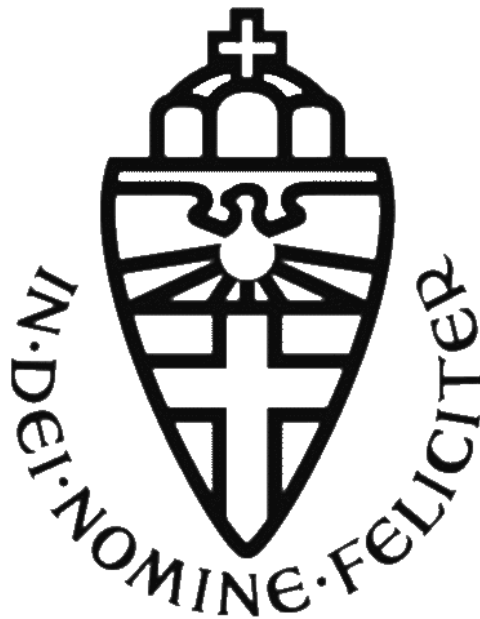


# **Circular Pioneers in a Linear Economy**

*The transition in value creation in circular business models*



## **Radboud Universiteit Nijmegen**

*Master thesis Business Administration: Strategic Management*

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## Foreword

*“You cannot escape the responsibility of tomorrow by evading it today”*

### Abraham Lincoln

We decide now, how we shape our future. We decide now, if there is a future at all for humankind on this earth. There have never been road maps for the future, because people have never been in the future before. Hence, there are no road maps now. People have never been where we are now before. The problems we face now and the problems we will face in the future are not solved with a guide from the past. Our ideas, laws, forms of political engagement, ways of doing business and established ways of working are the things that created our current situations, and for the future we face, our past is a feeble guide at best. Human’s ‘fight’ with nature is without doubt the most crucial concern for the future of humankind. But, as it is nature that enables our very existence, this is a fight we cannot overcome. The exhaustion of our planet’s resources and the emission of greenhouse gasses will irrevocably lead to the most terrifying future for mankind we can imagine. Our home, planet Earth, will turn into a planet with an atmosphere, climate, and environment where human beings are simply unable to exist.

So it is this generation that decides now, how we shape our future. This generation decides now, if there is a future at all for humankind on this earth, because if we leave it to the next generation, it might already be too late. Because if we continue to adhere to our current ideas and ways of living, working, and doing business, we’ll definitely face the consequences in the future, and this future might just be closer than most of us realise. Will we let it slip, or will we take our responsibility?

This thesis is written by Yannick Baudet, Master of Science in Work, Organisation, & Health Psychology and Master’s Student Strategic Management. My interest to work with ideas of sustainability and improving the way we treat planet Earth from a business administrative perspective has been satisfied by working on this thesis about the circular economy. I’d like to thank Prof. Dr. Jan Jonker for his guidance and support while writing this thesis.

Nijmegen, 25-08-2017

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## **Abstract**

Circular economy can be defined as an industrial model of development where the flow of materials is accommodated in closed loops, energy leakage is minimised, and waste is designed out of the products and processes. This makes the system regenerative and restorative by design. The explosive increase in resource demand requires the economy to shift to an economic model which is more resource efficient than the current linear model. The circular economy is presented as the solution to deal with a myriad of ecological issues like resource scarcity. Although circular economy has developed to a refined theoretical concept, in practice only few companies apply the circular principles. Circular economy requires companies to work with circular business models. Business models are the way a company creates value, and in a circular economy this significantly differs from a linear business model. The goal of this research is to understand how the circular economy, and more specifically, how circular business models are working out in practice, 69 interviews have been held with different companies. These companies are circular pioneers, meaning they are the first to implement the circular principles into their business models. The main research question: how are companies currently composing their business models for the circular economy? 7 Sub-questions have been derived from this question. Based on a qualitative content analysis of the 69 interview reports, these questions could be answered and eventually an answer to main research question can be formulated. Although the theory about the circular economy and about circular business models is quite sophisticated, in practice only the simple aspects are being used. Circular business models in practice have been reduced to reusing products, waste reduction, or just using green products with the goal of eco-efficiency. Several bottlenecks of circular business models in practice have been identified. The dominant revenue model is still conventional sales and consequently companies lose sight of their materials when selling them. This is problematic, because it is hard to reclaim materials when they are out of sight. Circular pioneers struggle with organising reverse cycles. Also, cooperation between companies often only contributes to extending the lifetime of resources instead of actually closing loops. Closing loops is mostly just done by companies in-house. Strategy remains a neglected topic, and the reasons why circular pioneers are engaging in circular activities translates into the value that is created. Mostly ecological value is created, and financial value is neglected. All in all, the first steps for circular business models in practice have been made, but for circular business models to become mainstream a long road still lies ahead.

