purple indicates CUSTOMER INTERFACE elements, yellow indicates INFRASTRUCTURE elements, and blue indicates FINANCIAL elements.

Table 12: Building blocks of Patagonia's circular business model canvas

Building blocks in Patagonia's CBM canvas	
VAL	produces high quality, environmentally friendly outdoor apparel.
CUS	outdoor enthusiasts who care about their environmental impact
CHN	webstore; physical retailers; Worn Wear section.
REL	educational, activist relationship
RES	ethically sourced, recyclable, recycled or organic materials; new manufacturing processes to eliminate chemicals and wastewater; clothing repair technicians
ACT	research; source ecological and durable materials; buy back used clothing; resell used clothing in Worn Wear section; repair clothing for customers; recycle clothing
PAR	suppliers; manufacturers; Ifixit; Yerdle
REV	clothing sales; clothing resales; repair fees
COS	buy back costs; research; repair technicians



Orange: infrastructure management; Green: product; Purple: customer interface; Blue: financial aspects

Figure 5: Patagonia's circular business model canvas

4.2 How does Rype Office design out waste?

Rype Office remakes old office furniture into “like new” pieces. The company targets offices that are new, expanding or need updating. It offers 3 services:

1. New – customers can acquire brand new furniture from Rype Office that is well suited for future remaking.
2. Remade – customers can purchase furniture that has been remade from used pieces. Rype office replaces as many pieces as needed to ensure “like-new” functionality. Also, the size, color and materials of the furniture are customized to the client’s needs.
3. Refreshed – in this service, the client pays Rype office to refresh its own old, used furniture.

With the New and Remade services, clients can choose two options. First, they can buy the office furniture with a guaranteed option to sell it back to Rype Office in the future for remaking. Second, they can lease or rent the furniture. In the Refreshed option, clients pay only a remanufacturing free since they already own the furniture pieces. The company offers design assistance to help clients create a beautiful, creative and sustainable space that is economical.

Rype Office sources components for its remade furniture from brands with “timeless, long-lasting pieces and great ergonomics”. On its website it names Orangebox, Senator, Camira, Kronospan, and Egger. Textile pieces are sourced in the client’s color of choice from Camira’s 100 percent recycled polyester ranges of fabrics. Nevertheless, a client can choose to use alternative (and less sustainable) materials, but it costs extra. New desktops are made in the client’s finish of choice from Kronospan or Egger. In the future, the company will also reclaim used furniture through its buy-back guarantee or leasing program from clients who have previously purchased Rype Office products.

Rype Office outsources the remaking work to specialized UK workshops that use the latest precision equipment for flawless finishes and new techniques for restoring services. It sources the work to ensure sufficient capacity and skills to serve large orders and diverse furniture types. To remake used furniture pieces, Rype Office and its workshop partners must disassemble, check and replace all worn components. All furniture pieces are then rigorously tested, inspected, and given a warrantee. The company can also install and regularly maintain the furniture.

Remade and refreshed pieces are graded (A+, A, B):

- A+: Indistinguishable from new up close; no visible scratches or marks from any angle

- A: Indistinguishable from new from a distance of 2 meters by the naked eye in good light; all staff interaction surfaces are remade.
- B: Working surfaces recoated or new; some visible scratches or marks on base, back and in cabinet drawers consistent with a piece of furniture that is in use.

Rype Office does not maintain a webstore or physical retailer. Instead, the data suggests that all sale and delivery of the furniture is done through direct sales channels as orders are customized completely for each client.

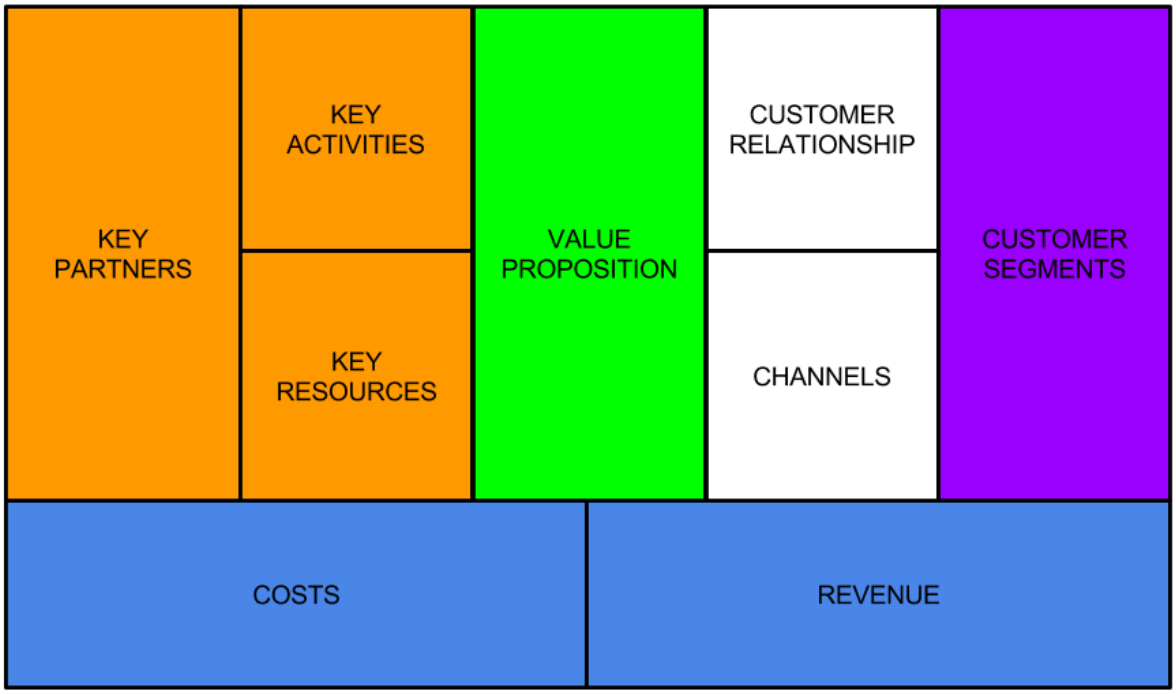
Rype Office earns revenue through the furniture sales, furniture rental, and fees from re-manufacturing, installation and maintenance. The company incurs special costs through its buy-back guarantee. The company will buy back any furniture that it previously sold a client when the furniture is no longer needed. This ensures that the furniture will be given a new life through remaking.

