BUSINESS MODELS FOR A CIRCULAR ECONOMY

A case study of Gabriel Holding A/S

MONICA ANAI RAMOS LI

Master Thesis

Joint European Master in Environmental Studies

- Cities & Sustainability

Business Models for a Circular Economy

A case study of Gabriel Holding A/S

Monica Anai Ramos Li

For the joint degree of Master of Science in Environmental Studies - Cities & Sustainability at

Aalborg University, Hamburg University of Technology,

University of Aveiro and Autonomous University of Barcelona

Date of submission: June 9, 2016

Main supervisors: Arne Remmen and Rikke Dorothea Huulgaard, Department of Development and Planning, Aalborg University

Co-supervisor: Jeroen Van Den Bergh, Institute for Environmental Science and Technology, Autonomous University of Barcelona

Project period: February 2016 – June 2016

Contact: moarali@gmail.com

Accompanying this thesis is a poster, which will be exhibited at Nordkraft, Aalborg on June 29, 2016. It can also be found as an annex at the end of the report. For attaining a digital version of the poster, please contact the author.

Cover image: “Armchair”, retrieved from https://thenounproject.com.

Abstract

As population increases, raising the pressure over the environment, solutions for a more sustainable economic growth are required. Circular economy is an economic model that has been gaining attention in the last years. It aims to reduce the input of raw materials and output of waste to the environment by closing economic and ecological loops of resources. This is particularly important for urban areas as most of the world population is moving to cities, where most of the resources are consumed and economic activities take place. Moreover, cities offer the opportunity to create synergies within the economy to increase resource efficiency due to the high density of people and stakeholders.

In this context, the thesis research focus on closing material loops from a business perspective through circular business models. A case study of Gabriel Holding A/S is analysed to assess how a company could adapt their current (linear) business model to a circular one. The results provide circular business models for FurnMaster business unit, which could potentially close material and economic loop in the furniture sector, by maintenance, refurbishment, and recycling or cascading of furniture/furniture parts, while creating value for the company and their customers.

Acknowledgments

I would like to thank my supervisors Rikke Dorothea Huulgaard, Arne Remmen and Jeroen Van Den Bergh, for your help, comments and constructive criticism throughout the research process. I would also like to thank Eva Guldmann, for your support at the beginning of the project and for sharing your research results in relation with the case study. Additionally, I would like to give special thanks to Joan Thiesen, for your time and support to develop the case study. And finally, I would like to thank my JEMES CiSu family, especially to the ones who shared with me late nights in the library in the last months: Clara, Gilang and Samuel, and Isidora, who despite of not being physically here, helped me go through this process. Thank you guys!

Table of Contents

List of Figures

List of Tables

List of Abbreviations

BAU	Business as usual
BM	Business Model
BMC	Business Model Canvas (tool)
CBM	Circular Business Model
CE	Circular Economy
CE100	Circular Economy 100 (network)
CO_2	Carbon dioxide
CRL	Close Resource Loops
EMF	Ellen Macarthur Foundation
EU	European Union
EoL	End of Life
GDP	Gross Domestic Product
IOT	Internet of Things
M2M	Machine to Machine
NRL	Narrow Resource Loops
PM QEP	Project Manager - Quality, Environment and Production
RC	Resource Cycles
SBM	Sustainable Business Model
SME	Small and medium enterprises
SRL	Slow Resource Loops
WEF	World Economic Forum

1. Introduction

This chapter introduces the current economic model and the circular economy. Furthermore, the research questions, the methodology applied and the structure of the report are also presented.

1.1 Problem context

> *"Today humanity uses the equivalent of 1.6 planets to provide the resources we use and absorb our waste. (..) by the 2030s, we will need the equivalent of two Earths to support us. And of course, we only have one."* (Global Footprint Network, 2016)

The current economic model is based on a linear flow of resources, where virgin materials are taken and goods are made to be eventually disposed. This model generates big amounts of waste and creates dependency between inputs of raw resources and economic growth. The linear economic model is not feasible in the long run, as we live in a world of finite resources and there is indication that it is reaching its limit (Morlett, 2014). Resource scarcity and the increasing amount of waste and pollution are likely to threaten the welfare and wellbeing of people, as well as the competitiveness, profits and business continuity of enterprises (Wijkman & Skånberg, 2015). Circular Economy is a systematic approach to the economy that aims to decouple economic development from resource constraints (Wallace & Raingold, 2012). It would turn goods that are at their end of life and transform them into resources for others, closing loops in the economy and reducing waste (Stahel, 2016). Figure 1 shows the contrast of the linear and the circular economy concept. In a linear economy (left), the flow of materials starts with the extraction of raw materials from the Earth and ends with the final disposal to the environment, as waste or emissions. In contrast, in a circular economy (right) alternative closed loops are created where resources move within a system of production and usage/consumption.(Sauvé, Bernard, & Sloan, 2015)

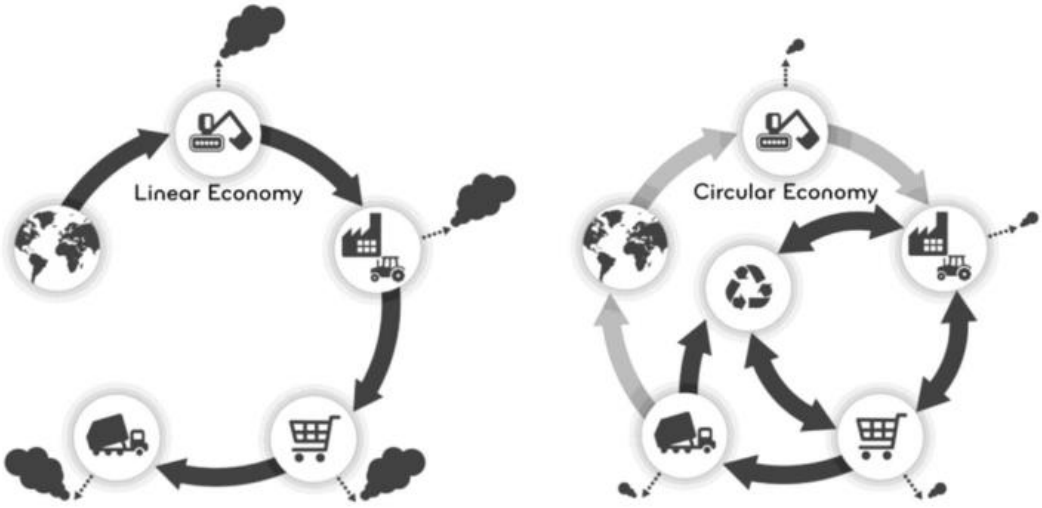

Figure 1 Contrast of a linear and a circular economy. Source: (Sauvé et al., 2015)

The notion of creating loops within the economy has been around for a long time (Ghisellini, Cialani, & Ulgiati, 2015). An example of this is the product-life extension proposed by W. Stahel in 1984 illustrated in Figure 2. It shows the life cycle of a product, where virgin resources are taken at the beginning of it, transformed into basic material production, then the products are manufactured, used and finally disposed as waste. Stahel proposes to create loops during the manufacture and use phases. Used products or components are the sources of new products of the same initial product by replenishing loops: reusing (loop 1), repairing (loop 2) and reconditioning (loop3). Moreover,

recycling (loop 4) uses scraps or material as locally-available raw material for different new products. (Stahel, 1984).

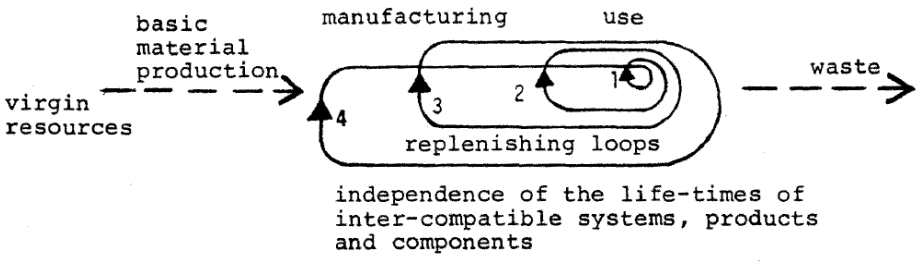

Figure 2 Product life extension proposed by W. Stahel in 1984. Source: (Stahel, 1984)

Nevertheless, it is in the last years that circular economy (CE) has gained momentum (CIRAIG, 2015). The World Economic Forum (WEF) has identified the following enablers, that due to their alignment, are accelerating the adoption of CE principles by reducing costs and increasing market acceptance of more circular business models (World Economic Forum, 2014):

- Consumer preferences are shifting away from ownership, as people rather have access to the services than owning the products that provide them.
- Socio-demographic trends make the benefits easier to capture, due to an increasing urbanization of the population. High density areas optimise reverse logistics and other operations required for a CE.
- Advances in technology create ever greater opportunities to accelerate the transition, such as the internet of things, where objects communicate within them and provide real time data.
- Governments and regulators are mobilizing, by creating the framework that enables and promotes the transition to a CE.

In addition, CE is supported by many stakeholders, from government institutions, academia, businesses and other organizations, leaded by the Ellen MacArthur Foundation (EMF) (CIRAIG, 2015). EMF, which mission is to accelerate the transition to a circular economy, has published a series of reports in collaboration with McKenzie & Company describing the economic and environmental opportunities of a CE (Ellen MacArthur Foundation, 2012, 2013, 2014).

CE is currently under the spot and different stakeholders are looking forward the transition toward it. The European Commission recently released the Circular Economy package: “Closing the loop - An EU action plan for the Circular Economy”, ensuring an adequate regulatory framework for a Circular Economy in Europe (European Commission, 2015). Denmark has the resource strategy “Danmark uden affald” (Denmark without waste), which was first released in 2013 aiming to increase material recycling. In 2015, an extension was disclosed, which focus on how to produce and consume with less resources (Miljøstyrelsen, 2015). Furthermore, EMF has organized a global platform called “Circular Economy 100” (CE100) to bring together corporates, governments and cities, academic institutions, emerging innovators and others, who are interested in collaborating toward a CE (Ellen MacArthur Foundation, 2015e). In Denmark, government efforts are bringing different stakeholders together for a more circular economy. An example of this is the project Rethink Business, a regional initiative by the Central Region of Denmark, which helps small and medium enterprises (SME) in the transition to a CE (Rethink Business, 2015). Within businesses, awareness of CE has increased and the number of sustainability executives that recognize the importance of CE to their businesses performance in the long run is increasing (GreenBiz & UPS, 2016).

As it was mentioned before, CE is a systematic approach. At company level, in the transition to a CE, new business models need to be developed, either to replace current ones or to seize new opportunities (Ellen MacArthur Foundation, 2015a). Hence, this report seeks to explore business model innovation in existing businesses in a CE context. For this purpose, Gabriel Holding A/S, a company with more than 160 years in the market, was selected as case study. Gabriel's primary business is the design, production and sale of textiles for the furniture industry (Gabriel Holding A/S, 2015b). However, the focus for this research will be on the potential business models for FurnMaster business unit, which offers outsourcing services to Gabriel's customers and handles projects related to furnishing new or refurnishing of public spaces.

1.2 Research question

In order to understand how CE can be implemented at business level in relation with the case study, the following research question will be answered through the report.

How can Gabriel Holding A/S implement circular business model?

For a better understanding, the main question is complemented with the following sub-questions:

1. What is circular economy?
2. What is a business model?

The first sub-question seeks to determine what it is currently understood as CE, which principles it follows, as well as how it creates value for the society. Moreover, it addresses the arguments behind CE and its current enablers. In addition, this sub-question also aims to provide a comprehensive understanding of the opportunities and barriers the transition to a CE is facing.

The second sub-question, seeks to understand how a business is operated. In order to accomplish this, the concept of business model is explained, as well as the tool business model Canvas. Moreover, it aims to provide an understanding of sustainable business models and circular business model, to be eventually used to answer the main research question.

Due to time constraint and the nature of the case study, the answers to the research question and sub-questions are focused on the technocycle (technical materials), rather than the biocycle (biological nutrients). Furthermore, the author is more acquainted with the technocycle.

1.3 Research methodology

For the sub-questions 1 and 2, literature review was performed. Literature has been searched using a combination of search strings in scientific databases and reports from relevant institutions. It was also used the snowball method[1] to gather other relevant sources.

For the sub-question 2 ("What is a business model?), besides the literature review, a comparative analysis of two different circular business model frameworks was performed, aiming to select the most appropriate one for answering the main research question. For the analysis, the concepts were contrasted and then allocated in EMF's Circular Economy System Diagram (Ellen MacArthur Foundation, 2015b). As a result, it was possible to visualize the scope of each framework in the economy. Furthermore, the same criteria was applied when assessing the suitability of sustainable business model's archetypes for circular business models.

For the main research question ("How can Gabriel Holding A/S implement circular business model?"), information was gathered mainly thought company reports (Gabriel Holding A/S, 2015b, 2015c),

[1] "Snowball sampling" refers when going over the reference list of relevant documentation. (Wohlin, 2014)

face-to-face interviews and personal communications with Joan Thiesen – Project Manager Quality, Environment and Production at Gabriel Holding A/S, and Guldmann (2016)'s research report on Gabriel Holding A/S[2].

Moreover, it was selected together with J. Thiesen the focus of the case study to be on one of their business units: FurnMaster. In order to get a better understanding of FurnMaster's business model, it was utilized the Business Model Canvas as a mapping tool.

Once a comprehensive understanding of the current business model was gathered, a catalogue with existing circular business models was provided to Gabriel Holding A/S, for them to point out which ones could serve as starting point to explore potential circular business model for FurnMaster. The catalogue of existing circular business models, which content can be found in section 4.3.1, comprises nine different examples to slow or close resource loops. Examples were gathered from EMF's case studies' database (Ellen MacArthur Foundation, 2016a), from news webpages focused on CE and sustainability (Circle Economy, 2016; Circulate News, 2016; The Guardian, 2016), from the reviewed literature (Ellen MacArthur Foundation, 2012, 2013, 2014; Kraaijenhagen, van Oppen, & Bocken, 2016; Lacy & Rutqvist, 2015), and from interviews with experts (Seijs, 2016; Thiesen, 2016). The criteria used to select the examples was (1) to close material loops in the technocycle and (2) it had to belong to the furniture or textile industry (in which Gabriel Holding A/S operates). Afterwards, potential circular business models for FurnMaster were developed, based on the obtained feedback, aiming to close resource loops. In order to describe the proposed circular business models, the business model Canvas is used. Moreover, to illustrate how FurnMaster could close loops, the potential circular business models are showed in EMF's Circular Economy System Diagram (Ellen MacArthur Foundation, 2015b).

1.4 Report structure

The report structure is illustrated in Figure 3. It has been organized in relation with the research question and sub-questions.

The problem context, research questions and methodology are provided in this chapter (Chapter 1). Chapter 2 answers the first sub-question by exploring the reasons behind CE and its enablers. Moreover, it provides CE definition, including principles and value creation, and the opportunities and barriers its transition faces. Chapter 3 addresses the second sub-question defining what a business model is. Furthermore, it also contains a description and analysis of sustainable business models and circular business models. Chapter 4 focuses on the case study, FurnMaster business unit at Gabriel Holding A/S. It reviews the furniture industry, the company and develops potential circular business models for FurnMaster. And Chapter 5 provides a summary of the discussion and conclusions of the report, as well as recommendations for future research.

In addition, Chapter 2, 3 and 4, which answer the sub-questions and the main question, have a discussion and conclusions of the chapter section at the end of each chapter.

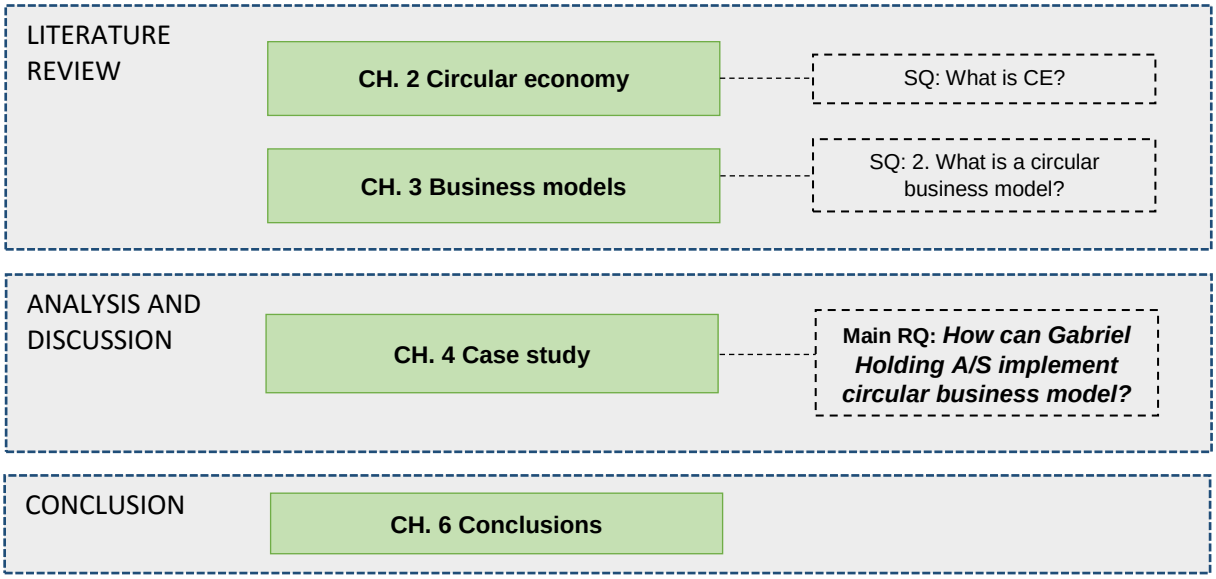

Figure 3 Report structure. Q: Question, SQ: Sub-question, RQ: Research question.

2. Circular economy

This chapter answers the research sub-question "What is circular economy?" In order to do so, it is explored the reasons behind CE and its current enablers. In addition, it is detailed the concept of a CE, the schools of thought that shaped the current definition of CE, its principles and value creation. And finally, opportunities and barriers of CE are mentioned.

2.1 Drivers for a circular economy and its enablers

This section seeks to understand the reasons behind CE and which enablers are allowing it to happen now.

2.1.1 Drivers for a circular economy

As it was mentioned in the introduction, resource scarcity and the planetary limit to absorb pollutants and waste are demanding for a change in the way economies grow. The following drivers were identified by the EMF (Ellen MacArthur Foundation, 2015f):

1. Economic losses and structural waste
2. Price risks
3. Supply risks
4. Natural system degradation
5. Regulatory trends.
6. Advances in technology
7. Acceptance of alternative business models
8. Urbanization

The first four drivers (economic losses and structural waste, price risks, supply risks, and natural system degradation) are explained below. The last four (Regulatory trends, advances in technology, acceptance of alternative business models, and urbanization) are considered as the key enablers of a CE by the WEF and will be developed in the next section (World Economic Forum, 2014).

1. *Economic losses and structural waste*

The current economic model generates waste and material value is lost to the environment. As can be seen in Figure 4, on a global scale in 2005, 58 gigatones per year (Gt/yr) was extracted of raw material. 26 Gt/yr were added to the stock (used in infrastructure or goods with a lifespan longer than 1 year) and 4 Gt/yr was used for short lived products (products with a lifecycle shorter than 1 year). Moreover, 4 Gt/yr of the processed material was discarded as waste rock, which added to the 9 Gt/yr discarded from the Stocks, equals 13 Gt/yr of End of Life (EoL) waste (19% of the total of material processed in 2005). In addition, only one third (4 Gt/yr) of the EoL waste is recycled or downcycled, leaving the remainder to be disposed to the environment. In 2005, resources in stocks increased only by 17 Gt/yr, less than 30% of the material extracted. (Haas, Krausmann, Wiedenhofer, & Heinz, 2015)

However, waste is not limited to materials. Accenture has identified four different types of waste, which offer an economic opportunity that businesses and the society could capture if they were avoided (Brinkman, 2015; Lacy, 2016):

- Wasted embedded values, such as energy and materials that are only used once and then discarded.
- Wasted capacity, which involves underuse and underutilized assets and products, such as cars.
- Wasted lifecycles, where products are discarded after a short period of time.
- Wasted resources, “leftovers” from the extraction, production or transport of goods that could be used in a different product. E.g. Organic waste, which could be turned into biofuel.