## 1. Prologue

It was in 2005 that Ellen MacArthur became the fastest solo sailor to circumnavigate the globe. With her she had the absolute minimum of resources to be as light and fast as possible. It was during that experience when she learned the true meaning of the word ‘finite’.

*“At sea, what you have is all you have, stopping en route to restock is not an option and careful resource management can be a matter of life or death – running out of energy to power the autopilot means you can be upside down in seconds. My boat was my world, I was constantly aware of its supplies limits and when I stepped back ashore, I began to see that our world was not any different.”*

MacArthur, 2005

### 1.1. The Need for Sustainability

A confluence of developments is the cause of a pressing need for a transition to more sustainable sociotechnical systems (Meadows et al., 2004). Environmental problems such as resource depletion, air, water, and soil pollution, loss of biodiversity, and excessive land use are increasingly jeopardising the earth’s life-support system (Rockström et al. 2009; Meadows et al. 2004). Climate change is the biggest global health threat of the 21<sup>st</sup> century, it includes direct and indirect threats to global health through changing patterns of disease, water and food insecurity, extreme climatic events, population growth and migration. (Costello et al. 2009).

A group of internationally renowned scientists identified nine planetary boundaries in 2009. Seven of them are presented in figure 1. The crossing of them could generate abrupt or irreversible environmental changes, and the world has already crossed three boundaries (Steffen et al., 2015). These are (1) Extinction rate: The Living Planet Report (2016) already shows a great loss of biodiversity (about 50% between 1970 and 2014). (2) Atmospheric carbon dioxide concentration and (3) atmospheric nitrogen fixation: Atmospheric concentrations of the main greenhouse gases now far exceed the natural range over the past 650.000 years (Lacy & Rutqvist, 2015). The planetary boundaries that haven’t been crossed (yet) are (4) stratospheric ozone depletion, (5) atmospheric aerosol loading, (6) climate change, (7) ocean acidification, (8) freshwater consumption and the global hydrological cycle, (9) land system change (Steffen et al. 2015).

The most salient development is the explosive increase in resource demand. Nowadays, the world population is using 34 times more materials, 27 times more minerals, 12 times more fossil fuels and 3.6 times more biomass than a century ago (Rli, 2015). Also, the extraction and

use of raw materials negatively impacts the climate and contributes considerably to carbon dioxide emissions. Now more than ever before, the indisputable fact that Earth’s resources are limited have been made clear to us. Some resources are non-renewable, like precious metals that are very limited due to pervasive mining in the past years, and they are getting more constrained. And although some resources are technically renewable, such as water, air and forests, the exploding demand and population growth will exhaust them to the breaking point if current practices continue. Where early threats of resource scarcity and overpopulation have rarely needed to be acknowledged, because price signals have driven innovation and other solutions, outpacing resource depletion, now the signs of scarcity have created a growing interest in how resources are extracted and used, which led to a movement for change (Lacy & Rutqvist, 2015, p 21).

This movement for change has grown in the last decade with several academics, thought-leaders and businesses that came up with ideas to fight the threats of resources scarcity. More on these ideas in chapter 2, about the origins of circular economy. The main statement this movement for change pleads for, is the necessity for an alternative to the current linear economy. But, what exactly makes it necessary to switch to an alternative model? In other words, what is wrong with the current linear economy and how is an alternative model going to address these issues?