Table 13 shows how these elements of Rype Office's business are reflected in the business model canvas. Figure 6 illustrates that seven building blocks are essential to design out waste in its circular business model. Although the company has channels and customer relationships, neither direct sales or customized service elements have been judged as necessary to design out waste.

Table 13: Building blocks of Rype Office's circular business model canvas

Building blocks of Rype Office's circular business model canvas	
VAL	New - brand new furniture from Rype that is well suited for future remaking Remade - furniture that has been remade from used pieces. Refreshed - refresh a company's own old, used furniture
CUS	offices that are new, expanding or need updating
CHN	direct sale; website for awareness
REL	customized service

RES	used furniture with “timeless, long-lasting pieces and great ergonomics” latest precision equipment for flawless finishes new techniques for restoring services
ACT	source used furniture pieces; disassemble, check and replace worn components; test, inspect, and grade remade pieces; install; maintain; design
PAR	specialized UK workshops; suppliers
REV	furniture sales; furniture leasing fees from remanufacturing, installation and maintenance
COS	buy back guarantee



Orange: infrastructure management; Green: product; Purple: customer interface; Blue: financial aspects

Figure 6: Rype Office's circular business model canvas

4.3 How does Splosh design out waste?

Splosh produces and sells re-fillable, environmentally-friendly home cleaning supplies to environmentally conscious home cleaners. The company and its team of experienced chemists have innovated the traditional cleaning product by removing the water (which often makes up approximately 90 percent of the liquid). To begin, a customer orders a starter pack

that comes with reusable bottles (2, 4, 6, or 8) and sachets full of concentrated cleaning liquid. The concentrate is mainly plant derived, septic tank safe, vegan friendly, palm oil free and never tested on animals. Fragrances are naturally derived from essential oils like lavender, grapefruit, and mint. Splosh ensures its cleaning products are sustainable and rapidly biodegradable in nature. They have banned the use of parabens, caustics, phosphates, chlorine, ammonia, animal by-products or EDCs. The concentrate is packaged in dissolvable sachets made from a PVOH (polyvinyl alcohol), a non-toxic, water-soluble polymer. Once immersed in warm water, PVOH biodegrades to acetic acid (the main component of vinegar) and then into carbon dioxide and water.

To make the cleaning product, the sachet is inserted into the bottle and the bottle is filled with hot tap water. After a few minutes the sachet dissolves and allows the concentrated cleaning liquid to mix with the hot water. The cleaning product is then used normally. When new cleaning sachets are needed, the customer orders a refill packet from the online store. Refills come also in dissolvable sachets in packages without bottles. Delivery packages are designed to fit in a standard letter box so the customer does not have to be home for it to be delivered.

Starter boxes and refill packages come in 100 percent non-toxic and recyclable cardboard boxes. Sachets are packaged in trays made from recycled polyethylene terephthalate (RPET), a widely used packaging material. They trays can be recycled easily. Splosh encourages customers to reuse trays and cardboard boxes when possible. Reuse is a better option than recycling because it preserves more embedded value and uses less energy. Though Splosh has made great strides to use circular materials, some small parts (i.e. plastic seal covering the trays and 2 plastic straps securing the boxes) are not currently recyclable and must be thrown away.

Originally, Splosh products were only available through its online store and mobile app, but a blog post on January 2, 2014[2], reveals that starter boxes are now also available in select UK retailers. Splosh also offers a 14-day 100 percent money back guarantee to encourage customers to try its eco-product. This is important because Splosh itself claims that many eco-brands, though eco-friendly, do not compete in quality or price with regular brands.

Using dissolvable sachets prevents repeated sales of 1-time-use cleaning bottles. Splosh sells plastic bottles only with its starter pack and eliminates the need for bottles with subsequent refills. Bottles are currently made from around 30 percent recycled material that comes from pre-consumer waste or former milk bottles. All bottles are natural HDPE and can enter the recycling stream when they are finally worn out. Bottles are printed with an extra long-lasting ink instead of using labels. Bottle dispensers are not typically recyclable, so Splosh has designed them to be tough, reliable, and long-lasting.