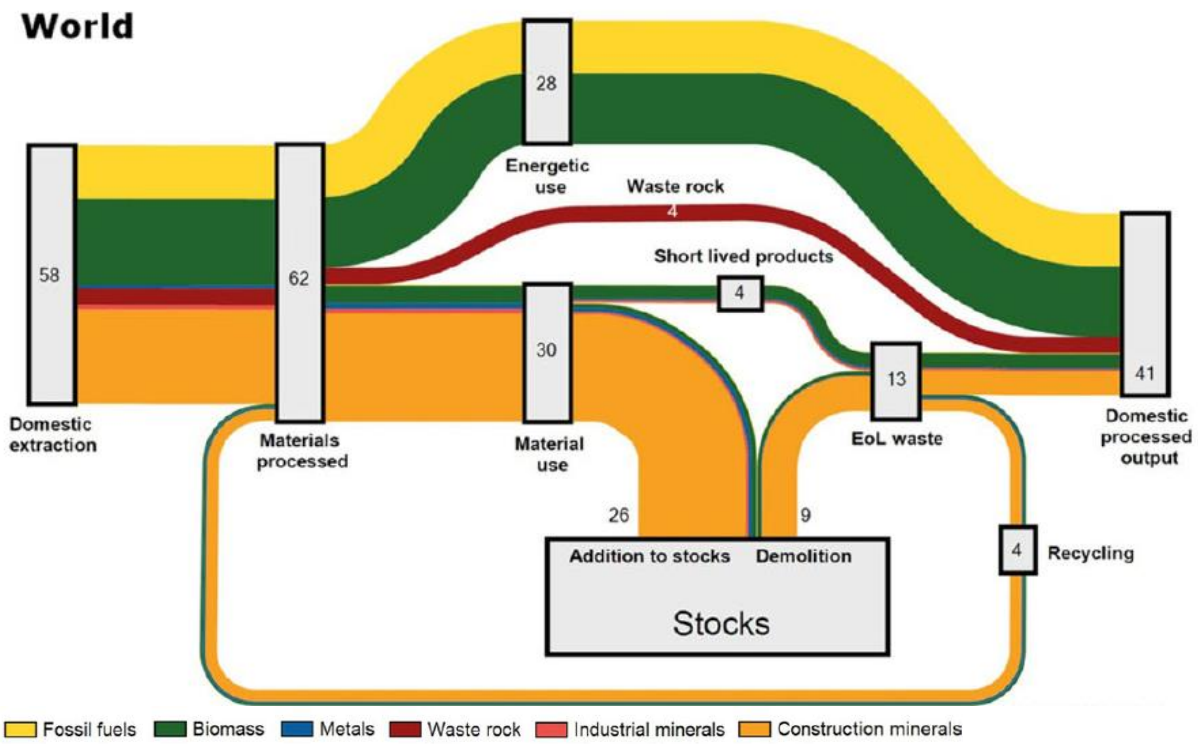

Figure 4 Sankey diagram of material flows through the global economy (world) in 2005. Numbers show the size of flows in Gt/yr. EoL waste = end-of-life waste; Gt/yr = gigatonnes per year; RoW = rest of the world. Source: Haas et al. (2015)

2. *Price risks*

In the current linear economy, where the economy is based on resources, companies are experimenting in the lasts years' volatile prices and supply disruptions. These factors increase uncertainty and could dampen economic growth. (Ellen MacArthur Foundation, 2015f; Lacy, 2015) For example, cotton, palm oil and cocoa prices grew by 75%, 230% and 246%, respectively between 2000 and 2010 (World Economic Forum, 2012).

3. *Supply risks*

As mentioned before, our planet has finite resources. If the demand for resources continues as business as usual, the world would face a huge gap between the demand and the supply, as can be seen in Figure 5. This could lead to a rising cost for materials, energy, land, water, etcetera; volatility in commodity markets – as seen in the previous point, and risk of supply disruption (Accenture, 2014).

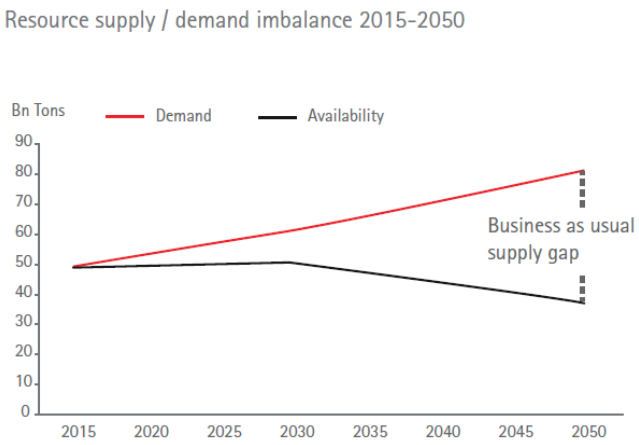

Figure 5 The widening gap between sustainable resource availability and demand. Construction minerals (e.g. sand and gravel) were excluded, as they are abundant. Source: Accenture (2014)

4. *Natural systems degradation*

As was mentioned in the introduction, we are using our planet capacity in a rate that is faster than the time it needs to recover. In 2009, nine planetary boundaries were proposed as a framework to provide a science-based analysis of the risk that human activity represents to the stability of the Earth System (Rockström et al., 2009; Stockholm Resilience Center, 2015). Given that the Earth is a single, complex and integrated system, these nine boundaries are interdependent on each other. Furthermore, four of the planetary boundaries have already been trespassed: climate change (carbon dioxide (CO_2) concentration in the atmosphere), biosphere integrity (extinction rate), biogeochemical flows of nitrogen and phosphorus, and land-system change (deforestation). (Steffen et al., 2015)

2.1.2 Enablers

The following enablers are accelerating the adoption and scaling up of CE (World Economic Forum, 2014):

1. Consumer preferences are shifting away from ownership
2. Socio-demographic trends make the benefits easier to capture
3. Advances in technology
4. Regulatory trends

1. *Consumer preferences are shifting away from ownership*

Customer behaviour's change is allowing the acceptance of alternative business models, where customers become users and have access to services on demand rather than ownership of the products which deliver them (Ellen MacArthur Foundation, 2015f). This shift could be attributed to psychological freedom, flexibility and variety of choice, absence of financial and nonfinancial costs related to ownership (e.g. maintenance and insurance), gain of space and access to assets of a better quality for an specific use (Sempels & Hoffmann, 2013). In addition, businesses are also moving away from ownership, e.g. assets like office spaces or aircrafts, and organizations like the government of the United States of America now requires suppliers to supply services or performance rather than products (Webster, 2016). Moreover, the shift to business models such as pay-per-performance, leasing and rent schemes, and return and reuse, allow a higher resource productivity, as well as a higher availability and quality of assets, and fewer information blind spots as the asset is tracked during its life cycle (World Economic Forum, 2014).

2. *Socio-demographic trends make the benefits easier to capture*

Urban population is increasing, since 2008 more than half of the globe population lives in cities, especially in developing countries, and it is expected that by 2050, 66 per cent of the world's population will be urban (United Nations, 2014). Cities promote the agglomeration of businesses and actors, which can benefit from synergies between them (UN-HABITAT, 2011). Furthermore, a higher density of people and actors make more efficient and cost-effective reverse logistics, supporting asset-sharing services, incentivizing the collection and treatment of assets at their end-of-life, and promoting systemic solutions (Ellen MacArthur Foundation, 2015f; World Economic Forum, 2014).

3. *Advances in technology*

Disruptive technologies are allowing the accelerated shift to a CE (Accenture, 2014). In what is called the Fourth Industrial Revolution[3], technologies such as the Internet of Things (IoT) will enable circular innovation. For example, products and components will "talk" between them (M2M: machine to machine) and make it possible to be traced during their lifecycle (Dedicoat, 2016). Moreover, Accenture has identified ten enabling technologies, shown in Table 1, that are already facilitating businesses to perform in a circular way.

Type	*Technology*	*Benefits*
Digital (information technology)	Social	Enables the creation of trust within a digital community necessary for sharing at scale
	Mobile	Enables individuals and businesses to access (proximate) goods and services everywhere and any time
	Cloud	Supports dematerialization and enables access to powerful applications and large databases from any connected device
	M2M Communication	Provides real-time insight in the status of assets and makes it possible to remotely and automatically manage them
	Big Data Analytics	Recognizes patterns and helps to optimize the performance of large collections of assets based on analysis of complex data sets
Hybrid	3D Printing	Enables local, customized and resource-efficient production on demand, thereby eliminating the need for transportation and stocks
	Trace and return systems	Enable cost-effective collection and sorting of used goods at a scale
Engineering (Physical technology)	Advanced recycling tech	Makes effective separation and recycling of more materials feasible and financially attractive
	Modular design technology	Allows for easy upgrades and repairs of products and enables quick and cost-effective reuse of components at end of life
	Life and Material Science	Enable the creation of high quality 'circular' (fully recyclable, biodegradable or renewable) alternatives to traditional inputs

Table 1 Ten Technologies for a circular economy. Source: Brinkman (2015)

[3] The Fourth Industrial Revolution is characterized by the velocity, scope and system impact of new technology. Compared to the previous industrial revolutions, the breakthroughs of the Forth one do not follow a linear pace, but an exponential one. It is also being disruptive in almost every industry and country. And it is transforming entire systems of production, management and governance. (Schwab, 2015)

4. Regulatory trends

Over the last years, many countries have been setting the legal framework for the transition to a CE, by providing incentives and rewards for more circular practices. An example of this is the Circular Economy Package released by the European Union in December 2015 and the Chinese Promotion Law for Circular Economy adopted in 2008 (European Commission, 2015; Zhu, 2014).

2.2 Circular economy concept

This section explains what a circular economy is and the related schools of thought that shaped the current definition of CE.

2.2.1 Schools of thought

As mentioned before, the idea of creating circular flows of materials is not new and the current concept of circular economy has been formed by different schools of thought, showed in Table 2 (Ellen MacArthur Foundation, 2013; European Commission, 2014).

School of Thought	*Overview*
Biomimicry	It imitates nature's solutions to inspire design and processes to solve human problems (The Biomimicry Institute, 2015).
Blue Economy	It is an open source movement that gathers case studies. It proposes an economy where resources "cascade", turning the waste of one product or system into the input or another one. It focuses on solutions being determined by their local environment and its characteristics. (Blue Economy, 2014)
Cradle to Cradle (C2C)	It is a design method that mimics nature considering all materials involved in commercial and industrial processes as "nutrients" and designing products that at their end of life become resources for new products. C2C differentiates two nutrients cycles: the technical and the biological one. (Braungart & McDonough, 2008)
Industrial Ecology	It takes a systematic approach on industrial activity, as a biological system, and studies the material and energy flows - aiming for close-loops processes and eliminating the undesirable by-products and waste. (Graedel, 1996)
Industrial Symbiosis	It is considered to be industrial ecology "in practice" (Lombardi & Laybourn, 2012). It is the symbiotic relation between a network of companies or business in their commercial and industrial operations, by using, recovering and redirecting resources for reuse. (Chertow, 2007)
Natural Capitalism	It contraposes the industrial capitalism as source of economic development. Natural Capitalism highlights the critical interdependency of human activities and natural capital (natural resources and ecosystem services). (Hawken, Lovins, & Lovins, 2010)
Performance Economy	It encourages a "close-loop" economy, based in services instead of materials/products. It promotes product life extension, long-life goods, reconditioning activities, and waste prevention. (Stahel, 1984)
Regenerative Design	It proposes that all processes within a system should renew or regenerate the sources of material and energy that they use, from design (Lyle Center for Regenerative Studies, 2015).

Table 2 Schools of thought that shaped current definition of CE

2.2.2 Definition and characteristics

The current definition of a Circular Economy is specified as a market driven simple, yet convincing, strategy that aims to reduce the input of raw materials and output of waste to the environment by closing economic and ecological loops of resources (Haas et al., 2015; Kraaijenhagen et al., 2016). Additionally, it internalizes environmental externalities associated to raw material extraction, waste generation and pollution (Sauvé et al., 2015). Its aim is to keep the value of products, materials and resources as long as possible within the economy (European Commission, 2015). Moreover, the EMF defines it as an industrial system that is restorative or regenerative by design (Ellen MacArthur Foundation, 2012). It can be found at different scale levels of organization: as an overall strategy in a

macro level (city, province, region or nation), in a meso scale (eco industrial parks or agglomeration of actors) and at a micro scale (single company or consumer) (Ghisellini et al., 2015). Figure 6 shows a simplified model of a CE for materials and energy.

Figure 6 A simplified model of the circular economy for materials and energy. Source: Reichel, Schoenmakere, & Gillabe (2016)

CE fundamental characteristics are (1) the elimination of waste by design, (2) diversity, (3) renewable sources of energy, (4) system approach and that (5) prices (or other feedback mechanisms) reflect externalities (Ellen MacArthur Foundation, 2012).

1. *Waste is "designed out"*

In a CE, waste is designed out on purpose (Ellen MacArthur Foundation, 2012). The pillars to achieve the virtual elimination of waste are the "cradle to cradle" principle and industrial symbiosis (European Commission, 2014). As explained in Table 2, C2C considers all materials as nutrients, either in a biological or in the technical cycles (Figure 7). In other to achieve C2C, products should be designed for durability, disassembly and refurbishment. Moreover, businesses should apply eco-design principles, such as the use of renewable resources, elimination of the use of toxic elements and hazardous materials, increase the life and reuse potential of assets, and facilitate sorting and final recovery of products (Braungart & McDonough, 2008). Industrial symbiosis, as mentioned before, is a symbiotic relation between different actors for economies of scale. It is a cross-sector approach, e.g. between product designers and recyclers, to optimize the life cycle of products and by-products (Chertow, 2007). These synergies are the ones that will allow biological and technical "nutrients" to continue in the "loop"(European Commission, 2015).

2. *Diversity*

CE highlights the importance of diversity as the key driver of versatility and resilience (Ellen MacArthur Foundation, 2015f). For example, if production systems are able to use different materials as inputs, they have less supply and prices volatility risks. Diverse modular systems with many connections and scales are more resilient to external shocks than systems built with a focus on efficiency (economy of scale) (Ellen MacArthur Foundation, 2013).

3. *Renewable energy*

The use of renewable sources of energy in a CE will increase its resilience to market prices and supply of non-renewable resources (e.g. oil) and decrease the economic impact over the environment, as renewable energy supply chain is generally less energy- and carbon-intensive than the fossil fuel energy supply chain (Ellen MacArthur Foundation, 2015f; Wijkman & Skånberg, 2015).

4. *System approach*

System thinking in a CE, instead of just focusing on single products and processes, allows a comprehensive, integrated and holistic approach to the complex systems where different parts are linked to each other (Lehmann, Leeuw, Fehr, & Wong, 2014).

5. *Externalities are reflected in feedback mechanism*

Nowadays, prices or other feedback mechanisms, do not reflect externalities, positive neither negative, thus the real cost embedded in the product is not showed. Therefore, many traditional business models today are feasible and competitive than they would otherwise be. In order for prices not to act as a barrier in the transition to a CE, but as messages, lack of transparency about externalities should be avoided for prices to be effective (Ellen MacArthur Foundation, 2015f; Helbling, 2012; SustainAbility, 2014).

2.2.3 Circular economy principles

As shown in Figure 7, CE rests on three principles which address several of that resource and system challenges industrial economies face. The three principles are (1) preserve and enhance natural capital, (2) optimise resource yields, and (3) foster system effectiveness. (Ellen MacArthur Foundation, 2015f)

Principle 1: Preserve and enhance natural capital

This principle is proposed to be accomplished by controlling finite stocks (technical cycle) and balancing the use of the renewable ones (biological cycle) (Ellen MacArthur Foundation, 2012). This principle supports the use of renewable energy to power the economy, as well as the decline in the need of finite resources. These will increase resilience in the involved systems. (World Economic Forum, 2014)

Principle 2: Optimise resource yields

The second principle stated that in order to achieve high resource yield, it is necessary to circulate products, components, and materials in both technical and biological cycles. In a CE, there are two different types of assets: consumables and durable components. Natural materials or “nutrients” are used to produce consumables which can safely be returned to the biosphere at their end-of-life. On the contrary, durable components – such as computers or machines – are made from technical “nutrients” that are not suitable for the atmosphere; therefore, there’s a need for them to be

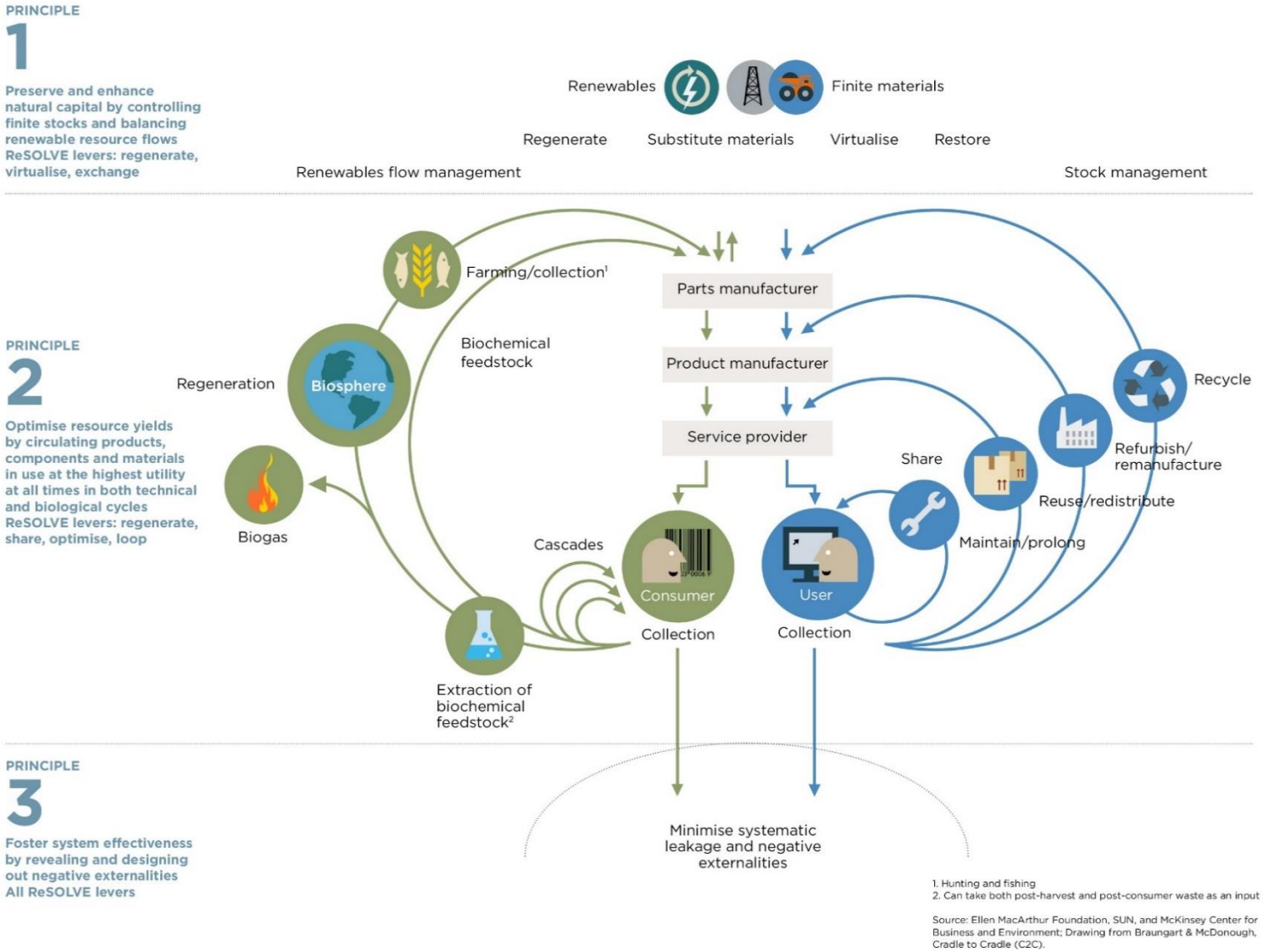

Figure 7 EMF's Circular Economy System Diagram which contains an outline of a CE, its principles and its connection with the ReSOLVE framework. Source: Ellen MacArthur Foundation (2015b)

designed to be reused or easily upgrade. (Ellen MacArthur Foundation, 2012; World Economic Forum, 2014)

Principle 3: Foster system effectiveness

The third principle proposes to support system effectiveness by bringing to the open and designing out negative externalities (Ellen MacArthur Foundation, 2012). Avoided damages include risk food supply, mobility, shelter, education, health, and etcetera, and externalities, such as land use, water, air, climate change, and etcetera (Ellen MacArthur Foundation, 2015f).

These principles do not only apply for businesses and economic sectors, but can also guide the development of sustainable cities (Morlett, 2014). Furthermore, in order to accelerate the transition, these principles should be integrated in education and training programs, such as leadership, in-company, management, economics, engineering, design, policy sciences, and etcetera (Kok, Wurpel, & Ten Wolde, 2013).

2.2.4 Value creation in a circular economy

The identified sources of value creation within CE are explained below (Ellen MacArthur Foundation, 2012) and showed in Figure 8.