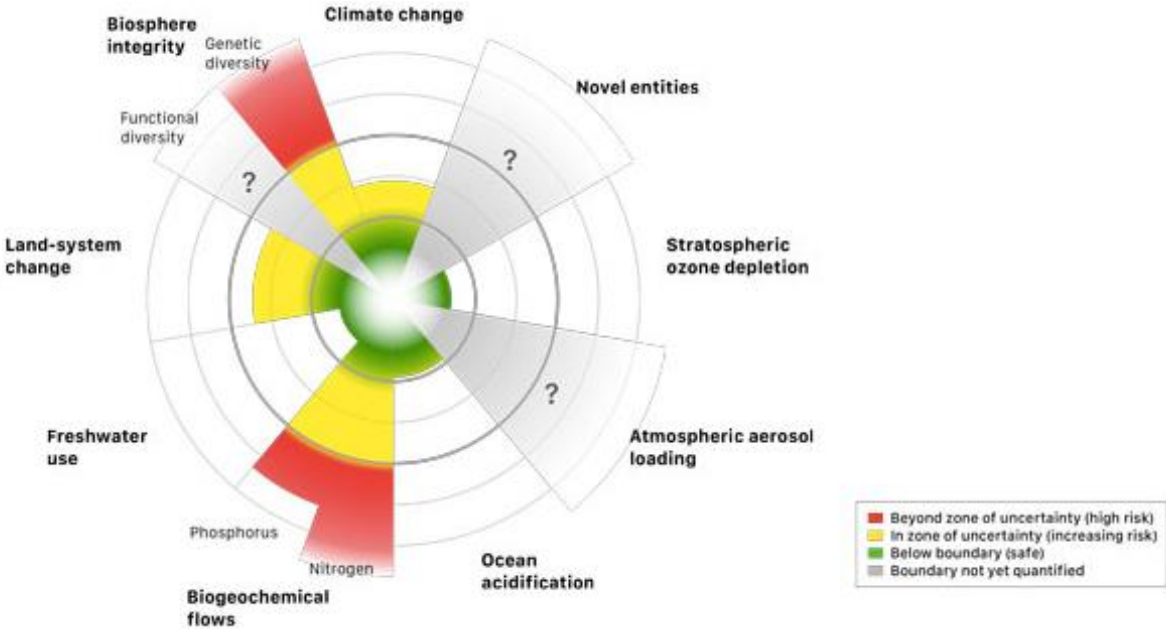


Figure 1. Estimates of how the different control variables for seven planetary boundaries have changed from 1950. Source: Steffen et al. (2015).

### *1.2.Linear Growth Model*

Historically, the use of natural resources was dictated by the seasons and it occurred locally on a scale that did not affect the regenerative capacity of nature (Sedlacek, 2012). It was not until the Age of Enlightenment, around 1750, that the notion of progress emerged, which meant that the average citizen should progressively be in a better position regarding the materials they possess. These are the fundamentals of the linear economy (Bonciu, 2014). But classic economists, such as Malthus, already indicated that linear growth is limited by the availability of natural resources (Malthus, 1976).

It appears that, as of the middle of the 20<sup>th</sup> century, a solid fundament of our modern economy was formed by the ‘Law of Obsolescence’, which describes a process of consciously aiming for the accelerated obsolescence of products with the intent of planned replacement (Jonker et al. 2017). Obsolescence refers to the state of being which occurs when a service or object is no longer wanted or used, even though it may still be in good working order. By purposely giving certain products a limited lifespan, the consumption of products is stimulated. Repair and reuse is discouraged because often a replacement for the product has become available that has more advantages than maintaining or repairing the original product. The planned obsolescence of products resulted in a continuous flow of new and improved products and a high charge rate for maintenance and repair. Nowadays, the principle of obsolescence has fully nestled into the design and production cycles, which has led to an economic design for the benefit of hyper consumption (Jonker et al. 2017).

For example, Apple introduces new iPhones at great pace and presents each of its new iPhone as an improved version of the previous version. Although many people have an iPhone that still works, they often want to upgrade to the newer and slightly improved version of the iPhone. Apple’s planned obsolescence is so successful that its customers don’t even need the new iPhone, but they are going to want it anyway (van Camp, 2015). This is typical for today’s tech giants, they don’t just practice planned obsolescence, they’re founded on it (Jones, 2016).

Mathews & Tan (2011) acknowledge that continued development in the traditional linear manner, starting with resources taken from nature at one end and proceeding through production processes to the creation of wastes disposed in nature at the other end, is simply no longer feasible. This way of organising is costly to both secure fresh resources all the time and lose resources in the form of waste. It is economically and ecologically inefficient. The negative effects caused by the “take, make and dispose” (Ness, 2008) model are threatening the stability of the economies and the integrity of natural ecosystems that are essential for humanity’s survival (EC, 2014; Park and Chertow, 2014). It was never a clever idea to follow a linear

growth model, which is basically growth from trashing the planet, but now linear economics has reached the end of the line. The current economy is heading for trouble. In fact, it has been in trouble for quite some time because of the Earth's limited resources. Also, the current model still treats the impact of waste as someone else's trouble. But meanwhile, the Earth's ability to absorb and process waste diminishes every year.