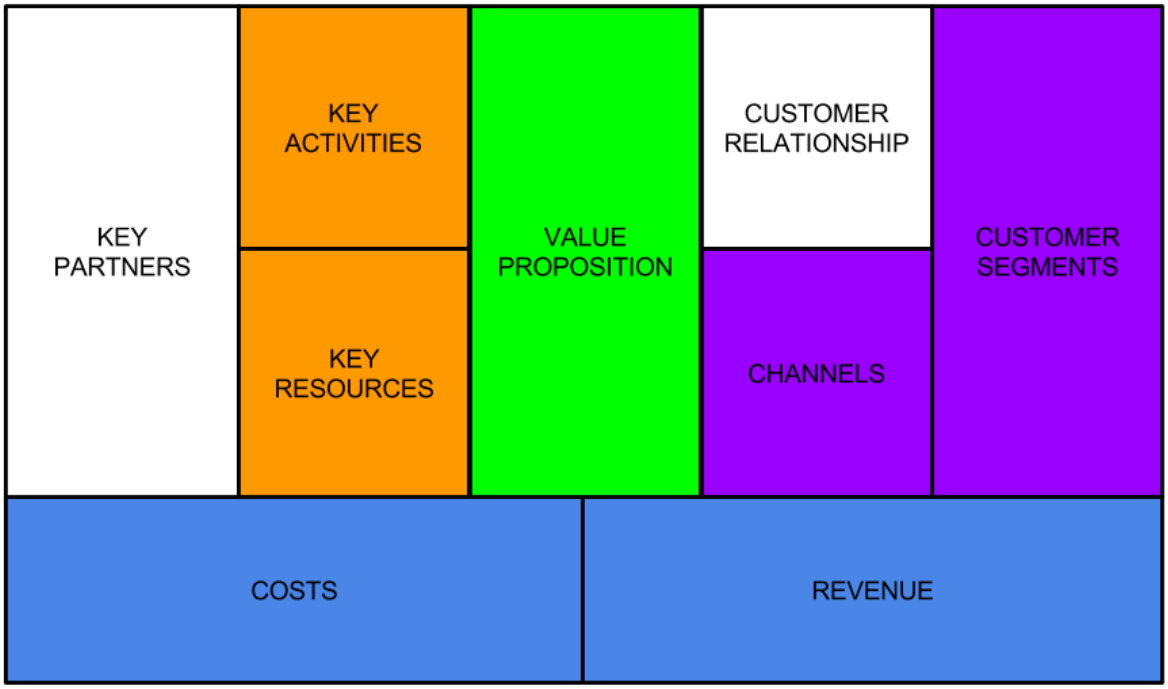
By eliminating the water, Splosh is able to reduce package size and weight. This reduces transportation costs, saves the company money and reduces transport CO2 emissions up to 95 percent. The cost savings from removing the water has allowed Splosh to price its product to be competitive with regular home cleaning product brands. It claims to be the world's first value (i.e. economical) eco-brand of cleaning supplies.

Table 14 shows how these elements of Splosh's business are reflected in the business model canvas. Figure 7 illustrates that seven building blocks are essential to design out waste in its circular business model. The data suggests that Splosh does not currently involve any key partners, and its online customer relationships have not been considered as necessary to design out waste.

Table 14: Building blocks of Splosh's circular business model canvas

[2] http://www.splosh.com/splosh-has-gone-retail/

Building blocks of Splosh's circular business model canvas	
VAL	sells eco-friendly, effective home cleaning supplies with reusable bottles
CUS	environmentally conscious home cleaners
CHN	webstore; select UK retailers
REL	online
RES	chemists; concentrated cleaning liquid; dissolvable sachets; durable bottles
ACT	R&D; quality testing
PAR	none
REV	1-time starter pack purchases; repeat purchases of refill sachets
COS	transport savings from reduced side and weight; money back guarantee cost



Orange: infrastructure management; Green: product; Purple: customer interface; Blue: financial aspects

Figure 7: Splosh's circular business model canvas

4.4 How does Desso design out waste?

Desso produces and sells carpets and sports surfaces that maximize people's health and wellbeing. For example, its DESSO Soundmaster reduces noise pollution inside buildings

and the DESSO Airmaster reduces the amount of dust in the air. The company sells to commercial organizations (e.g. offices, banks, schools); private homes in Germany, France and Switzerland; the hospitality, maritime and aviation sectors; and sports stadiums. The majority of Desso's business, 70 percent, is allocated to commercial sales. Carpets for commercial clients, industry, and sport surfaces are sold through direct sales channels. Carpets for private residential homes are sold through select retailers.

Desso's Cradle to Cradle (C2C) certified carpets are designed to be safe and nontoxic as well as to be disassembled, reused and/or recycled into new carpet. Figure 8 illustrates Desso's technical cycle for carpets which will be explained in greater detail below.