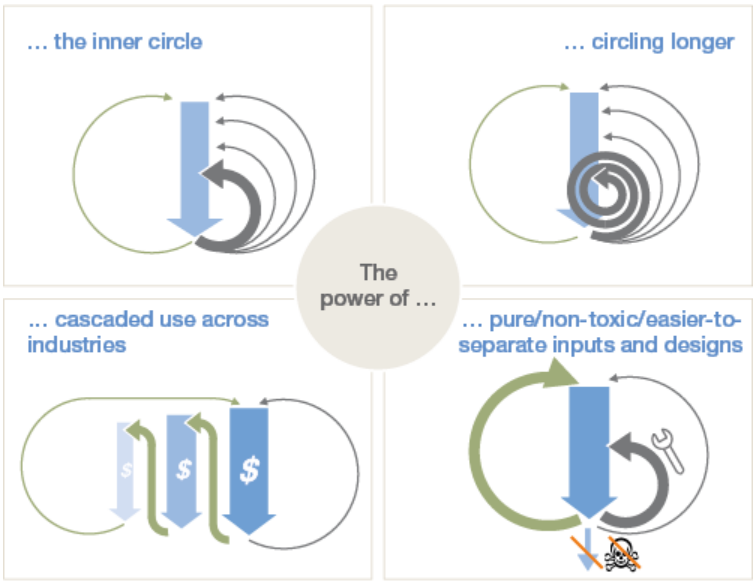

Figure 8 Value creation in a CE. Source: Ellen MacArthur Foundation (2012)

"The power of the inner circle": This source of value refers that greater savings or potential benefits would happen the more hidden cost (e.g. materials, labour, energy and capital) are kept in the products (Bastein, Roelofs, Rietveld, & Hoogendoorn, 2013). This means that strategies, such as maintenance and repair, that preserve products and resources in a tighter/closer loop to the original product, will create the most value (Ellen MacArthur Foundation, 2015f).

"The power of circling longer": Value is created from the ability of assets to maintain the same use for a long period of time by multiple users, avoiding the need of raw materials to produce new assets – which would be the case if every user have their own. For example, reuse of equipment and second hand shops.(CIRAIG, 2015; Ellen MacArthur Foundation, 2012)

"The power of cascaded use": Resources at the end of life of products, becomes "nutrients" for a system, instead of waste. Value is created by avoiding the need of raw material in the new system. An example of this are textiles, clothes that no longer can be use in the textile sector are cascade to

the furniture sector where they are used as fill-in material. Later, they can be used in the construction sector as isolation. In both cases, the use of raw material was avoided by cascading end-of-life products from other sectors. (Chamberlin, Jamsin, & Raksit, 2013; Ellen MacArthur Foundation, 2012)

"The power of pure inputs": This source of value comes from maintaining materials as pure as possible during the lifecycle of the products they are used in or making components easy to disassembly at their end of life. This action facilitates reuse, repair and recycling of materials and preserves its high quality. (Bastein et al., 2013; Ellen MacArthur Foundation, 2012)

2.3. Opportunities and barriers in the transition to a circular economy

2.3.1 Circular economy opportunities

Some of the opportunities that a CE offers have already been mentioned in this chapter and they will be broaden in this section. The opportunities can be categorized in relation with the economy, environment, businesses and citizens (Ellen Macarthur Foundation, Sun, & McKinsey Center for Business and Environment, 2015).

Economic opportunities

In relation with the economy, some benefits from the transition to a CE would be economic growth, net material cost savings, job creation and innovation.

Economic growth

Defined by the Gross Domestic Product (GDP), economic growth would be achieved as a consequence of a mix of increased revenues from emerging circular activities, and reduced costs of production by the more production utilization of inputs. For example, in a CE scenario, European GDP could increase up to 27% by 2050, compared to the 15% expected in the current development path; while in the Netherlands, the overall impact of CE would be of an additional EUR 7.3 billion per year. (Bastein et al., 2013; Ellen MacArthur Foundation, 2015f). In the case of Denmark, CE could lead to an additional 0.8% to 1.4% GDP growth by year 2035 (Ellen MacArthur Foundation, 2015d).

Substantial net material cost savings

EMF has estimated that in Europe, in sectors of complex medium lived products, the net material cost savings opportunity could be up to USD 650 billion in an advanced CE scenario. And for fast moving consumer good, the savings would be up to USD 700 billion globally. Moreover, there would also be savings from avoiding landfilling, which could save, for example, USD 1.1 billion a year in the U.K. (Ellen MacArthur Foundation, 2015f)

Job creation potential

CE would support job creation, especially due to increased spending by lower prices and to work-intensive activities, such as recycling and manufacturing (WRAP & Green Alliance, 2015). In Denmark, 7,300-13,300 jobs equivalents[4] would be created by CE by 2035 (Ellen MacArthur Foundation, 2015d). Moreover, in the European Union, it is estimated it would create 170,000 direct jobs in the waste management sector by the same year and 500,000 in the recycling industry (Henry, 2016; World Economic Forum, 2014).

[4] Job equivalents refers to the conversion of labour bill to job equivalents using a wage curve approach (Ellen MacArthur Foundation, 2015d).

Innovation

CE foster innovation to meet the aspiration to replace one-use products with assets that are "circular by design" and create systems that support it (Ellen MacArthur Foundation, 2015f). Furthermore, CE would boost innovation in business models, product design, supply chain, and in other aspects of the economy (World Economic Forum, 2016). For example, on-going research projects such as PlasCarb and ResCom, sponsored by the European Union, aim to turn food waste into a resource and to create close-loop production systems, respectively (Turecki, 2016).

Environmental opportunities

The main opportunities within CE for the environment are a reduction in carbon dioxide emissions, lower raw material consumption, and enrichment of soil and increase of land productivity (Ellen MacArthur Foundation, 2015f).

Carbon dioxide emissions

EMF estimated that for Europe, CE could decrease in 83% CO_2 emissions by 2050 compared to today's levels, only by analysing mobility, food and construction sectors (Ellen MacArthur Foundation, 2015f). Moreover, country specific, CE could reduce territorial emissions in Scotland, by 11 million tonnes of $CO_{2\ equivalent}$ per year by the same year compared to business as usual (BAU) (Pratt & Lenaghan, 2015). And Sweden could cut carbon emissions by 70% by 2030 if CE policies were adopted (Wijkman & Skånberg, 2015).

Primary material consumption

In a CE, raw material (car and construction materials, real estate land, synthetic fertiliser, pesticides, agricultural water use, fuels, and non-renewable electricity) usage would decrease by 32% by 2030 and by 53% by 2050, compared with today's consumption (Ellen MacArthur Foundation, 2015c). In widget market, showed in Figure 9, the substitution of raw material by circular ones could reduce the quantity of material consumed to a lower set point (World Economic Forum, 2014).

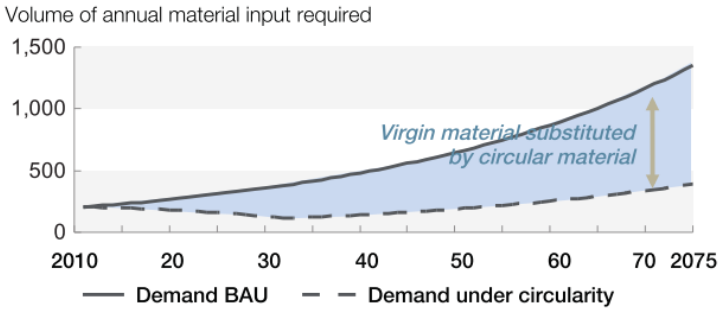

Figure 9 Effect of circular system on primary material demand in widget market. Source: World Economic Forum (2014)

Land productivity and soil health

In a CE, the cost of land degradation - USD 40 billion per year worldwide – would be prevented by moving much more biological material through composting processes or anaerobic digestion and back into the soil. In addition, hidden costs such as increased fertiliser use, loss of biodiversity and loss of unique landscapes would be avoided. (Ellen MacArthur Foundation, 2014) If available organic waste is used to replace chemical

fertilizers, the use of the late one could decrease in Europe up to 80% by 2050 (Ellen MacArthur Foundation, 2015f).

Opportunities for companies

Business would benefit or lower input cost, overcome of price volatility and supply risk of raw materials, as well as, the creation of new profit streams (Ellen MacArthur Foundation, 2015f). Business models that capture this value will be further explained in Chapter 3. Moreover, companies would be able to improve their relationship with customers and could increase their loyalty, as CE would offer more touch points with customers and access to insights during the life cycle of assets and services (Reichel et al., 2016)

Opportunities for citizens

Citizens, as consumers, will have a direct access to a broader selection of assets and services without the risks and costs associated to ownership (Reichel et al., 2016). Furthermore, customers and consumer would have access to products and services at a better overall cost and more conveniently (GreenBiz & UPS, 2016).

2.3.2 Barriers for circular economy adoption

A change of economic model would face many barriers, some of them are detailed below.

Lock-in to resource-intensive infrastructure and development models

The current infrastructure and development models support resource-intensive activities. For example, international production, consumption and trade is highly dependent on fossil fuels (Preston, 2012). Furthermore, linear business models have mastered key features that make them successful nowadays: (1) becoming leaner, meaner and more efficient, (2) gaining scale to reduce operation costs per unit, (3) increasing scope of activities to maximise margins, and (4) basing competition on prices (Zils, Hawkins, & Hopkinson, 2016). In addition, there are challenges obtaining financing resources and investment for CE transition (European Commission, 2014).

Political obstacles to putting an appropriate price on resource use

Still today many countries support, directly or indirectly, the excessive use of resources through subsidies and not making it compulsory for businesses and other organizations the incorporation of externalities' costs (Withana, Brink, & Russi, 2014). Furthermore, there are challenges shifting taxes from labour to resources and changes in the fiscal model (Bakker et al., 2016).

High up-front costs

Even though a CE would incentivize economic growth and reduce resource price risks, in the short term, it would require high investment to implement it (Kok et al., 2013). Some examples are staff re-training, adaptation of machinery, reverse logistics system implementation, and etcetera (Preston, 2012). In addition, suitable investment for infrastructure, such as recycling and recovery infrastructure, innovation and technology is yet not available (European Commission, 2014).

Complex international supply chains

Most of the times production and consumption take place in different geographical regions from multiple companies around the world (Flynn, Morita, & Machuca, 2011). The challenge is to align the different businesses interconnected in the supply chain in the transition to a CE – from design of the product, consumption and end-of-life recovery activities (Preston, 2012).

Challenges for company-to-company cooperation

A CE would require close collaboration between companies, which may rise issues related to confidentiality and trust, if companies are competitors or operate in the same sector (Kok et al., 2013; Preston, 2012). Furthermore, power and incentives between actors within the sector and across value chains are not aligned, such as between producers and recyclers, to improve cross-cycle and cross-sector performance (European Commission, 2014).

The innovation challenge

As mentioned before, CE would boost innovation. Nevertheless, innovation is also required for CE to move forwards. For example, innovation would be required in material science, product design, improve global supply chains, smart infrastructure and tracking technology. (Benton & Hazell, 2013; Preston, 2012).

Other barriers are consumers and public awareness and engagement, lack of an standardize metric and measurement method for a CE (Geng & Doberstein, 2008; Kok et al., 2013; Wallace & Raingold, 2012).

2.4 Discussion and conclusions of the chapter

In spite of being around for a while, the drivers affecting the transition to a CE have gained relevance in the lasts years as the economy has become more wasteful, the risks of resource's price and supply have increased and some of the limits of the planet have been trespassed. However, what has triggered CE's momentum is the realization of the enablers discussed in this chapter: new trends in the legislation, technology innovations, societal acceptance of new business models and an increasing urbanization of the world. While the drivers are encouraging the transition to a CE, the enablers are facilitating it. Moreover, the enablers are encouraging a rapid adoption of CE by different stakeholders.

The main objective in a CE is to reduce the input of material to the economy and the output of waste to the environment by closing resource's loops. In addition, it is characterized by designing out waste, diversity, the use of renewable energy, having a system approach and the integration of externalities. These characteristics are reflected in the CE principles and in the sources of value creation. Furthermore, CE principles can be applied from different perspectives, such as single companies, industry sectors, cities, countries and regions (e.g. European Union).

CE's opportunities benefit all organizational levels of society by boosting the economy, increasing revenues for businesses, creating jobs, etcetera, and the environment. However, there are still barriers that slow and limit the transition to a CE, such as existing infrastructure, policy, investment costs and cooperation challenges.

3. Business models in a circular economy

This chapter will answer the research sub-question "What is a circular business model?" It starts reviewing the definition of business model (BM) and the related business model Canvas tool, followed by the description of sustainable business models (SBM) and their archetypes. Furthermore, circular business models (CBM) are presented. Due to the fact that CBM are relatively new, its characterization is further discussed in relation with SBMs. For this purpose, a framework for the assessment in selected. Finally, an enriched definition of CBM is provided and a corresponding framework for this report.

3.1 Business model

The concept of business model is not new, as it can be tracked back to the late 1940s, and it is in the last decades that has been widely diffused as it became a necessity to understand value-capture mechanisms of companies (Sempels & Hoffmann, 2013).

3.1.1 Business model definition

There are many definitions of what a BM is, its elements and how it should be used (Johnson, Christensen, & Kagermann, 2008; Sawy & Pereira, 2013; Teece, 2010; Zott & Amit, 2010). However, this thesis uses the definition of BM developed by Osterwalder & Pigneur (2010) and their systematic approach to BM

"A business model is the rationale of how an organization creates, delivers and captures value". (Osterwalder & Pigneur, 2010)

Even though there are other comprehensive propositions for a systematic approach to BM, such as Wirtz's (2011), the framework business model canvas (BMC) from Osterwalder & Pigneur (2010) is more recognized and applied (Lewandowski, 2016). Thus, the BMC is employed as systematic mapping tool for business models in the case study developed in Chapter 4.

3.1.2 Business model canvas

BMC relies in nine building blocks that explain the logic behind how a company creates value, captures value and how value is shared along the value chain. The nine building blocks are described below and showed in Figure 10 (Osterwalder & Pigneur, 2010):

1. **Costumer segments**, which the organization creates value for.
2. **Value proposition**, which includes services and products, that satisfy a customer segment needs and solve its problem.
3. **Channels**, which are used by the organization to deliver, communicate and sell value propositions.
4. **Customer relationships,** which the organization creates and maintain with each customer segment.
5. **Revenue streams,** which are the result of successfully "selling" the value proposition to the customer segments.
6. **Key resources**, which are necessary to offer and deliver the value proposition.
7. **Key activities**, which need to be performed in order to deliver the value proposition.
8. **Key partnerships**, which refers to the network of suppliers and other partners that make it possible for the organization to deliver the value proposition.
9. **Cost structure**, which comprehend all the costs associated with the business model operation.

Companies use BMC systematic approach as a tool to support strategic planning and development; as a dashboard, allowing to set indicators for each building block to improve the overall performance of the company; to analyse competition; to develop a portfolio of business models, especially in large organizations; as a source of innovation, as it allows to prototype alternative business models and test them; as a template to develop new ideas and compare them; to understand customer segments; as a common language across the organization, etcetera. (Strategyzer, 2015)

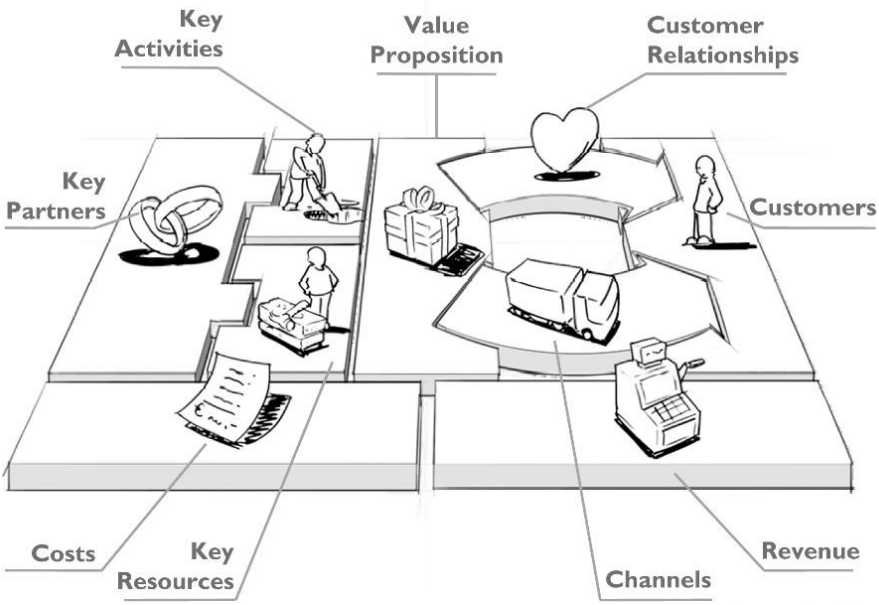

Figure 10 Business model's nine building blocks. Source: Osterwalder & Pigneur (2010)

Moreover, BMC have been recognized and used for further conceptualization of sustainable BM (Gorissen, Vrancken, & Manshoven, 2016; Kraaijenhagen et al., 2016; Lüdeke-Freund, 2010; Sempels & Hoffmann, 2013).

3.2 Sustainable business models

Sustainability has become part of businesses, as they have been developing win-win-win strategies to simultaneously benefit the company, its customers and society, and the environment (Elkington, 1994). This transition requires a transformation in companies' entire business logic and innovative solutions in processes (e.g. supply chain certifications, renewable energy sourcing, high performance buildings and transparency), products or services (e.g. from recycles materials, concentrated laundry detergents and energy- efficiency appliances) and business models (e.g. closed loop, shared economy and product as service) (Abdelkafi & Tauscher, 2015; SustainAbility, 2014). Nevertheless, process and product innovation can be constrained by traditional BMs, making it crucial for businesses to shift to BM that enable innovative processes and products to succeed in the market (SustainAbility, 2014).

SBM use both a systems and company-level perspective, build on the triple bottom line approach (Economic, Environmental and Social) to define the company's purpose and measure performance. SBM include a wide range of stakeholders, such as investors and shareholders, employees, suppliers, and partners, and consider the environment and society as stakeholders. (Bocken, Short, Rana, & Evans, 2013; Elkington, 1997; Stubbs & Cocklin, 2008).

Recent publications have researched the relationship between sustainability and business models (Abdelkafi & Tauscher, 2015; Bocken, Short, Rana, & Evans, 2014; Boons & Lüdeke-Freund, 2013;

Gorissen et al., 2016; Lüdeke-Freund, 2010; Roome & Louche, 2016; Schaltegger, Hansen, & Lüdeke-Freund, 2016; Sempels & Hoffmann, 2013; SustainAbility, 2014). Furthermore, Bocken et al. (2014) have introduced eight BM archetypes as a grouping tool of mechanisms and solutions to build up SBM.