The combination of the increasing need of raw materials, geopolitical tensions, the eroding of earth's capacity, strong population growth and technological developments increase the urgency of a transition to sustainability. The folly of endless resource extraction, endless waste dumping and endlessly unmet human needs have to end. In their book, Adams & Jeanrenaud (2008) ask the critical questions for this matter: how to devise strategies for society that will allow a peaceful, equitable, fulfilled human future in a diverse earth and how do we deliver, or even start to make progress towards delivering sustainability? Although the linear growth model has served companies so well for the past 250 years, in the near future it will reach the point where it will run out of gas, literally. The world needs a model that can generate far greater resource productivity than the linear model. It needs to make a switch towards a growth-model which is waste-free. This would preserve and regenerate material value and natural capital instead of losing it (Greyson, 2016). A transition from a linear to a circular economy is proposed by Lacy & Rutqvist (2015), but why is the circular economy proposed as a promising opportunity, and is it really?

### *1.3. Purpose of this thesis*

The pressing need for sustainability and a prediction that the road of the current linear economy does not lead to a bright future for mankind on this planet rises an important question, what is the alternative? There is currently an alternative economic model that is gaining increased attention: the circular economy. Therefore, this thesis will first explain what circular economy exactly constitutes, how it originated, on what schools of thought it is based, how it is currently defined and what the advantages of a circular economy are. Also, an attempt to critically reflect on the concept of circular economy is made.

To implement the principles of the circular economy and transform the current economy, companies have to make a transition from a linear to a circular business model. A business model describes the way a company creates value, and in a circular business model this significantly differs from the way value is created in a linear business model. New companies can start from scratch to compose their circular business models, but the established order of companies will have to make a transition. Issues on how to make this seemingly

complex transition can be very interesting for future research, but won't be addressed in this thesis.

The aim of this thesis is to study how circular business models work out in practice, theoretically it is about the transition in value creation. So, how is value created through a circular business model, and how does this work out in practice? This gap between the theoretical concept of circular economy, and the circular economy in practice, will be addressed with this thesis. The goal is to find out how companies are creating value while operating through a circular business model. A main research question and 7 sub-questions have been formulated to guide this the research. These can be found in table 1, and will be elaborated on below. The questions are based on the literature that will be presented in Chapter 2 and 3 of this thesis.

Table 1.

*Research questions*

<b>Main research question</b>
1 How are companies currently composing their business models for the circular economy?
<b>Sub-questions</b>
1 What does the concept of circular economy constitute according to companies?
2 What challenges do circular pioneers encounter when embracing the circular economy?
3 How do companies work with the concept of closing loops?
4 How do companies create value with a circular business model?
5 How do companies align their strategy with a circular business model?
6 How do companies organise their circular business model?
7 How do companies make money with a circular business model?

To find out how companies are creating value while embracing the circular principles, a series of interviews have been held with circular pioneers (Jonker et al. 2017). These interviews provide information about how organisations actually talk and think about the circular economy and the circular business models. They also provide information on how those companies are working with a circular business model. The dataset for this thesis consists of 69 reports of these interviews that will be thoroughly analysed with the goal to understand how the circular economy, and more specifically, how circular business models are working out in practice. This goal leads to the main research question: *How are companies currently*

*composing their business models for the circular economy?* Sub-questions have been formulated to answer the main research question. The sub-questions have been categorised in two categories, one about background information on the circular economy and one about the building blocks of circular business models. These building blocks will be elaborated on in Chapter 3.

To understand how companies work with circular business models, it might be useful to gain a better understanding of how companies actually talk about the circular economy in practice, what difficulties they encounter in embracing the circular economy, and how to overcome those difficulties. Circular business models can't be seen separately from the circular economy as a whole. For this reason, two sub-questions have been formulated with the goal to gain knowledge on the issues described above.

*(1) What does the concept of circular economy constitute according to companies?*

*(2) What challenges do circular pioneers encounter when embracing the circular economy?*

As mentioned before, there is circular economy in theory and in practice differ. This could possibly mean that managers who are talking about the concept of circular economy in their company, talk about a concept that differs from the theoretical concept. This dataset provides the opportunity to compare theoretical and practical definitions of circular economy.