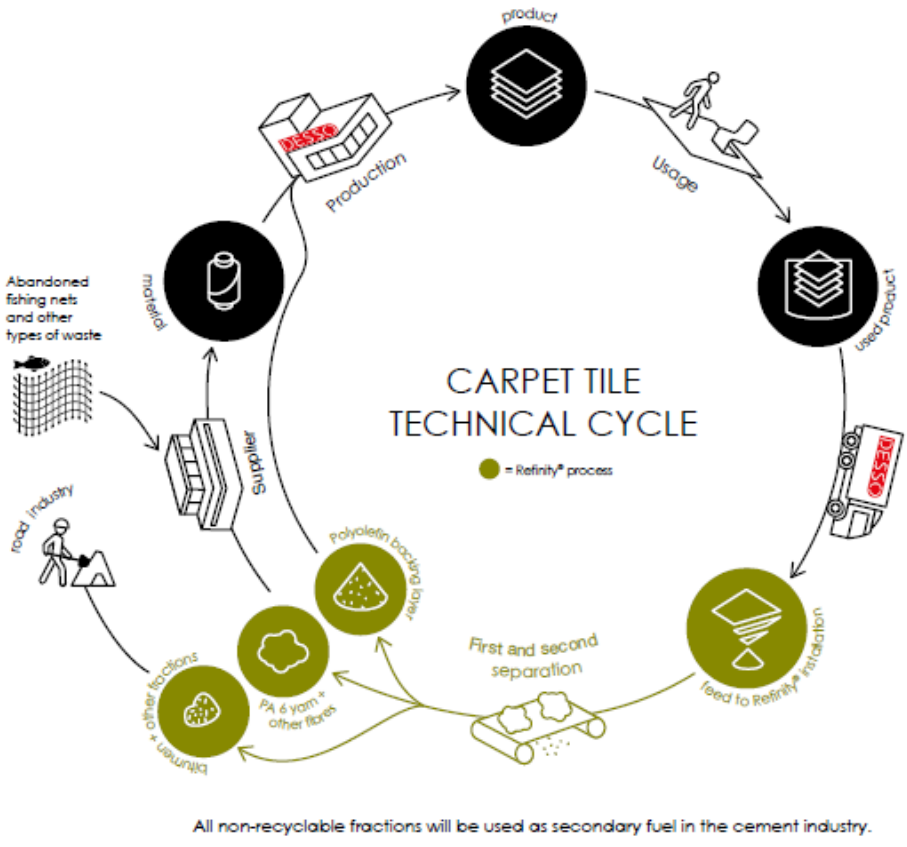


Figure 8: Desso's carpet tile technical cycle

The starting point for Desso’s carpets is pure and recyclable materials. Desso aims to ensure all of the chemical ingredients in its products are safe for the user (in C2C, defined as either optimal or tolerable). Its new Desso EcoBase carpet backing, for example, contains a polyolefin based layer that is 100 percent safely recyclable in Desso’s own production processes. This product has achieved a C2C Silver Certificate, certifying that up to 97 percent of the materials are either optimal or tolerable. Sixty percent of all Desso’s materials have been evaluated as recyclable, meaning the materials can be recycled in a non-toxic closed loop as assessed by C2C. Ninety-three percent of Desso's commercial carpet tile range is Cradle to Cradle certified either at the Bronze or Silver level (depending on backing type).

By 2020, all Desso products must be free from toxic chemicals making them safe for reuse as well as designed to be taken back and reused in new high-grade products. Desso’s purest carpet collection, the Gold collection, comes standard with an EcoBase backing that contains upcycled re-engineered calcium carbonate (chalk) from local drinking water companies and is 100 percent recyclable in Desso's production process. In addition, the Gold collection contains ECONYL, a 100 percent regenerated nylon made from recovered waste materials including post-consumer yarn waste from DESSO's Refinity plant. Therefore, carpets are designed from the beginning to be reclaimed, disassembled and either reused or recycled.

Since Desso does not make all of its own material, it has to work very closely with suppliers to disclose the make-up of its procured materials. Desso has developed a supplier declaration that asks suppliers to provide a list of their ingredients. It also works with Sedex, a platform for assessment and management of ethical business practice along the value chain, and EPEA Hamburg to ensure that procured products and services meet suitable material health standards.

Carpets are installed using Desso's QuickFix installation solution which utilizes Velcro to make replacing individual tiles easier. This reduces waste by eliminating needless replacements if only a small portion of the carpet is damaged.

After use, Desso reclaims used carpets through its Take Back program. It accepts any type of used carpet (except for carpets containing PVC) from 6 EU countries. It reclaimed 1,430 tons of carpet waste in 2014. All users who participate in Desso's Take Back program receive a certificate as a guarantee that the material is recycled according to Cradle to Cradle principles. The company then uses its Refinity technique to separate the carpet fibers from the backing. Fibers with the required about of purity are returned to Aquafil, a yarn manufacturer, to be recycled into new fibers called Econyl.