3.2.1 Sustainable business models archetypes

The SBM archetypes developed by Bocken et al. (2014) are grouped in three innovation categories: technical, social and organizational. The technical grouping includes archetypes based on technical innovation, such as manufacturing process or product design; the social grouping is based on social innovation such as changing consumer behaviour; and organization grouping is based on organizational innovation change, such as crowd funding. Figure 11 illustrates the BM archetypes and provides some examples. The SBM archetypes are explained below (Bocken et al., 2014):

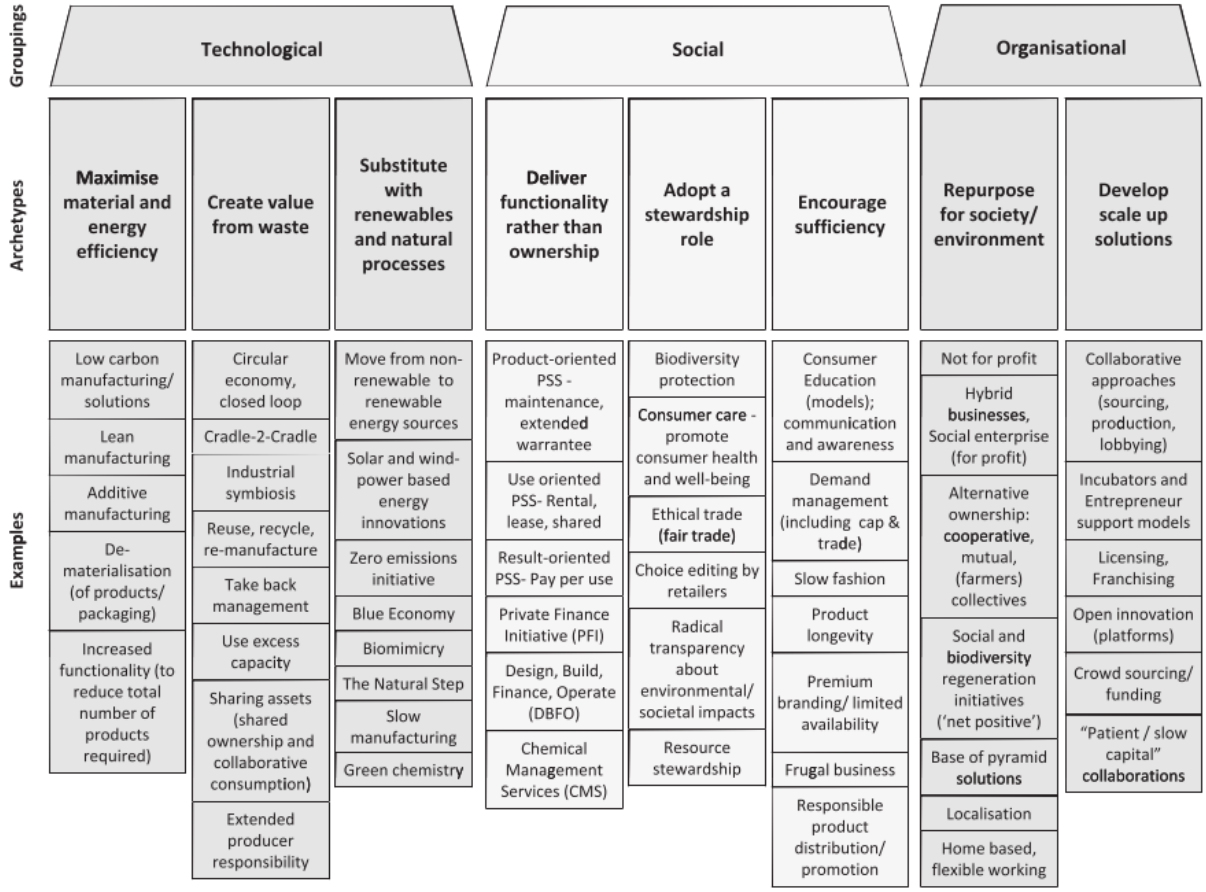

Figure 11 Sustainable business model archetypes. Source: Bocken et al. (2014)

Technical innovation

1. **Maximize material and energy efficiency**. It is based in resource efficiency, while generating less waste, emissions and pollution.
2. **Create value from waste**. Waste streams are turned into useful and valuable input of other production processes. It also considers a better use of under-utilize capacity.
3. **Substitute with renewable and natural processes**. It reduces environmental impacts and increases business resilience by decoupling growth from non-renewable resources and current production processes.

Social innovation

4. **Deliver functionality rather than ownership.** It satisfies the user's needs without having them buying the physical product that provides the service.
5. **Adopt a stewardship role.** It proactively engages all stakeholders to ensure a long-term good relationship and collaboration.
6. **Encourage sufficiency**. It include BM that seeks to reduce consumption and production.

Organizational innovation

7. **Repurpose for society/environment**. It prioritizes the delivery of value to the society and the environment, rather than economic profit.
8. **Develop scale-up solutions**. It refers to BM that scale-up sustainable solutions, to maximize the benefits to environment and society.

From the definition of the archetypes, they can be related to CE school of thought, CE principles or ways of value creation in a CE (Chapter 2). For this reason, they are assessed in the next section in relation with circular business models to discover if they could be used to develop circular business models.

3.3 Circular business models

CBM has not been yet well defined, as most of the literature available focus on specific CE loops or examples of BM for a CE (Bocken, Bakker, & Pauw, 2016; Kraaijenhagen et al., 2016; Lacy & Rutqvist, 2015; Linder & Williander, 2015; Ovaska et al., 2016; Van Renswoude, Ten Wolde, & Joustra, 2015; Zils et al., 2016). However, from the reviewed literature it was gathered that CBM much as SBM, are not about trade-offs where one group or customer segment benefits to the detriment of another stakeholder. Furthermore, CBMs are economically competitive while contributing positively to the environment and society. (Kraaijenhagen et al., 2016) Although, 100% CBM do not exist yet, circularity can be achieved by close loop systems in which one BM can be adding to other BM (and companies) (Van Renswoude et al., 2015). In addition, CBM is a BM for value creation based on the utilization of economic value retained in products after their end-of life in the production of new offerings (Linder & Williander, 2015). Moreover, CBM closes loops within the company and increases resource efficiency (Rizos, Behrens, Kafyeke, Hirschnitz-Garbers, & Ioannou, 2015).

In order to get a better understanding of CBM, how it can be generated and how to assess already existing CBM and SBM archetypes, CBM's existing frameworks are reviewed in this chapter.

3.3.1 Framework for circular business generation

From the literature review, two frameworks to approach CBM were gathered: (1) ReSOLVE (Ellen Macarthur Foundation et al., 2015) and (2) Resource cycles - slowing, closing, and narrowing loops (Bocken et al., 2016). Both are explained bellow, and an assessment on their similarities and differences is done at the end of this section. The aim of this analysis is to choose one of the frameworks, or merge them in a combined one, which will serve as a tool in this report in the assessment of already existing CBM and in the generation of new ones for the case study developed in Chapter 4.

3.3.1.1 ReSOLVE

ReSOLVE framework, based on CE principles, was developed as a tool for generation of circular strategies and growth initiatives to help governments and businesses move towards a CE (Ellen MacArthur Foundation, 2015c). ReSOLVE proposes six business actions (Regenerate, Share, Optimise, Loop, Virtualise, and Exchange) which, in different ways, prolong the life of goods, increase their use

and/or shift from finite to renewable resources (Ellen Macarthur Foundation et al., 2015). The elements from the ReSOLVE framework are explained below (Ellen MacArthur Foundation, 2015c):

- **Regenerate.** It implies the shift to renewable energy and material, as well as reclaim, retain, and regenerate health of ecosystems and the return of recovered biological resources to the biosphere.
- **Share.** It refers to slow the product loops by maximising its utilization, by sharing them among different users (e.g. peer-to-peer sharing of privately owned products or public sharing of a pool of products), by reusing them (e.g. second hand), and by prolonging their lifetime through maintenance, repair, and design for durability.
- **Optimize.** An organization can optimize by increasing the performance and efficiency of a product, by removing waste from the production process and supply chain and by leveraging big data, automation, remote sensing and steering. These actions are carried out without changing the actual product or technology.
- **Loop**. This means to keep components and materials in closed loops, prioritizing inner loops. In case of finite materials in the technical nutrients cycle, it relays in remanufacturing of products or components, as well as recycling of materials. While in the natural nutrients cycle, activities that loop the material are anaerobic digestion and extracting biochemical from organic waste.
- **Virtualise**. It refers to the dematerialization of resources by delivering utility virtually directly (e.g. books and music), or indirectly (e.g. online shopping, virtual offices, etcetera).
- **Exchange.** It implies the replacement of old materials with advanced non-renewable, as well as the application of new technologies. (e.g. 3D printing) and the selection of new products or services (e.g. multimodal transport).

In addition, Figure 12 shows some examples of BM and companies per strategy at the ReSOLVE framework.

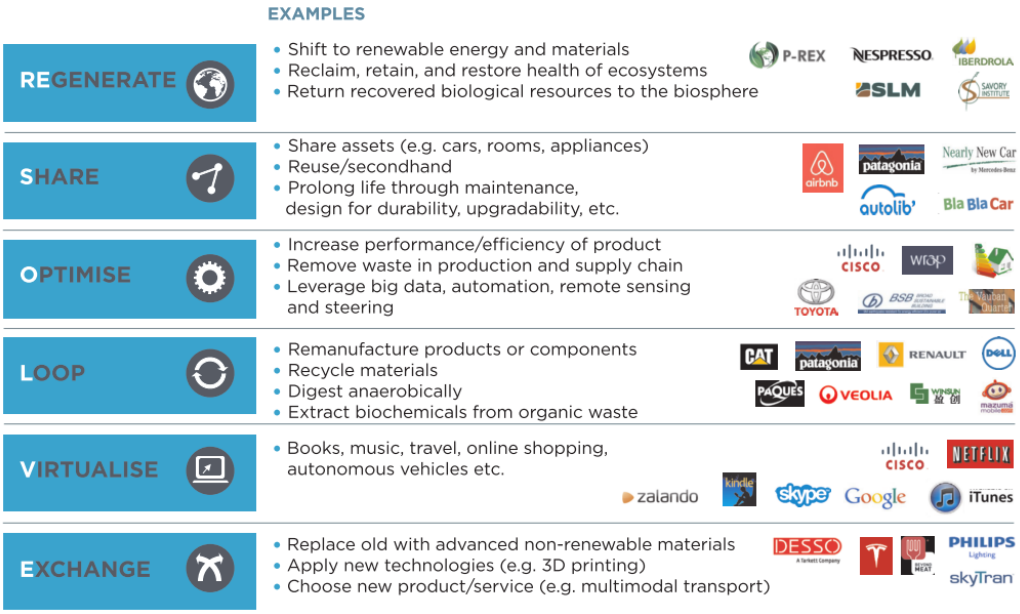

Figure 12 ReSOLVE framework and examples. Source: Ellen Macarthur Foundation et al. (2015)

3.3.1.2 Resource cycles - slowing, closing, and narrowing loops

Bocken et al. (2016) suggest the Resource Cycles approach with the aim to develop a common framework and terminology of strategies for business models for closed loops and closed loop design

in a CE. Based on how resources, materials and components flow through a system, the following strategies are proposed to increase the cycling of resources cycles (Bocken et al., 2016):

- **Slowing resource loops.** It comprises the design of long-life goods and product life extension (e.g. repair, remanufacturing, and etcetera) and the increase on the utilization of a product by extending its life or by intensifying its use.
- **Closing resource loops.** Reuse of materials through recycling, which closes the loop between the end-of-life of the product and the production phase.
- **Narrowing loops.** Through resource efficiency, aiming to use fewer resources per product. This strategy also works in the linear economy.

Based on this framework, Bocken et al., (2016) and Kraaijenhagen et al. (2016) has identified some examples of BM strategies for a CE that are detailed in Table 3.

BM Strategy	Definition	Examples
Business model strategies for slowing loops		
Functionality, not ownership / Access and performance model	Providing the capability or services to satisfy user needs without needing to own physical products.	• Bike and car sharing • Launderettes • Clothing hire schemes • Document Management Systems • Leasing jeans • Leasing phones
Extending product value	Exploiting residual value of products – from manufacture, to consumers, and then back to manufacturing – or collection of products between distinct business entities	• Automotive industry – remanufacturing parts • Gazelle offering consumers cash for electronics and selling refurbished electronics (gazelle.com) • Clothing return initiatives (e.g. H&M, M&S' Shwopping)
Classic long-life model	Business models focused on delivering long-product life, supported by design for durability and repair for instance	• White goods and furniture (e.g. Miele's 20 year functional life span of appliances) • Luxury products claiming to last beyond a lifetime (e.g. luxury watches such as Rolex or Patek Philippe)
Encourage sufficiency	Solutions that actively seek to reduce end-user consumption through principles such as durability, upgradability, service, warrantees and reparability and a non-consumerist approach to marketing and sales (e.g. no sales commissions)	• Premium, high service and quality brands such as Vitsœ and Patagonia • Energy Service Companies (ESCOs)
Business model strategies for closing loops		
Extending resources: collection and resource value	Exploiting the residual value of resources: collection and sourcing of otherwise "wasted" materials or resources to turn these into new forms of value	• Interface – collecting and supplying fishing nets as a raw material for carpets • RecycleBank – providing customers with reward points for recycling and other environmentally benign activities (recyclebank.com)
Industrial Symbiosis	A process- orientated solution, concerned with using residual outputs from one process as feedstock for another process, which benefits from geographical proximity of businesses	• Kalundborg Eco-Industrial Park (http:// www.symbiosis.dk/en) • AB sugar and other sugar refiners – internal "waste = value" practices

Business model strategies to narrow resource loops		
Maximize material and energy efficiency	This is about doing more with fewer resources and generating less waste, emissions and pollution (Efficiency and "zero waste" policies)	• Lean production from Toyota

Table 3 Business model innovations to slow, close and narrow resource loops. Adapted from Bocken et al. (2016) and Kraaijenhagen et al. (2016)

Although Bocken et al. (2016) and Kraaijenhagen et al. (2016) do not define clearly whether the Resource Cycles (RC) framework considers both biological and technical cycles or only one of them, it is assumed for this report it only refers to technical cycles. This assumption is a result of the reviewed definitions, BM's strategies and BM's examples, which define RC's strategies exclusively in terms of the technological cycle.

3.3.1.3 Framework analysis

In order to analyse the similarities and differences between ReSOLVE and Resource cycles, their elements are compared in Table 4.

		Resource cycles (RC)		
		Slow resource loops (SRL)	Close resource loops (CRL)	Narrow resource loops (NRL)
ReSOLVE	Regenerate	*Regenerate* BMs target the origin of resources as well as their end of life, using strategies to close biological loops. On the other hand, *SRL* strategies seek to prolong the use-phase and/or utilization of products.	While *CRL* mostly refers to recycling (closing loops of technological nutrients). On the other hand, *Regenerate* refers to regeneration of the biological nutrients, and also implies a shift to renewable energy and materials.	*NRL* strategies target to increase efficiency during the production phase, in order to require less resources per unit of product. On the contrary, *Regenerate* focuses on the input resources to the production process and the end-of-life of products.
	Share	Both strategies are similar: they aim to increase the utilization of products and/or to extend their use phase.	*Share*'s strategies focus on the use phase of the product, while *CRL* seeks to close the loop from the end-of-life of the product and the production process.	While *Share* strategies focus on the utilization phase of a product, *NRL* strategies aim the production process.
	Optimize	While *SRL* focuses on the use phase of a product, *Optimize* aims to increase efficiency during the production process.	Even though *CRL* aims to close loops from the end-of-life products to the production process and *Optimize* focus on the production process itself, some loops could also be closed during the manufacture of products. This could happen within the same company or within a network of companies (e.g. industrial symbiosis).	Both strategies are similar: they seek to optimize processes without changing the product.
	Loop	*Loop*'s strategies aim to keep components and materials in closed cycles, prioritizing inner loops. This strategy is shared with all *Resource cycle*'s strategies.		
	Virtualize	*Virtualize* aims to dematerialize resources by supplying the same services without material involved. For this reason, it cannot be compared with any of the *Resource cycles*, as no material or resource is directly involved.		

Exchange	*Exchange* of technologies for better ones, selection of new materials or services could indirectly slow, close or narrow loops. However, this may also not be the case.

Table 4 Analysis of ReSOLVE framework and Resource cycles BM strategies, based on definitions by Bocken et al. (2016) and Ellen MacArthur Foundation (2015c). *Shaded areas indicate intersection of similar elements.*

In addition to the assessment in Table 4, Figure 13 shows the location of ReSOLVE's and RC's strategies in the CE diagram. Some of the strategies are similar: NRL and Optimization (both increase efficiency while the material flows in the production process), and Share and SRC (both cover strategies to shift from ownership to service, maintenance and prolong products life, reuse and redistribution, and refurbishment and remanufacture). Nevertheless, others are not. Regenerate and CRL are similar as both close loops, however Regenerate strategies focus on biological nutrients, while CRL targets to close loops of technological nutrients through recycling.

Furthermore, ReSOLVE have a wider scope than RC. RC focuses on resource loops of technical nutrients, while ReSOLVE –in addition to the strategies covered by RC- covers actions before the material enters the industry: Regenerate (use of renewable energy/materials), Virtualize (eliminate the need of direct resources) and Exchange (changing of material or technologies for better ones), and also includes the loops of biological nutrients.

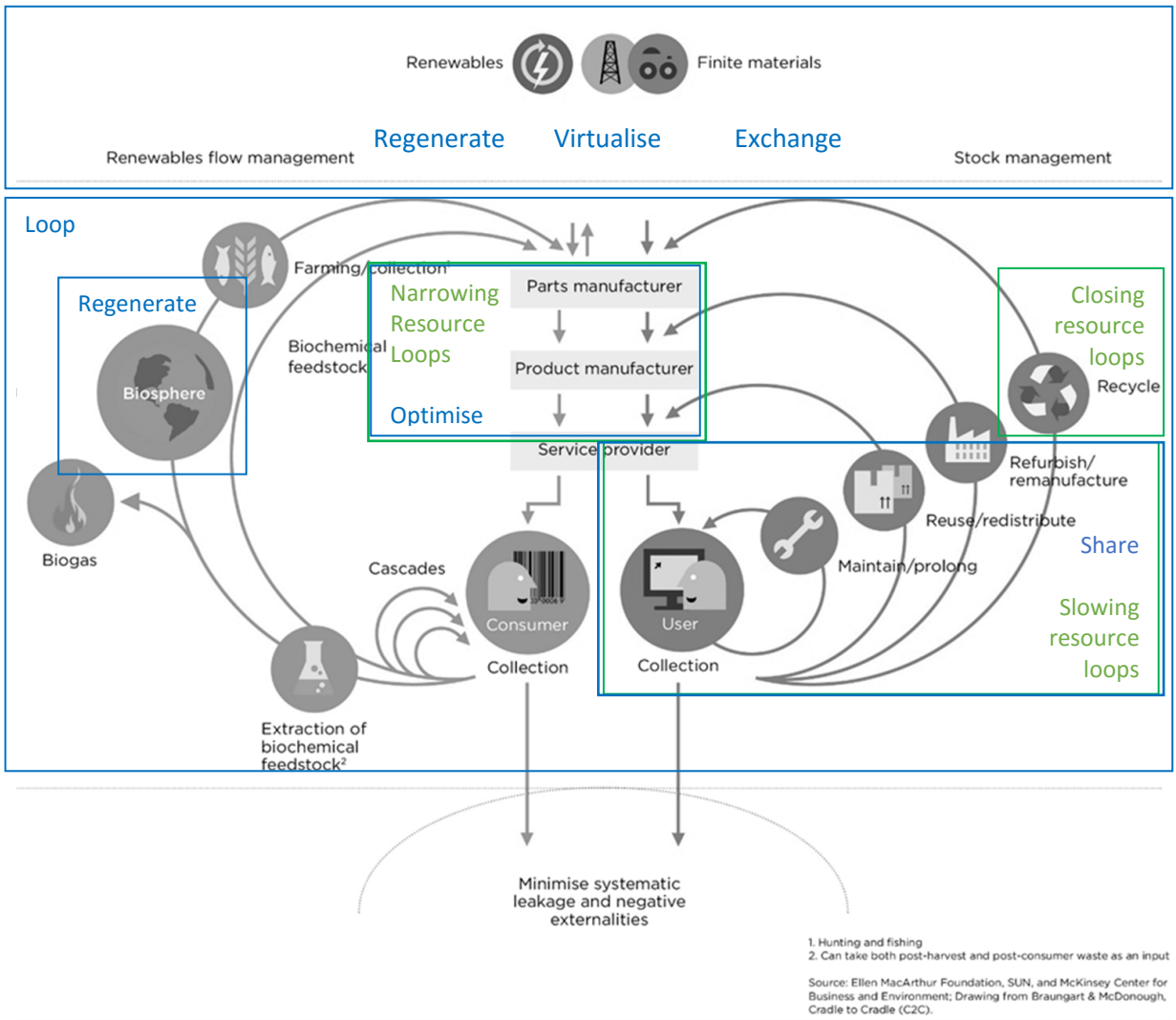

Figure 13 ReSOLVE (blue) and Resource cycles BM strategies (green) in the technological cycles of a CE. Boxes delimit the scope of the strategies, based on definitions by Bocken et al. (2016) and Ellen MacArthur Foundation (2015c), *in EMF's Circular Economy System Diagram* (Ellen MacArthur Foundation, 2015b).

In addition, both figures are necessary for the assessment. For example, in Figure 13 it is made a clear difference between Regenerating and CRL, within their similarity, by placing each of them in their corresponding flow of nutrients. Nevertheless, Figure 13 cannot illustrate the interaction and flow of materials between different sectors (e.g. industrial symbiosis). This strategy belongs to Optimize (ReSOLVE framework) and CRL (RC framework), both strategies are better explained in section 3.3.1.1 and 3.3.1.2 (Bocken et al., 2016; Ellen Macarthur Foundation et al., 2015).

Even though the scope of ReSOLVE is broader than RC's and covers all CE principles, the RC framework is selected to be used in the following section and in the case study in Chapter 4. This decision is made on the basis of (1) the focus of the thesis research is the technical cycle, which was mentioned in Chapter 1, and (2) for the technical cycle, both frameworks cover most of the possible resource loops. Nevertheless, it will be added –as a cross strategy- Loop's characteristic of prioritizing inner cycles. This characteristic is not clearly mentioned in the RC framework, however it would be included in the RC framework for this report.

3.3.2 Sustainable business models archetypes and circular business models

As mentioned before, SBM and CBM have some similarities. Nevertheless, CBM emphasises the creation of resource loops in the technical and biological cycles. Using the RC framework selected in the previous section, the SBM archetypes are assessed in order to discover if they could also be used for CBMs. Table 5 shows the comparison between the RC's strategies and the SBM's archetypes, where the shaded ones are the ones that could be used for CBM.

SBM Archetypes	*Resource cycling (RC)* *Slow resource loops (SRL), Close resource loops (CRL), and Narrow resource loops (NRL)*
Maximize material and energy efficiency	This archetype aims for efficiency and reducing emissions and pollution in the processes, not changing the functionality of the product or service. This premise is similar to NRL.
Create value from waste	This archetype seeks to eliminate the concept of waste, through recycling and other BM, closing resource loops. Moreover, this archetype also considers underutilized assets and capabilities a type of waste. For this reason, it gathers in this group BM related to share, reuse, remanufacture and recycle. This is similar to CRL and SRL.
Substitute with renewable and natural processes	This archetype replaces non-renewable resources for renewable ones. Even though it creates loops in the economy and it follows CE principles, it is not considered to be included in the RC framework, as it focuses in the biological cycle, rather than the technical one. However, in the ReSOLVE framework, this archetype would be placed as a Regenerate strategy.
Deliver functionality rather than ownership	This archetype provides access instead of ownership. It allows to maximize the lifecycle of the products and/or increase their utilization – similar to SRL.
Adopt a stewardship role	This archetype has no direct relationship with RC.
Encourage sufficiency	This archetype seeks to produce products and services that would slow down the demand from consumers, slowing the resource loop (SRL).
Repurpose for society/ environment	This archetype has no direct relationship with RC.
Develop scale up solutions	This archetype has no direct relationship with RC.

Table 5 Analysis of SBM archetypes and CBM framework similarities and differences, based on definitions by Bocken et al. (2016, 2014)*. Shaded areas highlight similarities.*

Despite the archetypes: *Adopt a stewardship role*, *Repurpose for society/environmen*t and *Develop scale up solutions* were not found to have a direct relationship with strategies for CBM, they can

indirectly support CBM. For example, organizations who's product or service engage other stakeholders have the possibility to change this behaviour for a better resource cycling. Moreover, organizational archetypes can be used for the benefit of the environment and increase resource loops, as businesses can repurpose their value proposition for it. Furthermore, businesses can take CBM that are still at the start-up phase, and scale them up to have a broader impact. However, none of these archetypes is exclusively for better resource management and can be applied to other purposes.

In addition, Figure 14 illustrates the scope of the selected SBM archetypes and the RC's framework in the technological cycle of a sector in a CE. Similar to Figure 13, Figure 14 only shows the loops from a one-industrial sector perspective, leaving out flows of resources between sectors. In this case, strategies like industrial symbiosis would be located under the *Create value from waste* SBM archetype and CRL (Bocken et al., 2016, 2014).

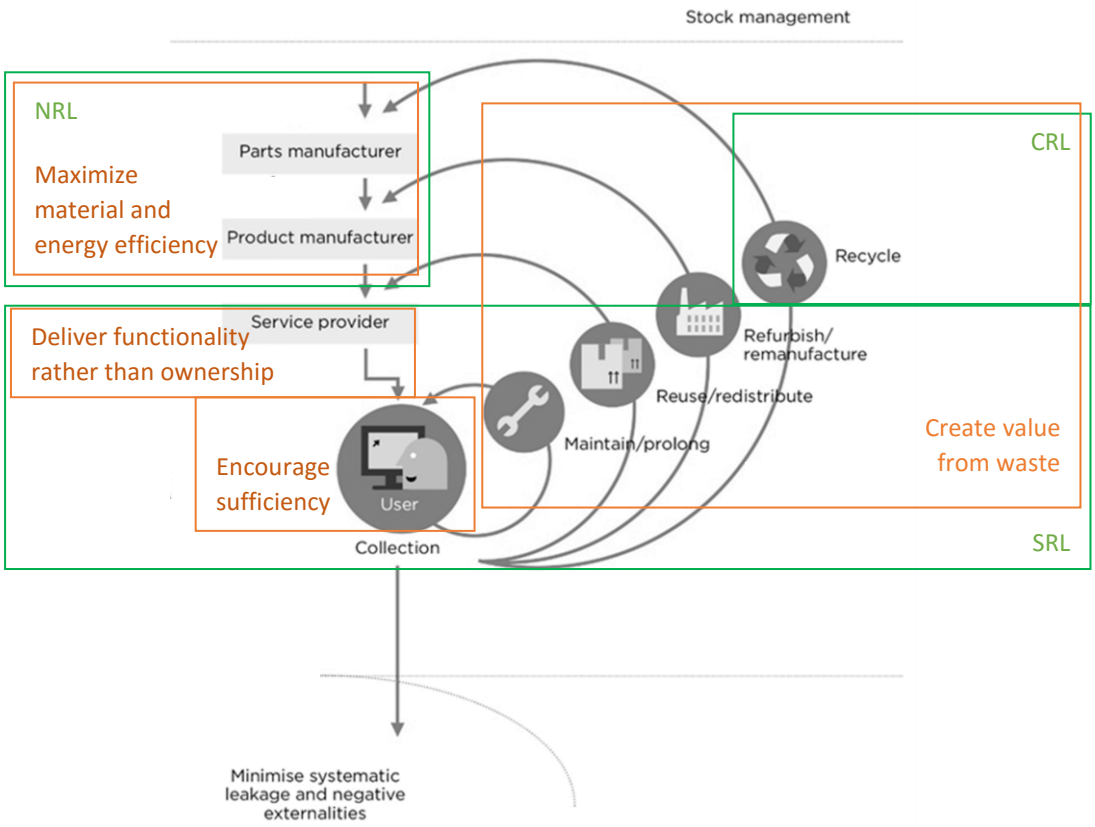

Figure 14 SBM archetypes (orange) and RC's framework (green) in the technological cycles of a CE. Analysis based on concepts by Bocken et al. (2016, 2014) *and boxes delimit the scope of the strategies in EMF's Circular Economy System Diagram* (Ellen MacArthur Foundation, 2015b).

Table 5 and Figure 14 point out which SBM archetypes could fit in a CE and were they are located in the technological cycle. *Maximize material and energy efficiency*'s scope is similar to NRL, however this archetype also considers the dematerialization of products (similar to Virtualize in the ReSOLVE framework). Moreover, SLR comprises two SBM archetypes: *Encourage sufficiency* and *Deliver functionality rather than ownership*. *Encourage sufficiency* includes not only product related strategies (product longevity design), but BMs that target consumer education and demand management, which is not directly covered by SRL. In addition, SRL overlaps with *Create value from waste*, on strategies such as maintain/prolong, reuse/redistribute and refurbish/remanufacture.

Nevertheless, *Create value from waste* also comprises Recycling, a strategy that belongs to CRL in the RL framework.

Although, four out of the eight SBM archetypes can be used for CBMs (*Maximize material and energy efficiency, Encourage sufficiency, Deliver functionality rather than ownership* and *Create value from waste),* they seem -from the assessment made- not to be a complete fit for CBM. SBM archetypes were based on SBM that are built on the triple bottom line approach of sustainability (Economic, Environmental and Social), while CBM mainly focus on material loops on the technical cycle.

3.4. Discussion and conclusions of the chapter

A BM is a representation of the rationale of how a company creates, delivers and captures value, the BMC tool provides a systematic approach to BM assessment. In addition, the BMC could be used as tool for further conceptualization of SBM or CBM.

Furthermore, SBM focus was developed for businesses built on the triple line approach. For this type of businesses, eight BM archetypes were identified to group similar BM. The archetypes are based on technological, social and organizational innovation, and some of them could be used also to group CBM for their similarity to CE principles and sources of value creation for a CE, reviewed in Chapter 2.

From the literature review performed in Chapter 2 and Chapter 3, a CBM represents the approach to CE from a company perspective which describes the logic behind its value creation, delivery and capture, while closing resource loops.

Moreover, two frameworks for CBM were presented. While ReSOLVE framework's scope comprised most of CE principles and characteristic, the RC's was centred on the technical cycle of a CE. For this reason, RC was chosen to be used in this report, however it was complemented by a cross strategy, taken from the ReSOLVE framework, to prioritize inner loops.

From the analysis of SBM archetypes and RC, some SBM archetypes were found to be suitable for CE. In addition, while doing the assessment, RC framework proved to be a limitation since it is focused on only the technical cycles. If the ReSOLVE framework was used, the SBM archetype *Substitute with renewable and natural processes* would have also be considered. Despite this limitation, RC framework was found easy to work with, as its approach is pragmatic when identifying to which strategy (SRL, CRL or NRL) the resource loop's strategies or actions belong to.

Furthermore, CBMs could be grouped under the SBM archetypes. Nevertheless, as the tool was developed for SBM (triple line approach BM) and the archetypes are grouped under innovation categories (technical, social and organizational), it was found not to be a perfect fit for identifying CBM. Perhaps a CE subcategory could be included to group the examples of the archetypes that follow CE principles, in order to supplement the tool.

4. Case study of Gabriel

In this chapter the main research question is answered: "How can Gabriel Holding A/S implement circular business models?" It starts providing information about the furniture industry and about the company. Moreover, in the third sub section, it reviews already existing circular business models that FurnMaster business unit could taka as point of departure to develop their own circular business model. Finally, the last section develops further a potential circular business model that FurnMaster could adopt.

4.1. About the industry

As mentioned in the introduction, Gabriel's core business is the production of fabrics for the furniture industry. Moreover, the FurnMaster business unit operates within the furniture sector, through projects or outsourcing activities related to this industry. For these reasons, the furniture industry is described in this section.

The furniture industry encompass, among others, products such as chairs, sofas, desks, tables, beds, storage and shelving, which have different product composition (WRAP, 2013). It is traditionally labour-intensive and dominated by SME and micro firms (European Commission, 2016). Furthermore, it has a complex and fragmented supply chain, with many steps that are often outsourced (Renda et al., 2014).

4.2.1 Circular economy and the furniture sector

The furniture industry is considered a priority sector in the transition to a CE (Ellen MacArthur Foundation, 2012; European Commission, 2014). It is composed by medium-lived complex products[5], which contain multiple parts, making it suitable for disassembly or refurbishment (Ellen MacArthur Foundation, 2012).

In addition to potential cycling of resources within the furniture sector, this industry is often cited as an example of an economic sector than receives cascaded material from other industries, such as textiles, which are used as a fibre-fill in upholstery (Ellen MacArthur Foundation, 2013; European Commission, 2014; World Economic Forum, 2014).

Moreover, countries, such as France, are already providing the legal framework to increase furniture recovery and recycling. In 2012, it was started the policy Extended Product Responsibility (EPR) for furniture, which, from May 2013, forces a recycling fee to be displayed on each piece of furniture sold in the country, hence consumers visibly co-fund development of CE infrastructure and recycling solutions (Lacy & Rutqvist, 2015).

4.2 About the company

Gabriel Holding A/S, a company with more than 150 years in the market, operates within the textile and furniture sector and had around 258 employees in the Financial Year (FY) 2014/2015. It develops, produces and sells furniture fabrics, components, upholstered surfaces and related services and products (Gabriel Holding A/S, 2015a, 2016a). Gabriel's customers are large furniture manufacture companies such as Arper, Steelcase and Herman-Miller (Gabriel Holding A/S, 2016b).

[5] Other medium-lived complex products sectors are machinery and equipment; office machinery and computers; electrical machinery and apparatus; radio, television, and communication equipment and apparatus; medical, precision and optical instruments, watches and clocks; motor vehicles, trailers, and semi-trailers; and other transport equipment (Ellen MacArthur Foundation, 2012).

Gabriel is a global organization, which has operating companies in Europe, Asia and North America (Gabriel A/S, Gabriel Asia Pacific and Gabriel North America Inc.). Furthermore, it has three business units: Fabrics, FurnMaster and SampleMaster. *Fabrics* is Gabriel's primary business and focuses on design and production of textiles. *FurnMaster* is a one-stop supplier for Gabriel's key accounts, which offers subcontracting of logistic solutions, cutting, sewing, upholstering and assembly of furniture, screens and other products. And *SampleMaster* develops and supplies sales material to the furniture industry. In addition, there are two companies that also belong to Gabriel Holding A/S: Gabriel Ejendomme A/S (real estate management) and ZenXit A/S (develops and distributes the product ZenXit). Figure 15 shows Gabriel's organizational chart.

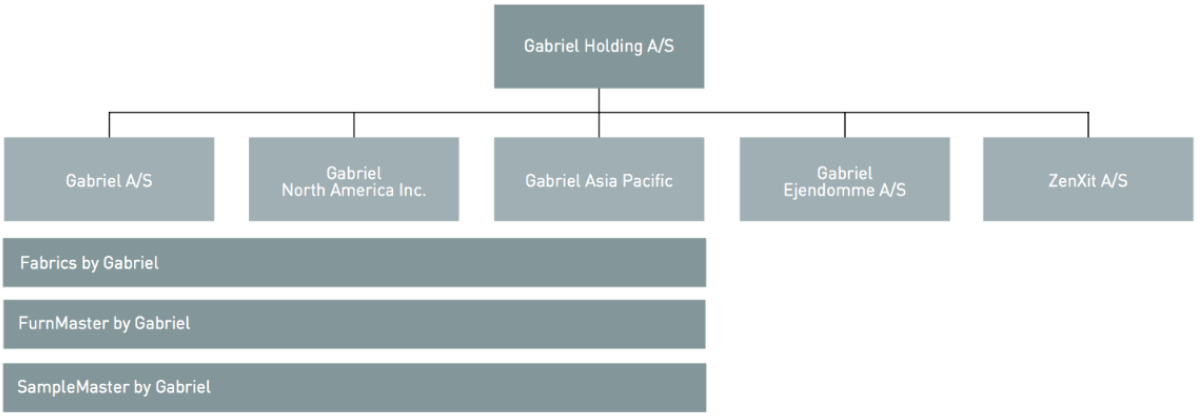

Figure 15 Gabriel Holding A/S organization. Source: (Gabriel Holding A/S, 2015b)

4.2.1 Innovation at Gabriel

From a business innovation perspective, described in Chapter 3 and displayed in Figure 16, Gabriel would be located at Product/Service innovation level due to its focus on responsible products, in addition to its continued processes improvement. Even though, this meant a competitive advantage in the past, competitors have reached similar competences in CSR (Gabriel Holding A/S, 2015c).

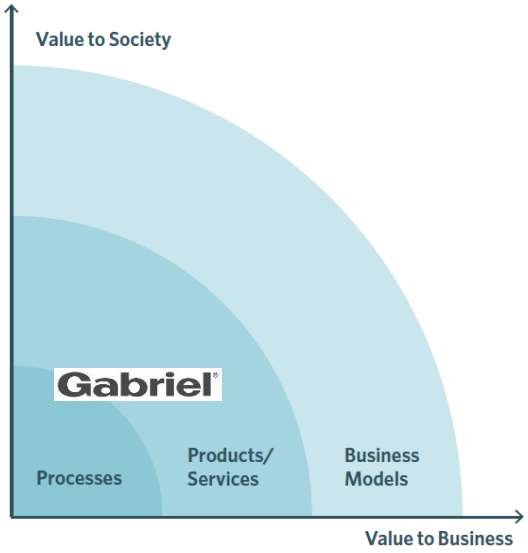

Figure 16 Gabriel in the innovation Framework developed by SustainAbility (2014)

Given these reasons, Gabriel is looking forward to move ahead and finds in circular economy business models a way to accomplish it (J. Thiesen - Project Manager Quality, Environment and

Production (PM QEP) at Gabriel, personal communication, April 15, 2016). From the FY 2014/15, Gabriel is part of a Ph.D. project which focuses on new requirements regarding furniture take-back systems and related business models (Gabriel Holding A/S, 2015a). From the Ph.D. research project, it was identified that Gabriel was interested in two main ideas: (1) The examination of possible requirements for take back of furniture in the United Kingdom and France, and (2) the examination of the potential for establishment of unique business models in connection with project sales (Guldmann, 2016).

4.2.2 Corporate social responsibility at Gabriel

Corporate Social Responsibility (CSR) is across all Gabriel's holding activities, taking responsibility for how products are produced, including those areas of the supply chain that do not belong to the Group. Concerning efforts toward environmental responsibility, product quality and consumer safety, Gabriel has been a front runner, being the first fabric manufacturer in the world to obtain the EU Ecolabel in 2002 and the first Danish company to receive a Cradle to Cradle (C2C) product certification in 2010. Gabriel focus is on providing the market with responsible products and assures it through product certification: it holds the largest share of EU Ecolabelled upholstery fabrics in the industry. Moreover, other labels and certification it holds are ISO 14001, Oeko-Tex, C2C and the Nordic Ecolabel (the Swan). (Gabriel Holding A/S, 2015a)

4.2.3 About FurnMaster

As mentioned in the section 4.2.1, Gabriel Holding A/S is interested in the development of new business models in project sales which belong to the FurnMaster business unit. FurnMaster was established in the FY 2003/04 and supplemented by the founding of the upholstery units in Lithuania (2012) and Poland (2014) (Gabriel Holding A/S, 2015b). Additionally to projects sales, it handles outsourced processes from key accounts of Fabrics business unit (J. Thiesen - PM QEP at Gabriel, personal communication, April 15, 2016).

Project sales customers are end-users furniture in public spaces (not mobile furniture such as office chairs) and FurnMaster's projects are related to furnishing of new or refurnishing of older furniture in, for example, music halls, movie theatres, or trains. This customer segment is characterized by placing large orders, occasionally requesting complex upholstery work and Gabriel's close ties with them, as Gabriel works directly with them.

The current business model of FurnMaster is described using the BMC in Figure 17. It contains information for each customer segment: project sales (orange), and existing key accounts of Fabrics business unit (furniture manufacturers, blue).

The customer segment integrated by end-users of projects related to public spaces (orange), as mentioned before, is characterized by placing large orders and having a close relationship with Gabriel. For this segment of customers, FurnMaster's value proposition is the furnishing of new or refurnishing of older furniture using Gabriel's high quality fabrics. An example of this kind of service is a current project FurnMaster is working on for the Danish train company (DSB)[6], which was awarded to Gabriel through a public tender, and that consists in the upholstery of chairs of some train models. In some occasions, Gabriel works as a supplier for businesses that are experts on delivery complete working spaces, e.g. theatres or concert halls, such as Martela[7], with whom Gabriel developed a concert hall in Esbjerg. FurnMaster's sales force looks after this customer segment, in order to maintain the relationship and to ensure the delivery of their services.

[6]Information about DSB can be found at www.dsb.dk.
[7]Information about Martela can be found at www.martela.com.