Desso's EcoBase carpet backing is 100 percent recyclable in Desso's production processes. However, not all materials can be made into new carpet like EcoBase. Therefore, Desso has identified material streams where other types of backing can be downcycled. Carpets with bitumen backing (the most common material for carpet backing) are recycled as raw material for the road and roofing industries. All non-recyclable pieces are used as secondary fuel in the cement industry. This activity is important to design out waste when materials cannot be reabsorbed into Desso's production system. However, the company faces several obstacles regarding its Take Back program: (1) it must be able to persuade contractors from buildings undergoing refurbishment to return the used carpets to Desso; (2) Desso must also be able to determine the materials used in tiles which may be manufactured by competitors.

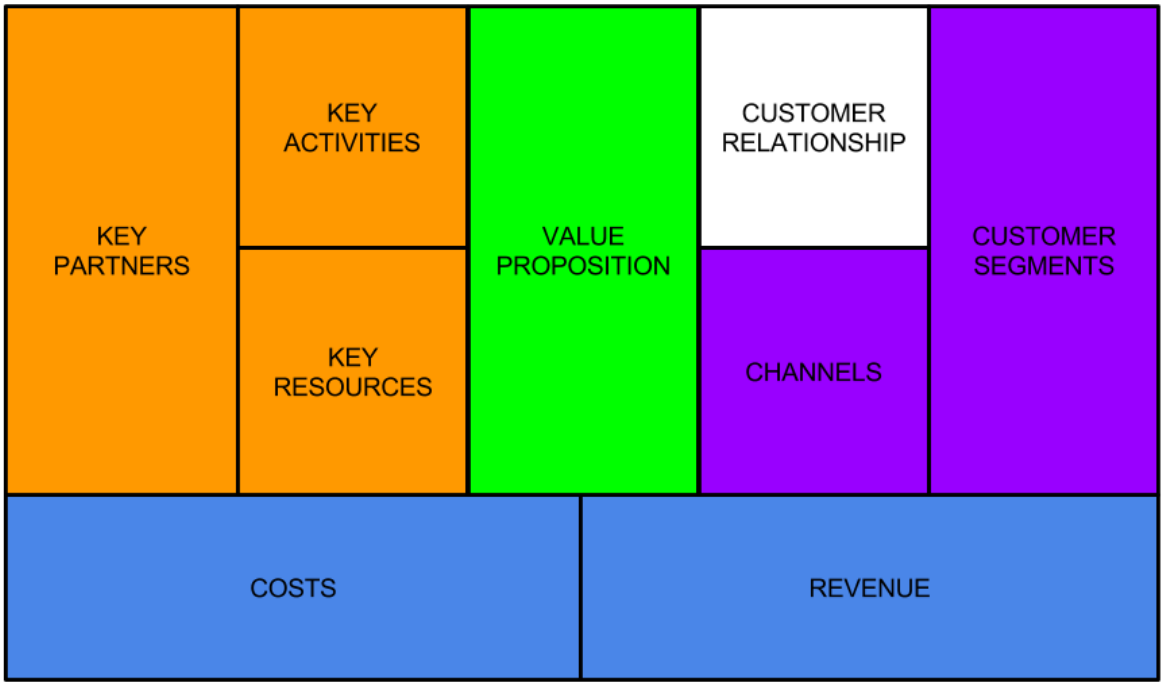
Desso earns revenue thorough carpet sales and carpet leasing. Carpet leasing packages include installation, cleaning, maintenance and eventual removal. This is an important element of the business model because it helps overcome challenges of persuading contractors to return used carpets. Desso, however, faces additional costs from setting up and

maintaining its reverse cycle Take Back program. This is a cost unique to its CBM and is not incurred in traditional carpet manufacturing business models.

Table 15 shows how these elements of Desso's business are reflected in the business model canvas. Figure 9 illustrates that eight building blocks are essential to design out waste in its circular business model with the exception of the customer relationship element. Though Desso has a customized relationship with its customers, I do not consider it essential to design out waste.

Table 15: Building blocks of Desso's circular business model canvas

Building blocks of Desso's circular business model canvas	
VAL	unique carpet and sports surfaces that maximize people's health and wellbeing
CUS	commercial organizations; private homes; maritime industry; hospitality industry; airline industry; sports stadiums
CHN	direct sales – commercial, industry, and stadium clients retailers – private homes
REL	customized – commercial, industry, and stadium clients none – private homes
RES	pure, recycled or recyclable materials processes and techniques – QuickFix, Refinity, Take Back program
ACT	identify new material streams; R&D; design for disassembly; supplier management creating reverse cycle; install, clean, maintain and remove carpet (leasing package only)
PAR	Aquafil; Sedex; EPEA Hamburg
REV	carpet sales; carpet leasing
COS	Take Back program costs



Orange: infrastructure management; Green: product; Purple: customer interface; Blue: financial aspects

Figure 9: Desso's circular business model canvas

5. Findings & discussion

In this chapter, I present the findings of the cross-analysis and discuss them in relation to the CBM literature.

5.1 Circularity impacts multiple business model elements

The most evident observation from the data is that many business model elements are affected by circularity. Table 16 shows that circularity impacts all four of the core business areas—product, customer interface, infrastructure management, and financial aspects—in all of the cases. Though, the specific business model elements within each core business area vary from case to case.