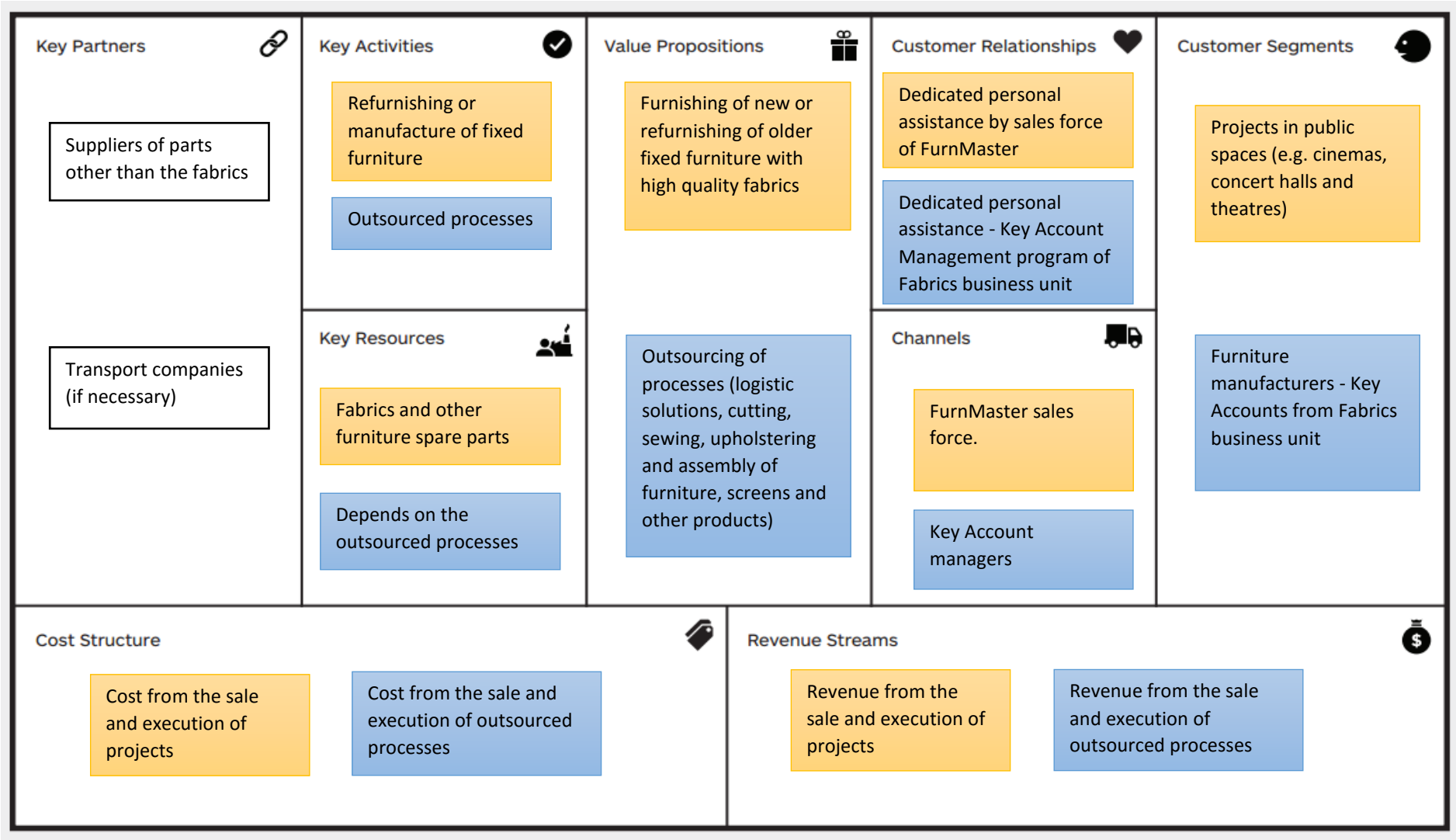

Figure 17 BMC of FurnMaster. Each colour represents a customer segment: (1) orange represents projects in public spaces, (2) blue represents key accounts from Fabrics business unit, and (3) white represents both customer segments. The BMC (Strategyzer, 2016) *was filled with information provided by Joan Thiesen – PM QEP at Gabriel through an interview* (Thiesen, 2016) *and personal communication (April 15, 2016).*

The key activities to support this value proposition and the key resources depend on the needs of the project, such as refurnishing of existing furniture or manufacture of new furniture. (Thiesen, 2016)

The other customer segment that FurnMaster looks after is the one conformed by furniture manufacturers that are key accounts of Fabrics business units. Gabriel, through FurnMaster, offers this segment to outsource some of their production processes (logistic solutions, cutting, sewing, upholstering and assembly of furniture, screens and other products). These key accounts have their own account manager, which keeps a close relationship with them. The key activities and resources depend on the necessities of the customer and the outsourced process.

Moreover, for both customer segments, the key partners are the suppliers of other parts than fabrics and logistic services that allows Gabriel to successfully deliver the value proposition to the customer. The costs and revenue are directly associated to the sale and execution of the value proposition. (Thiesen, 2016)

Furthermore, Figure 18 shows the current material flow by FurnMaster. There is only one material loop closed by FurnMaster due to projects of refurbishment of old furniture.

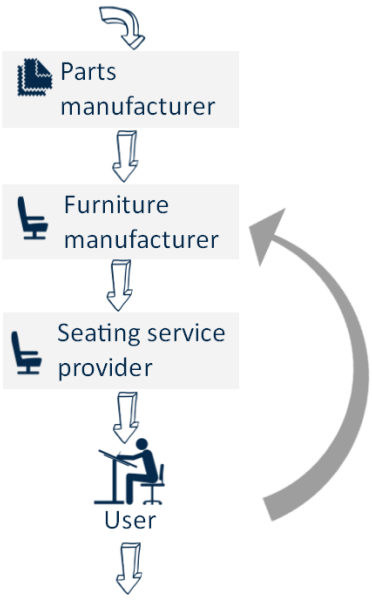

Figure 18 Material loop closed by FurnMaster

4.3 Circular business models for FurnMaster

4.3.1 Review of existing circular business models

Different companies from the furniture and textile sector are already approaching different circular business models that could serve as inspiration for circular business model generation at FurnMaster. From the literature review and interviews, nine existing circular business models were found and are described below. Table 6 groups them under the different strategies established by the *Resource Cycling* framework (Slow resource loops, Close resource loops and Narrow Resource Loops) reviewed in Chapter 3. However, examples of the strategy *Narrow resource flows* were not considered as it does not address the cycling of material in the economy, but resource efficiency. Furthermore, Gabriel is already seeking to reuse or recycle the fabrics from FurnMaster's production waste, which is around 20% of the total fabrics used by this business unit (Thiesen, 2016).

	Examples of Existing Circular Business Models
Slow resource loops	1. Ahrend Group and EMF - United Kingdom
	2. Furnishare - United States of America
	3. Gispen and Liander - Netherlands
	4. Nearly New Office Facilities - Belgium
	5. Patagonia repair service and iFixit – Global
	6. Rype Office - United Kingdom
	7. Shwopping (by Marks&Spencer and Oxfam) - United Kingdom
Close resource loops	8. Desso Take Back program and carpet recycling
	9. Textile recycling by Ahrend – Netherlands

Table 6 Examples of existing circular business models

In order to get a better understanding of the mentioned examples, their target customer segment, the value proposition for the customer and the revenue streams are described in each case. These building blocks of the BMC were chosen as they explain *what* is offered to the customer (value proposition), for *whom* (customer segment) and *how* it generates value to the company (revenue streams). Only these three building blocks were selected inspired by Ovaska et al. (2016)'s CBM descriptions and due to information availability.

1. Ahrend's business model for Ellen MacArthur Foundation's project - United Kingdom

Ahrend provides office environments, such as receptions or meeting rooms for customers in 25, countries, and EMF is a charity which mission is to accelerate the transition to a CE (Ellen Macarthur Foundation, 2016; Royal Ahrend, 2016). The business model Ahrend is using in this project is described in Table 7.

Customer segment	Customers, such as EMF, that want to achieve maximum circularity in their working stations and office furniture.
Value Proposition	Access to well- equipped work stations according to the customer's needs.
Revenue stream	The business model is pay-per-use, in which the customer only pays for the time it uses the working stations. The current contract between Ahrend and EMF is for three years. At the end of the contract the customer can choose to return the working station to Ahrend or buy it.

Table 7 Ahrend business model for EMF's project. Source: Seijs (2016)

2. Furnishare - United States of America

Furnishare, which currently only operates in New York City, is an intermediary between people who have an excess of furniture and households that need furniture (Furnishare, 2016). Its BM is described in Table 8.

Customer segments	Furnishare has two customer segments: 1. Households with an excess of furniture 2. Households that need furniture
Value Proposition	The value proposition for the two customers segments is: 1. It offers people that have an excess of furniture 50% of the revenue from renting their furniture. Furnishare picks up the furniture for free within a day they upload the information to their web page. 2. For people that need furniture, Furnishare offers to rent them furniture for a monthly payment. It offers free delivery and pick up service of furniture at the end of the renting period.
Revenue stream	Furnishare revenue as an intermediary, comes from renting out the available furniture for a fixed period of time.

Table 8 Furnishare business model. Source: Furnishare (2016)

3. Gispen's business model for Liander's project - Netherlands

Gispen is an office furniture brand and Liander is a Dutch energy network company (Gispen, 2016; Liander, 2016). The description of the BM developed for this project is described in Table 9.

Customer segment	Customers, such as Liander, that want to achieve maximum circularity for the supply of their office furniture.
Value Proposition	Access to high quality new office furniture in exchange of a deposit for a fixed period of time in a depository value model[8]. Once the contract is over, Gispen gives back the deposit to Liander when it returns the furniture. Moreover, at the end of the contract, the actual market value of the furniture is stablished (how much would a third party pay for the furniture in that moment?) and the difference between the deposit and the real market price is shared between Gispen and Liander.
Revenue stream	The customer functions as the capital investor when up-front capital investments for performance-based models is hard to get. Furthermore, both parties are motivated to maximize the value of the product in order to maximize the market value of the furniture at the end of the contract, and the risk is shared. In case the market value of the furniture is higher than the deposit, then the difference is shared between Gispen and Liander. On the other hand, if the furniture market value is lower than the deposit, then both companies share the loss. This motivates Liander to take good care of the furniture and Gispen to deliver a product that would keep as much of its initial value at the end of the contract. Gispen profits mainly from the second (and subsequent) lifecycle(s) of the furniture, through new performed based or depository value based contracts with a third-party or by the sale of the furniture.

Table 9 Gispen BM for Liander's project. Source: Kraaijenhagen et al. (2016)

4. Nearly New Office Facilities – Belgium

Nearly New Office Facilities (NNOF) belongs to the PMC Holding and focuses on offices remodelling (NNOF, 2016; UCM, 2016). Its BM is described in Table 10.

Customer segment	Businesses that want to refurbish their office facilities using existing furniture.
Value Proposition	NNOF refurbish complete offices, using existing furniture. The furniture that can no longer be used by the customer, NNFO sorts it out either to reuse or donates it to social organizations.
Revenue stream	Revenue from the service of office refurbishment.

Table 10 NNOF business model. Source: NNOF (2016) and UCM (2016)

5. Patagonia repair service and iFixit - Global

Patagonia provides high-end outdoor clothing. Aside from product sales, it offers the service to repair their customers worn out garments. In addition, in a partnership with iFixit, Patagonia has developed tutorial videos for customers to learn how to repair their Patagonia products themselves (Patagonia, 2016). Its BM for the last service is showed in Table 11.

Customer segment	Customers that own a Patagonia garment that needs to be repaired.
Value Proposition	Patagonia repairs garments from their customers. Moreover, it partnered up with iFixit to empower customers to fix their own clothing. iFixit offers video manuals with sewing techniques for customers.

[8] In a transaction based economy (linear economy), products move quickly towards the customer, who takes the financial burden, hence the company usually do not need large capital investments for the manufacture of their products. On the other hand, in performance-based models in a CE, the product manufacture carries the costs for a longer period of time. This up-front investment is a barrier for some companies that want to move their BM to a CBM. The depository value model positions the customer as the capital investor for the products manufacture. (Kraaijenhagen et al., 2016)

Revenue stream	Revenue mainly from repair service.

Table 11 Patagonia repair service and iFixit business model. Source: Kraaijenhagen et al. (2016) and Patagonia (2016)

6. Rype Office – United Kingdom

Rype Office operates within the office furniture sector (Rype Office, 2016). Its BM is detailed in Table 12.

Customer segment	Rype Office has three different customer segments. 1. Businesses that want brand new furniture 2. Businesses that want remade furniture 3. Businesses that want their own furniture remade
Value Proposition	1. For customers that want brand new furniture, Rype Office offers them the possibility to purchase the furniture with an option of a buy-back offer or lease it for a monthly fee. Moreover, the chosen models of furniture are of high quality and easily remanufactured. 2. For customers that want remade furniture, Rype Office offers furniture that suit the sizing, colours, and materials specified by the client, but using the cores of already used furniture. Furthermore, customers of this segment can also purchase the furniture with an option of a buy-back offer or lease it for a monthly fee. 3. For customers that want their own office furniture remade, Rype Office offers the service of remaking it to as-new condition.
Revenue stream	The revenue streams from the first 2 segments, customers that want either brand new furniture or remade one, comes from the sale of the furniture and from the contract of leasing. In the last segment, the revenue comes from the service of furniture remaking.

Table 12 Rype Office business model. Source: Ellen MacArthur Foundation (2016) and Rype Office (2016)

7. Shwopping (by Marks&Spencer and Oxfam) – United Kingdom

Marks&Spencer (M&S) is a British retailer which specializes in the selling of clothing, home products and luxury food products (M&S, 2016). And Oxfam is an international confederation of 18 organization working to relief poverty in the world (Oxfam, 2016a). Their BM is described in Table 13.

Customer segment	M&S customers that possess M&S clothes that they no longer want.
Value Proposition	M&S encourage its customers to give a second life to their unwanted M&S clothing by offering £5 off a £35 spend on clothing, home and beauty products in M&S stores and online when they donate their M&S clothes in Oxfam shops.
Revenue stream	Shwopping increases loyalty within M&S customers. Moreover, it simulates that their customers' purchases of clothing, home and beauty products are above £35.

Table 13 Shwopping business model. Source: *Oxfam (2016b)*

8. Desso Take Back program and carpet recycling

Desso is a carpet manufacture that has implemented since 2010 a take back program for carpets. It developed a technology for separation of yarn and other materials from carpet backing, allowing the yarn to be used back in the production process (Accenture, 2014; Carpet Recycling UK, 2016). Table 14 describes Desso's business model for their Take Back program.

Customer segment	Customers that own Desso carpets can return it to their recycling factory in Netherlands without any extra cost. It does not include carpets that contain PVC.
Value Proposition	Desso makes it easy for customers to return used carpets, being more effective in their collection.
Revenue stream	Take back program provides Desso more efficient collection of old carpets, better customer relations, recycling and recovery of material, and the opportunity to access certifications such as Cradle to Cradle.

Table 14 Desso Take Back business model. Source: Carpet Recycling UK (2016)

9. Re-blended fabric by Ahrend – Netherlands

Using fabrics recovered from their take-back system of old furniture and collected clothes – no longer suitable for wearing - by a local charity, Ahrend is able to produce re-blended fabrics for furniture (Seijs, 2016). Table 15 describes Ahrend's business model for re-blended fabrics.

Customer segment	Ahrend has two customer segments in this business model: 1. Customers who own old furniture 2. Customers who want to have 100% recycled fabrics on their furniture
Value Proposition	Ahrend value proposition for each segment is: 1. Ahrend offers to buy back old furniture from customers (e.g. in the case of office chairs, they pay 50 euros per chair and can take it back up to three times) 2. For new customers, Ahrend can supply 100% re-blended fabric for their furniture.
Revenue stream	Revenue from sales of re-blended fabrics.

Table 15 Ahrend's re-blended fabric business model. Source: Seijs (2016)

In addition, Figure 19 shows in which loop of the technological cycle these examples would be allocated. In the first loop (close to the user) is *Patagonia repair services and iFixit* CBM, which allows the user to repair and prolong the life of his/her garments. In the next loop are the following CBM: *Ahrend Group and EMF, Furnishare, Gispen and Liander,* and *Shwopping.* These CBM seek to increase the utilization of the furniture and textiles, by BMs that allow the company retain ownership of the products and sell their services to as many customers as possible (Ahrend and Gispen), provide a platform for users to share underutilized furniture (Furnishare) and promote a second life for clothes (Shwopping). In the next loop are *NNOF* and *Rype Office*, which refurbish furniture for their customers, keeping valuable material in the economy. In the last loop are *Desso Take Back program and carpet recycling* and *Textile recycling by Ahrend.* The last two examples recycle material, which avoids the use of virgin material.

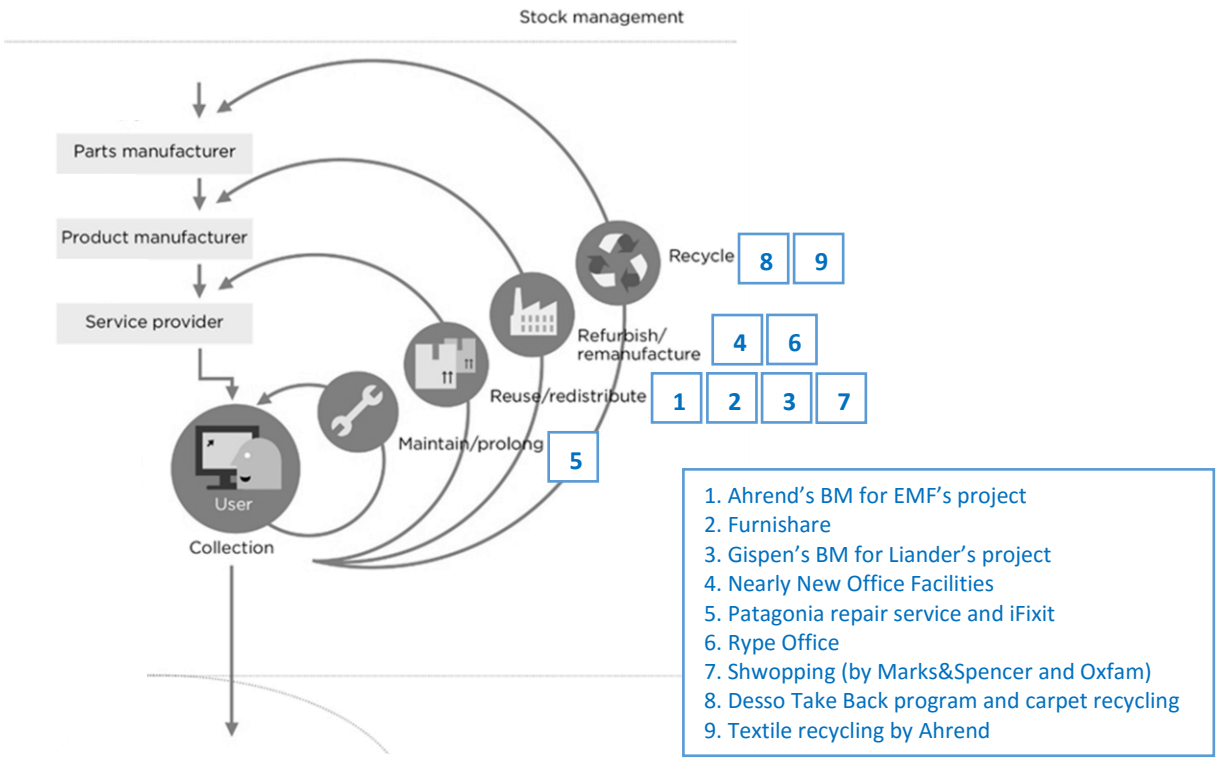

Figure 19 Examples of circular business models allocated in the technological cycles on EMF's Circular Economy System Diagram (Ellen MacArthur Foundation, 2015b)

4.3.2 Circular business models for FurnMaster

This section seeks to develop and analyse potential CBMs for FurnMaster. Once the CBM's examples of the previous section were compiled, they were presented to Kim Holmberg Jakobsen - Project Manager at FurnMaster, in order to obtain his opinion about which CBM could work better for FurnMaster. His feedback is considered valuable due to his knowledge of the company, market and customer segments. He showed interest for CBMs that focus on maintenance (e.g. Patagonia repair service and iFixit) and on recycling of material (e.g. Desso Take Back program and carpet recycling, and Textile recycling by Ahrend). These CBMs seem more feasible for FurnMaster to implement than the others, because they could be developed to target their existing customers (key accounts of Fabrics business unit), with whom Gabriel has a close relationship. (J. Thiesen - PM QEP at Gabriel, personal communication, May 26, 2016). Although at the beginning of the research Gabriel Holding A/S showed interest to develop a CBM for end-users through project sales (J. Thiesen - PM QEP at Gabriel, personal communication, April 15, 2016), the whole FurnMaster business unit is taken as focus for the analysis.

From the feedback obtained from Gabriel, the reviewed CBM's examples and the analysis of the different material loops in the economy, it is developed in this section a potential CBM for FurnMaster and showed in Figure 20. New value propositions for three customer segments are developed: two for the current customer segments of FurnMaster (*Projects in public spaces customer segment* and *Furniture manufacturers - Key Accounts from Fabrics business unit customer segment*), and the third customer segment is proposed to be *Businesses that could use worn out fabric as input material.*

Below is a description of each customer segment characteristics:

a) Projects in public spaces customer segment

For this customer segment the current value proposition is proposed to be expanded in order to extend the use stage of the furniture and Gabriel's fabrics.

Current value proposition: Furnishing of new or refurnishing old furniture.

Proposed value proposition: Provide long-lasting, new or refurbished, furniture, and services/tools to prolong its lifecycle.

In addition to the current value proposition, it is proposed that Gabriel develops tutorials, similar to iFixit and Patagonia's example, which would allow customer's in-house maintenance team to learn how to take better care of Gabriel's fabrics. Moreover, fabric maintenance training could be included in the initial project's scope, as the training could be provided face-to-face when delivering the project to the customer.

Furthermore, Gabriel could develop a new service for this customer segment, which would offer the customer the possibility of having a programed maintenance of the furniture. This service could be delivered, perhaps, every 6 months or year, depending on the utilization of the furniture. The service could include in depth cleaning, change of fabric –if necessary – and furniture fixing, therefore it would have the same performance as new.

Other idea for this segment is to gather data through sensors in the seats that could storage information about the utilization of the furniture (e.g. seats). This information could be processed by a software that could help the maintenance team to rotate the seats in order to use them at the same utilization rate. Additionally, this information could be available to the very end-user of the furniture: people seated waiting for the performance or the movie, who

would be able to access it through an application in their smartphones to learn more about their seat – such as how many people have been used it or how many hours or spectacles it has witnessed.

The relationship with this customer segment would be maintained as it is today: dedicated personal assistance through FurnMaster sales force.

Moreover, the additional key activity to the current ones would be the development of training material, to be available online and for face-to-face training. The key resources are considered to be similar to the ones FurnMaster have now. Furthermore, an additional key partner to today's operations would be an Information Technology (IT) company, which would provide Gabriel of the IT tools and applications to supply the proposed value proposition.

The costs and revenue structure are related directly to project sales and execution, and the post sales services (e.g. maintenance).

b) Furniture manufacturers - Key Accounts from Fabrics business unit customer segment

For this customer segment, it is proposed to expand the current value proposition to a strategic partnership in order to provide an enhanced value proposition to Gabriel's key accounts' customers. This cooperation with Gabriel's customer is proposed in order to build on the existing relationships between Gabriel's key accounts and their customers and, moreover, to avoid possible cannibalization of the end-user market which could threat Gabriel's current relationship with its key accounts.

Current value proposition: Outsourcing of processes related to mobile furniture production

Proposed value proposition: Outsourcing of processes related to furniture production, maintenance and refurbishment services, and support of Take Back schemes for worn out furniture from end-users.

The proposed value proposition offers the possibility to key accounts not to only sell the furniture to their customers, but to provide them the possibility to maintain and refurbish their old one, in which case FurnMaster would outsource the process. Moreover, for customers who already offer these services to their clients, FurnMaster could help them achieve it more cost-effective and/or to reach new markets.

Furthermore, FurnMaster could also outsource Take Back schemes in geographical areas where its key accounts do not have it implemented, complementing their current value proposition. Some of Gabriel's key accounts, such as Ahrend, already provide their customers the possibility to sell back their old furniture. However, this offer is limited to customers within a certain area due to associated transport costs, which in case of Ahrend, means that the opportunity is offered only to customers located in the Netherlands, where Ahrend has its upholstery facilities (Seijs, 2016). Moreover, for customers who do not have a Take Back scheme yet, FurnMaster could help them implement one, and by doing this, supplement their current value proposition for their own clients.

The relationship with this customer segment would be maintained as it is today: dedicated personal assistance through the Key Account management program. Moreover, the key activities and resources depend on the outsourced processes. And the key partners are consider to be the same as they are now. In addition, the costs and revenue structure are related directly to the outsourced processes from the customer.

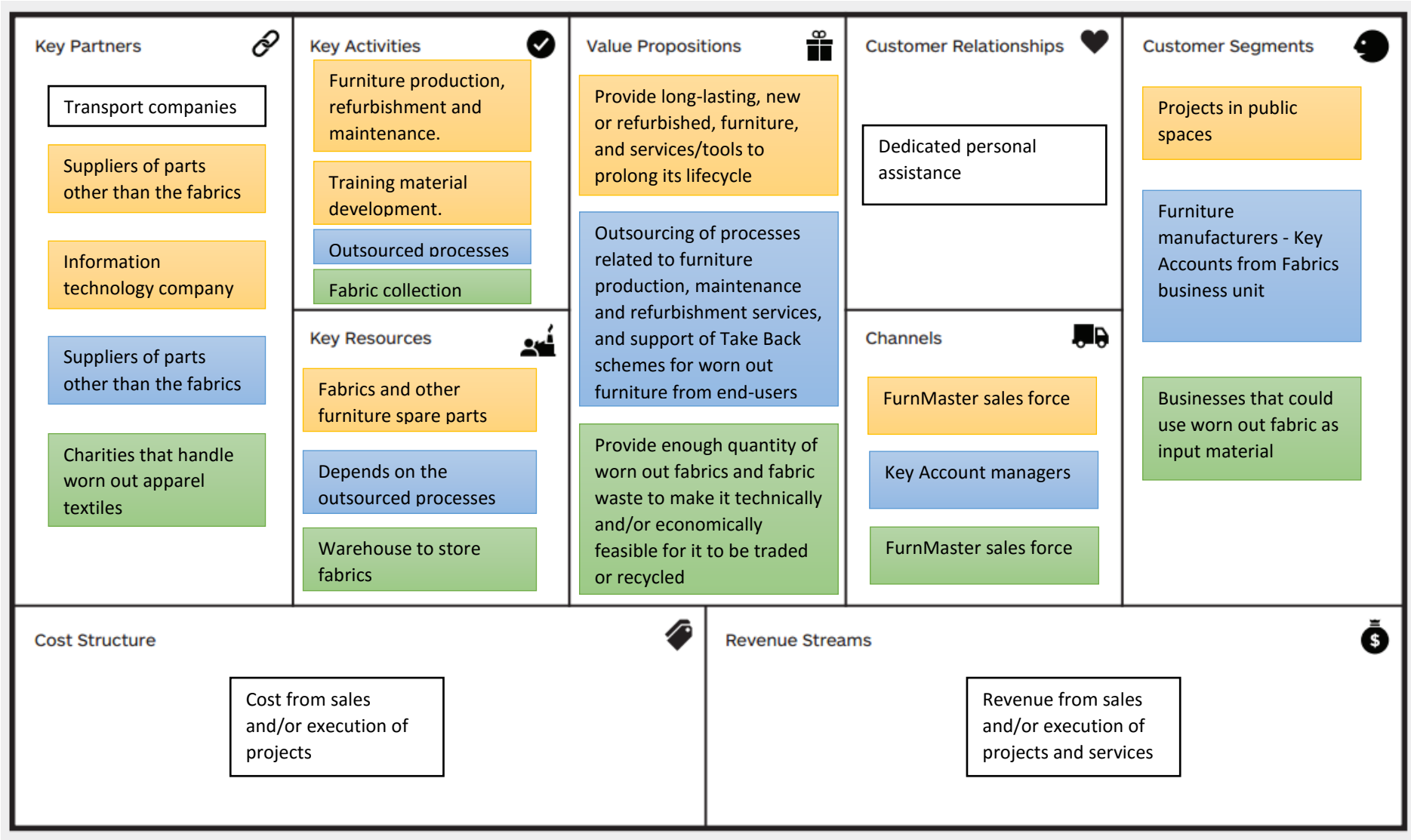

Figure 20 Proposed CBMs for FurnMaster illustrated using the BMC (Strategyzer, 2016) *. Each colour represents a customer segment: (1) orange represents projects in public spaces, (2) blue represents key accounts from Fabrics business unit, (3) green represents Businesses that could use worn out fabric as input material, and (4) white represents all three customer segments.*

c) Businesses that could use worn out fabric as input material customer segment

This last customer segment and value proposition are consequence of the proposed value propositions explained above. Due to the new activities and services that FurnMaster would perform, it would obtain as by-product worn out fabrics that could be recycled into new ones, used as filling material for furniture or as isolation material at the building sector. This stream of material would be added the current FurnMaster's fabric waste, making it an attractive quantity for trading (cascaded to other industries or recycled).

Proposed value proposition: provide enough quantity of worn out fabrics and fabric waste to make it technically and/or economically feasible for it to be traded or recycled.

In case the obtained quantity is not adequate to be economically sustainable, FurnMaster could supplement it with worn out apparel textiles from charities, as Ahrend is currently doing (Seijs, 2016), making them a key partner to deliver this value proposition.

The relationship with this customer segment would be through dedicated personal assistance by FurnMaster sales force. A key activity for this value proposition would be fabric collection and storage, for which a key resource would be a warehouse, until enough material is gathered for it to be traded or processed. Nevertheless, this would not be necessary in case fabric is collected in a similar speed as it is sold or processed.

The costs and revenue structure are related directly to sales of the worn out fabrics and fabric waste.

Furthermore, Figure 21 shows where the proposed value propositions would be locate in the technical cycles. For this allocation, the customer segments are used for identification of the different CBM.

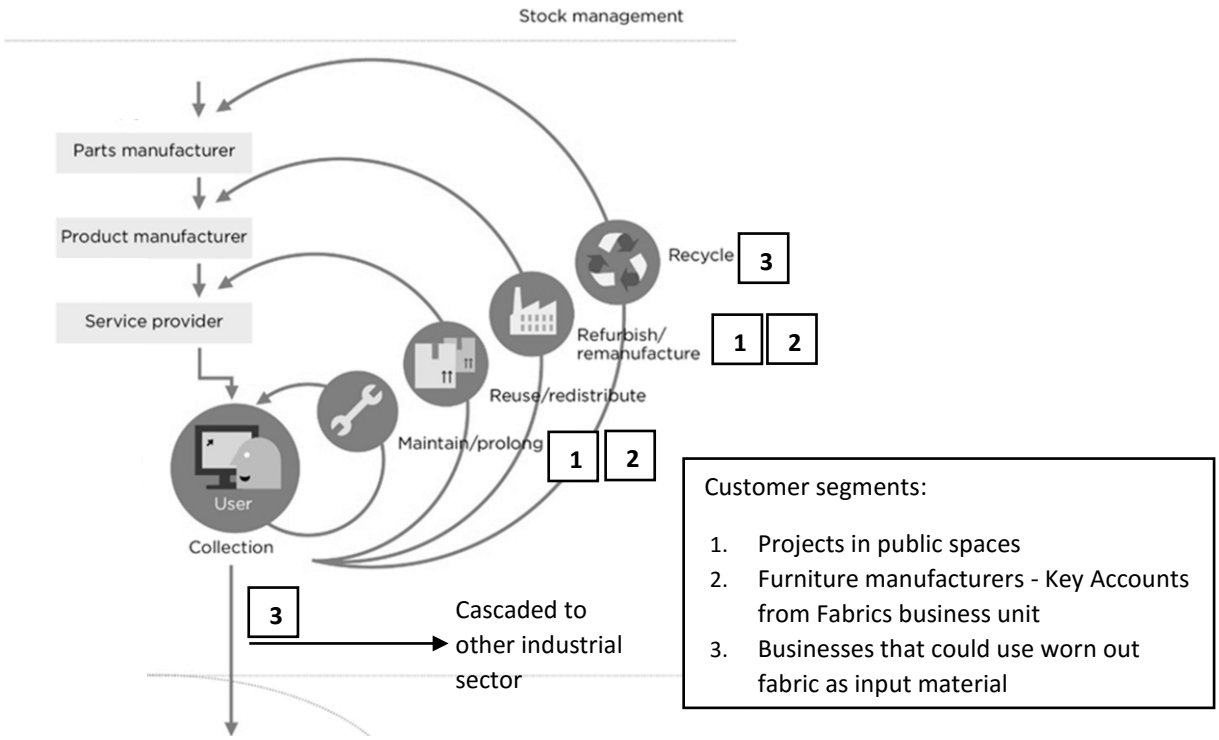

Figure 21 Proposed material loops by CBM for FurnMaster on EMF's Circular Economy System Diagram (Ellen MacArthur Foundation, 2015b). *Customer segments are used to identify the value propositions in the loops.*

The first loop: “Maintain/prolong”, which is the closest to the user, is achieved by two value propositions for the following customer segments: (1) *Projects in public spaces* and (2) *Furniture manufacturers - Key Accounts from Fabrics business unit.* In the first case, (1) *Projects in public spaces,* this loop is closed by FurnMaster through maintenance services during the use stage of the furniture. Moreover, it is empowered by training to customer’s in-house maintenance teams (face-to-face or virtual), that allows a better keeping of the fabrics and furniture. For (2) *Furniture manufacturers - Key Accounts from Fabrics business unit,* FurnMaster closes this material loop through outsourced maintenance activities from their key accounts.

The next loop: “Reuse/redistribute” is not directly addressed by any of the proposed value propositions. However, the outsourcing of Take Back schemes from (2) *Furniture manufacturers*, could be considered as a way to reuse or redistribute existing furniture. Although this may be a possibility, the main purpose of taking back the furniture is to either recycle its components or cascade them as input material for another industry, and this is why it has not been considered in this loop.

The “Refurbish/remanufacture”, similar to “Maintain/prolong” loop, is closed for two customer segments: (1) *Projects in public spaces* and (2) *Furniture manufacturers.* This loop comprises activities related to projects of furniture refurbishing in public spaces, which is already being offered by Gabriel to their customers, and the outsourcing of refurbishing activities from furniture manufacturers – not yet implemented.

And the final loop, “Recycling”, is closed in collaboration of the third customer segment: (3) Businesses that could use worn out fabric as input material. This customer segment re-introduce the material to the same technical flow or to a new one, keeping it in the economy.

4.3.3 Circular business model adoption

After reviewing the proposed value propositions and how they close different material loops in the technological cycle, this section reviews how they could be implemented by FurnMaster. Although in an ideal scenario, all of them would be carried out, it is important to take into consideration potential barriers, such as resources availability and market acceptance of suggested CBMs, when selecting where to start.

Overall, for selecting where to start, it is suggested to follow the CE principles reviewed in Chapter 2 and prioritize inner loops of material. This would keep as much of the embedded material and energy already utilized in the fabric or furniture goods for a longer period of time in the economy.

In the following paragraphs each customer segment is discussed:

a) Projects in public spaces customer segment

In case of this customer segment, the value proposition could be implemented starting by developing training material for the customers. This would allow customer to take better care of the furniture and fabrics, prolonging their life cycle.

Moreover, maintenance services would be the next service to implement for this customer segment. FurnMaster could provide this service as a post-sale service (in a new contract) or include programmed maintenances in the initial project scope on new or refurbished furniture. This would depend on FurnMaster sales team and the customer needs.

Furthermore, refurbishment of old furniture is a service FurnMaster already provides to this customer segment. Nevertheless, this could be promoted in order to be the preferred option

rather than acquiring new furniture, perhaps by increasing customer awareness about the importance of prolonging furniture life cycle.

In addition, E. Guldmann discovered from interviews with Gabriel's customers in this segment, that the criteria to select one or another potential business model depends on the individual client setup and the financing, as well as how daily operations are carried out at the customers' and weather the service or product needed by the client is refurbishment or new furniture. (Guldmann, 2016)

b) Furniture manufacturers - Key Accounts from Fabrics business unit customer segment

Within this customer segment, it is proposed to start with key accounts who are already providing maintenance, refurbishing of furniture and/or Take Back schemes to their own customers in selected markets. For them, FurnMaster would expand their current geographical scope by outsourcing those processes, strengthening their value proposition. This sub-segment of furniture manufactures is prioritized because they already have these services as a "product" for their end-users and have management support to deliver these services. On the contrary, the sub-segment comprised by manufacturers who do not provide these services now, still needs to develop the value proposition to be offered to their customers (e.g. service design). Nevertheless, FurnMaster could help this last sub-segment to develop their value position to include these services, and then, as a consequence, outsource them.

For this segment, it is important to perform an economic feasibility assessment in order to select the geographical areas or regions in which FurnMaster outsourced services could be provided competitively.

c) Businesses that could use worn out fabric as input material customer segment

These customer segment has not been developed yet. However, it could already start being developed by seeking potential businesses that could use discarded fabrics from FurnMaster current production processes. In addition, once FurnMaster starts providing the proposed value proposition for the two other customer segments, the recovered worn-out fabric would be added to this flow.

Furthermore, when deciding which recovering processes or industry to cascade the fabrics, it should be taken into account the least transformation of the material in order to preserve the energy and resources already invested in making that fabric. For this reason, in case there is more than option to recycle/cascade the fabrics, it is suggested to perform an environmental assessment, such as Life Cycle Assessment, to compare which option is the best for the environment.

4.4 Discussion and conclusions of the chapter

As was described at beginning of this chapter, the furniture sector has a huge potential to close loops in the economy, which was confirmed by the existing CBMs described in this chapter.

During case study research process, Gabriel changed the focus of the customer segments for potential CBM. At the beginning, it was stated to focus the research on projects sales, however later it was decided to focus on existing key partner of Gabriel. This could be attributed to their historically close collaboration with them, which could make future cooperation easier. By widening the scope to the complete business unit, the analysis was enriched, favouring the development of a comprehensive and more holistic approach and proposals.

The CBM developed for FurnMaster are characterized by a close collaboration with the different stakeholders involved. Due to this reason, a further assessment with Gabriel's stakeholders should be performed to analyse the feasibility of the CBM described in this chapter. In addition, the proposed CBM, if successful, would allow FurnMaster to have a closer long-term relationship with its customers, as well as, to improve its designs based on the direct feedback gathered from users and learn from the furniture allocated in their customer's facilities, as they would have easy access to it.

Additionally to the proposed assessment of the CBMs with Gabriel's stakeholders, the next step would be to analyse the economic feasibility of each CBM in the different markets Gabriel operates. This would help determine the market where FurnMaster should start providing these services to be more cost effective. Furthermore, in case there is more than one option for the material flows, e.g. recycling of fabrics or cascading them to the building sector, and environmental assessment (e.g. Life Cycle Analysis) to supplement the economic assessment and determine which would be the best option.

5. Conclusions

In this chapter it is summarized the discussion and conclusions from chapter 2, 3 and 4. Moreover, suggestions for future research are portrayed.

5.1 Summarized discussion and conclusions

Chapter 2 presented the concept of CE, which is not new, but has gained momentum in the last years. Although its opportunities benefit most stakeholders in the society, it still need to overcome significant barriers for its adoption.

Chapter 3 reviewed the business model concept, business model Canvas and different models to understand sustainable and circular business models. From the frameworks reviewed for CBM, it was selected the *Resource Cycles,* which provided a suitable frame to assess BM in the technocycle. However, it was supplemented with ReSOLVE frameworks' characteristic to prioritize inner loops. This enhanced framework was comfortable to work with, both from a theoretical perspective in Chapter 3, and from a practical one in the case study.

And finally, Chapter 4 developed the case study of FurnMaster, which was helpful to increase the understanding of the CBM and how it can be applied by existing companies. The case study showed different material loops that could be closed. However, further analysis and research is required to determine which CBM could fit better FurnMaster.

5.2 Suggestions for future research

For future research, it is suggested to explore a holistic quantitative approach to assess the overall impact of CBMs, beyond economic and environmental variables.

In relation with the case study, as mentioned in the conclusions of Chapter 4, it is required further analysis to assess the proposed CBM. It is strongly recommended to improve the proposed CBMs through co-creation sessions with FurnMaster stakeholders and then assess the economic feasibility and environmental impact of the different options and markets FurnMaster could supply.

References

Abdelkafi, N., & Tauscher, K. (2015). Business Models for Sustainability From a System Dynamics Perspective. *Organization & Environment*, 1–23. http://doi.org/10.1177/1086026615592930

Accenture. (2014). *Circular Advantage*. Dublin.

Bakker, M., Bakker, P., Bos, E., Brubaker, L., Draijer, L., Gersen, P., … Walker, R. (2016, April). Iconic Projects. *Scope*, (April), 52. Retrieved from http://www.netherlandscircularhotspot.nl/tl_files/nlch/netherlandsascircularhotspot.pdf

Bastein, T., Roelofs, E., Rietveld, E., & Hoogendoorn, A. (2013). *Opportunities for a Bio-based Economy in the Netherlands*. (V. Jones, Ed.)*Energies* (Vol. 1). Delft: TNO. http://doi.org/10.3390/en1030105

Benton, D., & Hazell, J. (2013). *Resource resilient UK: A report from the Circular Economy Task Force*.

Blue Economy. (2014). About us. Retrieved January 12, 2016, from http://www.blueeconomy.eu/page/

Bocken, N., Bakker, C., & Pauw, I. De. (2016). Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering [E-Journal]*, (0), 20. http://doi.org/10.1080/21681015.2016.1172124

Bocken, N., Short, S., Rana, P., & Evans, S. (2013). A value mapping tool for sustainable business modelling. *Corporate Governance: The International Journal of Effective Board Performance*, *13*(5), 482–497. http://doi.org/10.1108/CG-06-2013-0078

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

Boons, F., & Lüdeke-Freund, F. (2013). Business models for sustainable innovation: State-of-the-art and steps towards a research agenda. *Journal of Cleaner Production*, *45*, 9–19. http://doi.org/10.1016/j.jclepro.2012.07.007

Braungart, M., & McDonough, W. (2008). *Cradle to cradle : remaking the way we make things*. London: Jonathan Cape.

Brinkman, J. (Accenture). (2015). *Waste to Wealth: The Circular Economy Advantage (overview of the book with the same name)*. Retrieved from http://ec.europa.eu/environment/integration/green_semester/pdf/07_09_2015/5. Accenture - Waste to wealth - creating advantage-final.pdf

Carpet Recycling UK. (2016). *Innovation Case Study : DESSO takes to the floor with carpet tile Take Back scheme*. Cheshire. Retrieved from http://www.carpetrecyclinguk.com/downloads/desso_takeback_case_study.pdf

Chamberlin, L., Jamsin, E., & Raksit, A. (2013). *Wales and the Circular Economy: Favourable system conditions and economic opportunities*. Wales.

Chertow, M. R. (2007). " Uncovering " Industrial Symbiosis. *Journal of Industrial Ecology*, *11*(1).