Table 16: Active business model building blocks in each case

Case	Product	Customer interface			Infrastructure management			Financial aspects	
CASE	**VAL**	**CUS**	**CHN**	**REL**	**RES**	**ACT**	**PAR**	**REV**	**COS**
Patagonia	x	x	x	x	x	x	x	x	x
Rype Office	x	x			x	x	x	x	x
Splosh	x	x	x		x	x		x	x
Desso	x	x	x		x	x	x	x	x

Both Splosh and Rype Office's business models were affected in seven blocks. Desso was affected in eight. Only Patagonia's CBM was impacted in all nine building blocks. This supports claims in recent research (e.g. EMF, 2012; Preston, 2012; Schulte, 2013; European Commission, 2014b) that circular business requires a holistic approach. Below I discuss the similarities, differences and insights for each of the core business areas.

PRODUCT (Value proposition)

Findings by EMF (2012) and Accenture (2014) support a shift in the value proposition in CBMs. In some cases, they claim, a company will shift from selling products to selling services. In this analysis, Patagonia and Splosh continue to sell products and do not experience this value proposition shift. Due to the nature of their products, this is not surprising. With fast-paced consumer goods, leasing is an unattractive option. Why rent clothing or cleaning supplies that are used regularly, have a short shelf-live, and are cheap (in comparison to goods like household appliances)? Rype Office and Desso, on the other hand, sell products or sell products as services depending on the customer's preference. This might result from several causes. First, both Rype Office and Desso's leasing options are offered to businesses not private consumers. Second, the nature of their products is different. Both commercial carpet and office furniture have longer product lives, are used more heavily, and are more expensive. Will circularity always imply a change from products to services? It is unlikely. The choice undoubtedly depends on the type of product and needs and preferences of the customer.

Another notable insight is how these companies communicate their value propositions. Patagonia, Rype Office, and Splosh all incorporate the environmental benefit of their product or service, such as environmentally friendly clothing, eco-cleaning product, and sustainable workspace. Whereas Desso promotes health and welling benefits, like improved air quality, reduced sound pollution, and better light reflectivity. There is little discussion about communicating the value proposition in CBM literature, and it could be a valuable avenue for future research.

CUSTOMER INTERFACE (Customer segments, customer relationships, channels)

EMF (2012, 2013) believes that the CE can create niche business spaces. Rype Office has clearly found a niche space in the office furniture business. In this industry, remanufacturing

is not included in more traditional business models. Yet, Rype Office makes furniture remaking the core of its business. Interestingly, both Splosh and Patagonia have created niche spaces by targeting customers who are sensitive to environmental issues – niche by worldview. Desso, in this regard, differs from the other case and acts more like its non-circular competitors. The company targets commercial institutions and industries that are searching for superior quality, customized solutions and health enhancing products even though its carpets would likely appeal to an environmentally sensitive audience.

Discussions in the CBM literature have not yet addressed channel implications. This study, unfortunately, has nothing significant to offer this gap either. None of the cases stood out as having particularly innovative channels. Companies used online stores, direct sales, and retail stores. All of which are used in many other companies and industries. What is important, though, is that the channels used support the other elements in the CBM. A direct sales channel was used in Desso and Rype Office. This choice appears necessary because remade furniture and leased carpets challenge the norm in their respective industries. More direct channels may be necessary to appeal to customers who are accustomed to a different type of buying behavior. For example, a company that has bought new office furniture for many years may not be aware of, realize the value of, or trust remade pieces.

Patagonia stood out slightly from the other cases by having a special channel, e.g. Worn Wear, to resale gently used Patagonia clothing in select retailers. Selling reused clothing in-store is not a typical practice among clothing manufacturers. Splosh also stood out as unique when compared to other cleaning product manufacturers because it sells cleaning products online instead of in retail stores. However, Splosh has recently expanded into select UK retailers. This alludes to the ineffectiveness of an online channel in a market where customers normally buy cleaning products at supermarkets and other big box stores.

Customer relationship findings are likewise unremarkable. Patagonia was the only case that had a noticeable customer relationship essential to design out waste and to promote its value proposition. The company has an educational and somewhat activist relationship with its customers. It regularly creates educational, emotion-provoking and controversial campaigns, videos, and research reports.

Rype Office and Desso both maintain relationships that are common in their industry. Acting as a consultant, both companies provide personalized, customized services to its clients. Splosh has the least effort relationship with its customer – online and impersonalized.

INFRASTRUCTURE MANAGEMENT (Key resources, activities, and partners)

My analysis validates claims (Preston, 2012; EMF, 2012) and findings (Accenture, 2014) that circular materials and new processes are important when doing circular business. Desso, Patagonia, and Splosh all use pure, eco-friendly materials which compose the foundation of their BMs. Splosh relies on its eco-liquid concentrate and dissolvable sachets that eliminate the need for additional cleaning bottles. Patagonia procures ethically-sourced, recyclable, recycled and organic fabrics and fibers. Desso uses fibers that are pure enough to be safe for use and reuse and carpet backing that can be disassembled and reused in other carpets. As a manufacturer of technical materials, Rype Office, on the other hand, relies on durable materials—high quality furniture pieces with great ergonomics.

Regarding manufacturing operations, Rype Office, Desso, and Patagonia all have developed their own unique, innovative processes and techniques to help them design out waste. Rype Office relies on new techniques for restoring, ensuring that their used furniture is remade to look “like new”. Desso has developed the DESSO Refinity process for separating carpet backing from yarn and other fibers. Disassembly must be performed before materials can be reused or recycled. Desso also uses a Velcro QuickFix installation technique that allows

small portions of carpet tiles to be easily replaced. This way, the company avoids needless replacement of an entire carpet. Patagonia likewise boasts new manufacturing processes that help avoid the use of harmful chemicals.

My research also hints that human resources are an important element in a CBM. For example, Patagonia employees 45 repair technicians to fix customers' broken clothing. Other than a small discussion on needed skills (Accenture, 2014; EMF 2012), the research has yet to address the human resource aspects in the CE literature.

Activities are another important foundation of a CBM. This is not surprising as doing business is inherently an activity. Much of the CBM discussion (e.g. EMF 2012, European Commission, 2014b, Preston, 2012) focuses on reverse cycle activities, such as reuse, repair, remanufacture, recycle, and disassemble. I discovered, though, that not all CBMs involve reverse cycle activities. Splosh stands out as a notable example. It does not perform any reverse cycle activities because it does not need to take anything back. Its product is designed to return to biological cycles or to be reused or recycled elsewhere – but not in Splosh's own production system. This is to be expected when dealing with some biological materials, e.g. food.

Desso and Patagonia, on the other hand, both have reverse cycles that would be expected based on EMF's (2012) CE model. Desso takes back and dissembles used carpets to be either reused or recycled. Patagonia repairs, resales, and recycles clothing. At first glance, Rype Office seemed like another textbook example of reverse cycle activities until I realized that those activities (disassemble, check, replace) were performed not by itself but by its workshop partners. In Rype Office's cases, partner management becomes an extremely important reverse cycle activity – an activity that is normally not associated with circularity. After cross examining the cases, it is clear that activities greatly differ case to case depending

on other elements in the CBM. For example, for Desso to successfully offer its leasing package, it must install, maintain, repair and eventually remove its carpet.

My findings also support the European Commission (2014b)'s claim that companies will need partners to take advantage of circular opportunities. Patagonia, Rype Office, and Desso all require key partners to help design out waste. Patagonia, for example, has partnered with Ifixit, an online do-it-yourself community, to create a series of videos to help customers repair their own clothing. Desso ships old reclaimed yarn to Aquafil, a firm that recycles the old yarn into new and sells it back to Desso. Partnerships are the foundation of Rype Office's CBM because much of the remaking activities are outsourced to UK workshops. Splosh is the only case that does not currently have an essential key partner. However, I see clear opportunities to bring in partners. During my research, I proposed a partnership between Finnish startup RePack and Splosh to eliminate more packaging waste in its CBM.

FINANCIAL ASPECTS (Revenue streams, cost structure)

Findings on revenue models are inconclusive. Recent research (e.g. EMF, 2012; Accenture, 2014) suggests that companies will shift from selling ownership to selling use, implying a shift to usage-based revenue models. Although all cases continue to sell ownership of their products, two cases began to make this shift by offering a leasing option. Desso and Rype Office's customers are able to buy or lease depending on their preferences. On its website, Desso mentions the difficulty of persuading contractors to return used carpets. This alludes to the attractiveness (and perhaps necessity) to use a leasing or other pay-per-use model to ensure that the company's products are returned to the production system. However, with products that are designed to return to the biosphere, such as in Splosh's cleaning products, pay-per-use models seem useless.

There is also a clue that customer buying behavior is an important factor in choosing a revenue model. Although Patagonia's products are not designed to return to the biosphere, it still sells ownership. This is likely because customers are accustomed to buying clothing ownership. Leasing models are more common with durable goods like cars. Though, there are some notable exceptions, such as the rental of formal wear. Startups are now trying to challenge this norm. Mud Jeans, for example, has recently launched a jean rental program[3].

Does a CBM costs money or save money? In line with Preston (2012), capturing circular opportunities may cost money at the beginning. Desso, Rype Office, and Patagonia all clearly incurred additional costs to support reverse cycles. Desso set up a large, European-wide Take Back program for all carpets – even those of its competitors. Rype Office provides a buy-back option for customers who choose to purchase the ownership of its office furniture. Patagonia pays wages to 45 repair technicians to extend the life of its clothing. Like Rype Office, Patagonia also offers a clothing buy-back option (50 percent of the resale value) for pieces that can be resold in the Worn Wear section of select retailers.

EMF (2012) presents a parallel argument that the CE can save money. This was obvious for only one case in the study. By eliminating the water and its weight from its cleaning products, Splosh was able to save significantly on transportation costs and compete in the price range of its competitors. In its words, Splosh is the world's first eco-value brand. These results show circularity can have both effects. Costs can increase or decrease depending on how circularity is designed and implemented. However, a more rigorous financial analysis is needed to build a stronger case for circular business.