CIRAIG. (2015). *Circular Economy: A Critical Literature Review of Concepts*. Montreal. Retrieved from http://www.ciraig.org/pdf/CIRAIG_Circular_Economy_Literature_Review_Oct2015.pdf

Circle Economy. (2016). News. Retrieved June 7, 2016, from http://www.circle-economy.com/news/

Circulate News. (2016). Home. Retrieved June 7, 2016, from http://circulatenews.org/

Dedicoat, C. (Cisco). (2016). Circular economy: what it means, how to get there. Retrieved April 6, 2016, from https://www.weforum.org/agenda/2016/01/the-importance-of-a-circular-economy

Elkington, J. (1994). Towards the Sustainable Corporation: Win-Win-Win Business Strategies for Sustainable Development. *California Management Review*, *36*(June 1992), 90–100. http://doi.org/10.2307/41165746

Elkington, J. (1997). *Cannibals with forks: the triple bottom line of 21st century busines*. Oxford: Capstone Publishing.

Ellen MacArthur Foundation. (2012). *Towards the Circular Economy Vol. 1*. Isle of Wight.

Ellen MacArthur Foundation. (2013). *Towards the Circular Economy Vol. 2*. Isle of Wight.

Ellen MacArthur Foundation. (2014). *Towards the Circular Economy Vol. 3*. Isle of Wight.

Ellen MacArthur Foundation. (2015a). Building blocks of a Circular Economy. Retrieved January 15, 2016, from http://www.ellenmacarthurfoundation.org/circular-economy/building-blocks

Ellen MacArthur Foundation. (2015b). Circular Economy System Diagram. Retrieved April 24, 2016, from http://www.ellenmacarthurfoundation.org/circular-economy/interactive-diagram

Ellen MacArthur Foundation. (2015c). *Delivering the Circular Economy: A Toolkit for Policymakers V1.1*. Isle of Wight.

Ellen MacArthur Foundation. (2015d). *Potential for Denmark As a Circular Economy a Case Study From : Delivering the Circular Economy – a Toolkit for Policy Makers*. Isle of Wight.

Ellen MacArthur Foundation. (2015e). The Programme. Retrieved March 23, 2016, from http://www.ellenmacarthurfoundation.org/ce100/the-programme/enabling-collaboration

Ellen MacArthur Foundation. (2015f). *Towards a Circular Economy : Business Rationale for an Accelerated Transition*. Isle of Wight.

Ellen MacArthur Foundation. (2016a). Case Studies. Retrieved June 7, 2016, from https://www.ellenmacarthurfoundation.org/case-studies

Ellen Macarthur Foundation. (2016). Home page. Retrieved May 23, 2016, from https://www.ellenmacarthurfoundation.org/

Ellen MacArthur Foundation. (2016b). Rype office - Circular economy options in office furnishing. Retrieved May 10, 2016, from https://www.ellenmacarthurfoundation.org/case-studies/circular-economy-options-in-office-furnishing

Ellen Macarthur Foundation, Sun, & McKinsey Center for Business and Environment. (2015). *Growth within: a circular economy vision for a competitive europe*. Isle of Wight.

European Commission. (2014). *Scoping study to identify potential circular economy actions , priority sectors, material flows and value chains*. Luxembourg.

European Commission. (2015). *Closing the loop - An EU action plan for the Circular Economy*. Brussels.

European Commission. (2016). Furniture industry. Retrieved May 26, 2016, from http://ec.europa.eu/growth/sectors/raw-materials/industries/forest-based/furniture/

Flynn, B., Morita, M., & Machuca, J. (2011). *Managing global supply chain relationships: operations, strategies and practices*. Hershey: IGI Global.

Furnishare. (2016). Our mission. Retrieved May 7, 2016, from https://www.furnishare.it/mission-statement/

Gabriel Holding A/S. (2015a). *Front Runner Gabriel - CSR Report 2014/15*. Aalborg.

Gabriel Holding A/S. (2015b). *Gabriel Profile 2014/15*. Aalborg.

Gabriel Holding A/S. (2015c). *Internal report: Competitor CSR activities 2015*. Aalborg.

Gabriel Holding A/S. (2016a). About Gabriel. Retrieved April 13, 2016, from http://www.gabriel.dk/en/about-gabriel/about-gabriel/

Gabriel Holding A/S. (2016b). Customer Collaboration. Retrieved May 6, 2016, from http://www.gabriel.dk/en/fabrics/customer-collaborations/

Geng, Y., & Doberstein, B. (2008). Developing the circular economy in China: Challenges and opportunities for achieving'leapfrog development'. *International Journal of Sustainable Development & World Ecology*, *15*, 231–239.

Ghisellini, P., Cialani, C., & Ulgiati, S. (2015). A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner Production*, 1–22. http://doi.org/10.1016/j.jclepro.2015.09.007

Gispen. (2016). Over ons. Retrieved May 10, 2016, from https://www.gispen.com/nl/overons/organisatie

Global Footprint Network. (2016). World Footprint. Retrieved April 4, 2016, from http://www.footprintnetwork.org/en/index.php/GFN/page/world_footprint/

Gorissen, L., Vrancken, K., & Manshoven, S. (2016). Transition Thinking and Business Model Innovation Towards a Transformative Business Model and New Role for the Reuse Centers of Limburg, Belgium. *Sustainability*, *8*(2), 112. http://doi.org/10.3390/su8020112

Graedel, T. E. (1996). On the Concept of Industrial Ecology. *Annual Review of Energy and the Environment*, *21*(1), 69–98. http://doi.org/10.1146/annurev.energy.21.1.69

GreenBiz, & UPS. (2016). *The Growth of the Circular Economy - A 2016 UPS/GreenBiz Research Study*. Atlanta. Retrieved from http://sustainability.ups.com/media/UPS_GreenBiz Whitepaper.pdf

Guldmann, E. (AAU). (2016). *Gabriel - Research report* (Unpublished manuscript). Aalborg.

Haas, W., Krausmann, F., Wiedenhofer, D., & Heinz, M. (2015). How Circular is the Global Economy?: An Assessment of Material Flows, Waste Production, and Recycling in the European Union and the World in 2005. *Journal of Industrial Ecology*, *19*(5), 765–777.

Hawken, P., Lovins, A., & Lovins, H. (2010). *Natural Capitalism: Creating the Next Industrial Revolution* (2nd ed.). London - Washintong DC: Earthscan.

Helbling, T. (IMF). (2012). Externalities: Prices Do Not Capture All Costs. Retrieved April 23, 2016, from http://www.imf.org/external/pubs/ft/fandd/basics/external.htm

Henry, P. (EC). (2016). *Circular Economy package – what' s in it ?* Brussels. Retrieved from http://ec.europa.eu/environment/circular-economy/pdf/seminar/1 DG ENV_Circular Economy package.pdf

Johnson, M. W., Christensen, C. M., & Kagermann, H. (2008). Reinventing your business model. *Harvard Business Review*, *86*(12), 50–60. http://doi.org/10.1111/j.0955-6419.2005.00347.x

Kok, L., Wurpel, G., & Ten Wolde, A. (2013). *Unleashing the Power of the circular economy. Report by*

IMSA Amsterdam for Circle Economy. Amsterdam: IMSA Amsterdam.

Kraaijenhagen, C., van Oppen, C., & Bocken, N. (2016). *Circular Business: Collaborate and Circulate*. (C. Bernasco & L. Hilten Goodchild-van, Eds.). Amsterdam: Ecodrukkers.

Lacy, P. (2015). *Competitiveness & the Digital Innovation Opportunities - Last Call to Europe 2020*. Milan. Retrieved from http://www.sodalitas.it/public/allegati/Lacy_LastCall_2015723165650743.pdf

Lacy, P. (2016). Accenture: From Waste to Wealth - Building a Circular Economy. Retrieved April 6, 2016, from http://www.greatbusinessdebate.co.uk/opinion/accenture-from-waste-to-wealth-building-a-circular-economy/

Lacy, P., & Rutqvist, J. (2015). *Waste to Wealth: The Circular Economy Advantage*. London: Palgrave Macmillan.

Lehmann, M., Leeuw, B. de, Fehr, E., & Wong, A. (2014). *Circular Economy. Improving the Management of Natural Resources*. (B. Huber, Ed.)*Schweizerische Akademie der Technischen Wissenschaften*. Zurich: SATW. Retrieved from http://www.satw.ch/publikationen/schriften/kreislaufwirtschaft/index_EN

Lewandowski, M. (2016). Designing the Business Models for Circular Economy — Towards the Conceptual Framework. *Sustainability*, *8*(1), 43. http://doi.org/10.3390/su8010043

Liander. (2016). Over Liander. Retrieved May 10, 2016, from https://www.liander.nl/over-liander

Linder, M., & Williander, M. (2015). Circular Business Model Innovation: Inherent Uncertainties. *Business Strategy and the Environment*, (Published online in Wiley Online Library). http://doi.org/10.1002/bse.1906

Lombardi, D. R., & Laybourn, P. (2012). Redefining Industrial Symbiosis: Crossing Academic-Practitioner Boundaries. *Journal of Industrial Ecology*, *16*(1), 28–37.

Lüdeke-Freund, F. (2010). Towards a Conceptual Framework of Business Models for Sustainability. *Knowledge Collaboration & Learning for Sustainable Innovation ERSCP-EMSU Conference, Delft, The Netherlands*, *49*(0), 1–28. http://doi.org/10.13140/RG.2.1.2565.0324

Lyle Center for Regenerative Studies. (2015). About Regeneration. Retrieved January 13, 2016, from https://www.cpp.edu/~crs/regeneration.html

M&S. (2016). About us. Retrieved May 10, 2016, from https://corporate.marksandspencer.com/aboutus

Miljøstyrelsen. (2015). Affaldsforebyggelse: Strategi & aktiviteter. Retrieved March 25, 2016, from http://mst.dk/virksomhed-myndighed/affald/affaldsforebyggelse-strategi-aktiviteter/

Morlett, A. (2014). Cities as the front-runners of circular economy. Presentation in the event “London Infrastructure Plan – Circular Economy” of November 27th, 2014. London: London Sustainability Exchange. Retrieved from http://www.lsx.org.uk/docs/events/3623/Cities as the front-runners of circular economy - Andrew Morlett.pdf

NNOF. (2016). Home. Retrieved May 8, 2016, from http://www.nnof.be/

Osterwalder, A., & Pigneur, Y. (2010). *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. (T. Clark, Ed.)*A handbook for visionaries, game changers, and challengers* (1st ed.). Amsterdam: John Wiley & Sons.

Ovaska, J.-P., Poutiainen, P., Sorasahi, H., Aho, M., Levanen, J., & Annala, M. (2016). *Business Models*

for a Circular Economy 7 Companies Paving the Way. Helsinki: Finnish Innovation Fund Sitra.

Oxfam. (2016a). About us. Retrieved May 10, 2016, from https://www.oxfam.org/en/about

Oxfam. (2016b). Shwopping. Retrieved May 8, 2016, from http://www.oxfam.org.uk/donate/donate-goods/mands-and-oxfam-shwopping

Patagonia. (2016). Patagonia Returns and Repairs. Retrieved May 8, 2016, from http://www.patagonia.com/us/returns-repairs/start.jsp

Pratt, K., & Lenaghan, M. (2015). *The Carbon Impacts of the Circular Economy Summary Report*. Stirling. Retrieved from https://consult.scotland.gov.uk/zero-waste-delivery/making-things-last/supporting_documents/CIoCE Summary Report FINAL 15.06.15.pdf

Preston, F. (2012). *A Global Redesign? Shaping the Circular Economy*. *Energy, Environment and Resource Governance*. London. Retrieved from http://www.chathamhouse.org/sites/files/chathamhouse/public/Research/Energy, Environment and Development/bp0312_preston.pdf

Reichel, A., Schoenmakere, M. De, & Gillabe, J. (2016). *Circular economy in Europe Developing the knowledge base*. Luxembourg. Retrieved from http://www.eea.europa.eu/publications/circular-economy-in-europe

Renda, A., Pelkmans, J., Schrefler, L., Luchetta, G., Simonelli, F., Mustilli, F., … Busse, M. (2014). *The EU Furniture Market Situation and a Possible Furniture Products Initiative*. Brussels.

Rethink Business. (2015). The Road to a Circular Economy. Retrieved March 26, 2016, from http://en.rethinkbusiness.dk/p/about-rethink-business/the-mission

Rizos, V., Behrens, A., Kafyeke, T., Hirschnitz-Garbers, M., & Ioannou, A. (2015). *The Circular Economy: Barriers and Opportunities for SMEs*. Retrieved from https://www.ceps.eu/system/files/WD412 GreenEconet SMEs Circular Economy.pdf

Rockström, J., Steffen, W. L., Noone, K., Persson, Å., Chapin Iii, F. S., Rockstrom, J., … Foley, J. (2009). Planetary Boundaries : Exploring the Safe Operating Space for Humanity. *Ecology and Society*, *14*(2), 32. http://doi.org/10.1038/461472a

Roome, N., & Louche, C. (2016). Journeying Toward Business Models for Sustainability: A Conceptual Model Found Inside the Black Box of Organisational Transformation. *Organization & Environment*, *29*(1), 11–35. http://doi.org/10.1177/1086026615595084

Royal Ahrend. (2016). About us. Retrieved May 23, 2016, from https://www.ahrend.com/en/about-us/Organisation/

Rype Office. (2016). Home. Retrieved May 8, 2016, from http://www.rypeoffice.com/

Sauvé, S., Bernard, S., & Sloan, P. (2015). Environmental sciences, sustainable development and circular economy: Alternative concepts for trans-disciplinary research. *Environmental Development*, 1–9. http://doi.org/10.1016/j.envdev.2015.09.002

Sawy, O. A. El, & Pereira, F. (2013). *Business Modelling in the Dynamic Digital Space - An Ecosystem Approach*. New York-Dordrecht-London: Springer Heidelberg.

Schaltegger, S., Hansen, E. G., & Lüdeke-Freund, F. (2016). Business Models for Sustainability: Origins, Present Research, and Future Avenues. *Organization & Environment*, *29*(1), 3–10. http://doi.org/10.1177/1086026615599806

Schwab, K. (WEF). (2015). The Fourth Industrial Revolution: What It Means and How to Respond.

Retrieved April 6, 2016, from https://www.foreignaffairs.com/articles/2015-12-12/fourth-industrial-revolution

Seijs, D. (Ahrend). (2016). Circular economy at Ahrend. Interview with the Coordinator CSR & Sustainability by Heidi Simone Kristensen and Edward Vingwe. Amsterdam. May 19, 2016.

Sempels, C., & Hoffmann, J. (2013). *Sustainable innovation strategy: creating value in a world of finite resources*. New York: Palgrave Macmillan.

Stahel, W. R. (1984). The Product-Life Factor. In S. Grinton Orr (Ed.), *An Inquiry Into the Nature of Sustainable Societies: The Role of the Private Sector* (Vol. 3, pp. 72–96). Houston: Houston Area Research Center. Retrieved from http://www.product-life.org/en/major-publications/the-product-life-factor\nhttp://infohouse.p2ric.org/ref/33/32217.pdf

Stahel, W. R. (2016). Circular Economy. *Nature*, *531*(24 March 2016), 435–438. Retrieved from http://www.nature.com/news/the-circular-economy-1.19594

Steffen, W., Richardson, K., Rockstrom, J., Cornell, S. E., Fetzer, I., Bennett, E. M., … Sorlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science*, *347*(6223), 1259855–. http://doi.org/10.1126/science.1259855

Stockholm Resilience Center. (2015). The nine planetary boundaries. Retrieved April 9, 2016, from http://www.stockholmresilience.org/research/researchnews/tippingtowardstheunknown/theni neplanetaryboundaries.4.1fe8f33123572b59ab80007039.html

Strategyzer. (2015). *The Business Model Canvas - Why and how organizations around the world adopt it.* Zürich. Retrieved from http://blog.strategyzer.com/posts/2015/2/9/why-and-how-organizations-around-the-world-apply-the-business-model-canvas

Strategyzer. (2016). Business model Canvas. Retrieved May 14, 2016, from https://assets.strategyzer.com/assets/resources/the-business-model-canvas.pdf

Stubbs, W., & Cocklin, C. (2008). Conceptualizing a " Sustainability Business Model ." *Organization & Environment*, *21*(2), 103–127. http://doi.org/10.1177/1086026608318042

SustainAbility. (2014). *20 Business Model Innovations for Sustainability*. Brooklyn-Oakland-London. Retrieved from http://www.sustainability.com/library/model-behavior#.VvefKvl942w

Teece, D. J. (2010). Business models, business strategy and innovation. *Long Range Planning*, *43*(2-3), 172–194. http://doi.org/10.1016/j.lrp.2009.07.003

The Biomimicry Institute. (2015). Biomimicry 101. Retrieved January 7, 2016, from http://biomimicry.org/what-is-biomimicry/

The Guardian. (2016). Sustainable Businesses. Retrieved June 7, 2016, from http://www.theguardian.com/uk/sustainable-business

Thiesen, J. (Gabriel). (2016). FurnMaster business unit. Interview with the Project Manager of Quality, Environment and Production at Gabriel by Monica A. Ramos Li. Aalborg. May 23, 2016.

Turecki, T. (EC). (2016). *Innovation for the circular economy*. Brussels. Retrieved from http://ec.europa.eu/environment/circular-economy/pdf/seminar/2 DG RTD_Innovation for the CE.pdf

UCM. (2016). Nearly New Office Facilities - NNOF. Retrieved May 10, 2016, from http://eco-conception.be/nl/exemple/3-nearly-new-office-facilities-nnof.html

UN-HABITAT. (2011). *The Economic Role of Cities: United Nations Human Settlements Programme*.

Nairobi.

United Nations. (2014). *World Urbanization Prospects: The 2014 Revision, Highlights*. *New York, United*. New York. http://doi.org/10.4054/DemRes.2005.12.9

Van Renswoude, K., Ten Wolde, A., & Joustra, D. J. (2015). *Circular business models - Part 1: An introduction to IMSA's circular business model scan*. Amsterdam. Retrieved from http://www.norden.org/en/news-and-events/news/circular-business-models

Wallace, S., & Raingold, A. (2012). *Resilience in the Round: Seizing the growth opportunities of a circular economy*. London.

Webster, K. (2016). Selling access over ownership, cui bono? In Ellen MacArthur Foundation (Ed.), *New Dynamic 2* (1st ed., pp. 130–141). Isle of Wight: Ellen MacArthur Foundation Publishing.

Wijkman, A., & Skånberg, K. (2015). *The Circular Economy and Benefits for Society - Jobs and Climate Clear Winners in an Economy Based on Renewable Energy and Resource Efficiency*. Retrieved from http://www.clubofrome.org/cms/wp-content/uploads/2015/10/The-Circular-Economy-and-Benefits-for-Society.pdf

Wirtz, B. W. (2011). *Business Model Management. Design - Instruments - Sucess factors* (1st ed.). Dordrecht: Springer Science+Business Media Dordrecht. http://doi.org/10.1007/s11573-011-0437-z

Withana, S., Brink, P., & Russi, D. (2014). Hidden subsidies : the invisible part of the EHS iceberg. In F. H. Oosterhuis & P. ten Brink (Eds.), *Paying the Polluter: Environmentally Harmful Subsidies and their Reform* (pp. 41–69). Massachusetts: Edward Elgar Publishing.

Wohlin, C. (2014). Guidelines for Snowballing in Systematic Literature Studies and a Replication in Software Engineering. *18th International Conference on Evaluation and Assessment in Software Engineering (EASE 2014)*, 1–10. http://doi.org/10.1145/2601248.2601268

World Economic Forum. (2012). *More with Less : Scaling Sustainable Consumption and Resource Efficiency*. Geneva.

World Economic Forum. (2014). *Towards the Circular Economy: Accelerating the scale-up across global supply chains*. Geneva.

World Economic Forum. (2016). 8 videos that explain the circular economy. Retrieved April 25, 2016, from https://www.weforum.org/agenda/2016/04/8-videos-that-explain-the-circular-economy

WRAP. (2013). *Product Opportunity Summary : Furniture*. Oxon.

WRAP, & Green Alliance. (2015). *Employment and the circular economy Job creation in a more resource efficient Britain*. London. Retrieved from http://www.green-alliance.org.uk/resources/Employment and the circular economy.pdf

Zhu, D. (2014). China's policies and instruments for developing the circular economy. Retrieved April 6, 2016, from http://europesworld.org/2014/06/15/chinas-policies-and-instruments-for-developing-the-circular-economy/#.VwVCIqR942x

Zils, M., Hawkins, P., & Hopkinson, P. (2016). Challenges and Capabilities for Scaling up circular economy business models -a change in management perspective. In Ellen MacArthur Foundation (Ed.), *A New Dynamic 2* (1st ed., pp. 157–175). Isle of Wight: Ellen MacArthur Foundation Publishing.

Zott, C., & Amit, R. (2010). Business model design: An activity system perspective. *Long Range Planning*, *43*(2-3), 216–226. http://doi.org/10.1016/j.lrp.2009.07.004