[3] http://www.fastcoexist.com/1681388/dont-buy-those-expensive-jeans-lease-them-instead

5.2 Systems thinking & interconnectedness

Based on my findings, it is clear that companies that design out waste embrace a systems thinking approach—one of the criteria in the proposed CBM definition—within the boundaries of the business model. They optimize the whole system instead of isolated parts. Numerous examples support this. Because Patagonia sells ownership of its clothing (REV), it must develop clothing made from nontoxic and durable materials (RES), go through great lengths to educate customers (REL) and provide various reverse cycles such as resell (ACT/CHN), repair (ACT/RES/PAR) and recycling (ACT). Desso, on the contrary, offers a leasing package (REV), which means it installs, maintains, cleans and eventually removes the carpet (ACT). Leasing ensures that the carpet is returned. However, in order to reuse the carpet, the product has to have been designed with disassembly (ACT) in mind with the proper materials (RES/PAR) and supporting processes (RES). Rype Office is unique in that its BM is built on the back of essential partnerships with UK workshops (PAR) that do all the remaking activities (ACT). This makes partner management a very important reverse cycle activity – an activity that is normally not associated with circularity. Finally, Splosh is the company that acts the most like a traditional linear business. It sells ownership (REV) and has no reverse cycle activities. However, the key to Splosh's circular success is a product design that features safe, nontoxic concentrated cleaning liquid packed in water dissolvable sachets (RES). Its design eliminates water, saves money (COS), and allows the product to be competitive with regular, non-eco brands (VAL).

This insight is present in prior research is well. Although the Ricoh case study (Hopkinson & Spicer, 2013) highlights remanufacturing as a proven path to a CBM, a closer look reveals that other BM elements, such as the leasing revenue model, contribute to Ricoh's success. Leasing ensures that old machines are returned to the production system to be remanufactured. Considering this, reports (e.g. Accenture, 2014) that isolate certain elements

do not show the whole picture. I caution that ignoring the holistic approach will lead to an unsuccessful CBM design. For example, it is not enough to offer a product as service without also having materials, processes and activities that support the reverse cycle. This is an example also supported by Tukker (2015) who writes that product as service mechanisms do not necessarily support a circular economy. Within the CBM discussion, both academia and in public discourse, there is a need to communicate this interconnectedness and holistic approach. To design a CBM, companies have to consider the whole BM, not isolated parts.

6. Conclusion

Our linear economy is at a crossroad. There is inherent conflict between economic growth and resource consumption. Over a century of economic activity has left our environment severely damaged. To make matters worse, we are reaching a threshold level where continued economic growth may not be possible and may have even direr environmental consequences. This is troubling when we consider how much the global population is growing.

In theory, a circular economy has the potential to ease the conflict between economy and environment by delinking economic growth from resource consumption. This way, our economies can continue to meet the needs of future generations without suffering more environmental damage. EMF (2014) believes that a rapid scale-up of the circular economy could significantly reduce pressure on our resources and avoid negative effects on the economy and environment overall. Although many (Preston, 2012; Su et al., 2013; Geng & Doberstein, 2008; EMF, 2012; European Commission, 2014a, 2014b) have discussed the significant political, social, economic, and technological barriers to a circular economy transition, hope still seems to be much greater.

A transition to a circular economy will undoubtedly require systemic and transformative change with collaboration on many different fronts. Significant attention has been given to policy discussions, but as the European Commission (2014b) acknowledges, closing some inner loops such as reuse, repair, refurbishment, and remanufacturing, are difficult for policy-makers to address. This had led many (e.g. Preston, 2012; EMF, 2012; European Commission, 2014b) to suggest that companies will take the lead in the transition to a circular economy. After all, companies have the financial power, technological knowledge, and institutional capacity to be a force for change (Shrivastava, 1995). EMF (2012) proposes that

they will drive business model innovation, explore new service models, and challenge ownership-driven consumption models. Yet, few studies have rigorously addressed the business model angle.

This study has begun to address this gap by exploring how circularity—specifically designing out waste—impacts the business model. I analyzed the business models of four companies: Patagonia, Rype Office, Splosh and Desso. What I discovered is that to design out waste multiple elements of the business model have to work together. All the companies' business models in this study reflected a systems thinking approach – optimizing the whole instead of individual parts. In my data sample, between seven and nine business model building blocks (of 9 total) were affected. This insight gives strength to claims (e.g. EMF, 2012; Preston, 2012; Schulte, 2013; European Commission, 2014b) that circular business requires a holistic approach.

The findings have hinted at some clues for promising future research questions such as the role of consumer behavior and preferences in designing a CBM. Much of the value-creating side of the business model canvas (customer relationships, value propositions, channels and revenue streams) highly depends on the preferences of the customer. For example, does the customer prefer to rent or own? This study's findings and Hopkinson and Spicer's (2013) Ricoh case study both hint at a deeper connection between customer preferences and other elements of the CBM. Furthermore, this study has provided a big picture but surface level look at the entire circular business model canvas. Yet, I see a need to take a deeper dive into certain elements of the canvas. For example, how can a company create a compelling value proposition for circular products and services? As Accenture (2014) argues, value proposition innovation is essential for capturing a circular advantage.

This explorative study has taken the first steps in the long journey to understanding CBMs. It has provided support for a holistic approach and clues for further research. For future CBM researchers, the gap is wide and the opportunities are many.

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