The main research question is built upon the notion of value creation. Because business models are essentially about the way value is created for a company, the analysis will focus on how the building blocks of circular business models (Jonker et al. 2017) will contribute to the creation of value for a company. The sub-questions will comprise all the different aspects of a circular business model, which leads to the following sub-questions:

*(3) How do companies work with the concept of closing loops?*

The idea of closing raw material loops is a core principle of a circular business model; companies can close the material loops on their own or cooperate with other institutions to close the material loops. The goal of this question is to gather information about how companies are able to close the material loops, how they embed the concept of closing loops into their business model and how closing material loops creates value for the companies.

*(4) How do companies create value with a circular business model?*

Only creating financial value doesn't qualify for a circular business model. Circular business models should also create ecological and social value. The goal of this question is to gather information on how companies incorporate these types of value creation into their circular business model.

*(5) How do companies align their strategy with a circular business model?*

Being successful with a circular economy requires a clear strategy on how to organise the circular enterprise. Several basic foundations of a linear model no longer apply to a circular business model. The moment of sale is no longer a central aspect, instead in a circular business model it's about adding value throughout the lifespan of a product. This affects the way business is done with customers. The goal of this question is to gather information on how companies set out their strategy that aligns with their circular business model, so what is their strategy to create the value?

*(6) How do companies organise their circular business model?*

The idea is that no company can be circular on its own. Cooperating, integrating value chains and working in networks is argued to be essential for a company to successfully operate in a circular manner. This also means that value is created in conjunction with other companies or institutions. The goal of this question is to gather information on how companies cope with the issues mentioned above.

*(7) How do companies make money with a circular business model?*

The goal of this question is to gather information on how companies cope with the following issues. The moment of sale is no longer the central point in value creation, as value is created throughout the lifespan of a product. Besides that, value is created in conjunction with other companies. So, how do companies arrange their revenue models? How is money made?

To answer the questions, Chapter 2 sets out the literature on the concept of circular economy and Chapter 3 sets out the literature on circular business models, this chapter also includes an attempt to critically review the concept of the circular economy. The literature discussed in Chapter 2 and 3 will be critically reviewed in Paragraph 5 of Chapter 3. These chapters have formed the basis of the research questions.

The details of the dataset and how it will be analysed to answer the research questions will be discussed in Chapter 4. Chapter 5 will present an extensive overview of the results of the analysis of the dataset and the research questions will be answered with these results. Chapter 6 brings forward the conclusion on what the answers actually mean for the practice of the circular economy, in other words, what has this thesis contributed to the knowledge of the circular economy and circular business models in practice. Chapter 6 also includes a discussion of some issues that emerged from the analysis. It will conclude with a number of limitations of this research.

## **2. Circular Economy**

This chapter will elaborate on the circular economy. First an introduction about the origins of circular economy is presented, followed by an overview of the definitions of circular economy and how the concept of circular economy has developed over time. This chapter then proceeds with explaining what the circular advantage exactly is and how a circular economy is build. Subsequently, it'll elaborate on what the current barriers are and on what the current state of the circular economy in practice is. Criticism on the concept of circular economy is quite rare among scientific literature, but that doesn't mean that it's not necessary to critically review the concept. This critical review will be discussed in chapter 3, after all the information on circular economy and its business models is presented.

### *2.1. Introducing Circular Economy*

As a way to overcome the current production and consumption model that is based on continuous growth and increasing resource throughput, increasing attention has been paid worldwide to the concept of circular economy (Ghisellini, Cialani, & Ulgiatie, 2016). The transition from a linear to a circular economy may be the biggest revolution and opportunity for how we organise productions and consumption in our global economy in 250 years (Lacy & Rutqvist, 2015). To introduce the concept of circular economy, first the origins of circular economy are debated followed by an explanation of what circular economy is and what its potential advantages are.

The origin of circular economy itself is debated, but the roots go back further than many people realize. In the late eighteenth century Thomas Malthus (1798) argued that continued population increases would eventually diminish the ability of the earth to feed itself. Other influential figures, like Hans Carl von Carlowitz (around 1713) and John Stuart Mill (in 1848) advanced theories around managing natural resources in a responsible manner. The interest in the topic from an environmental perspective began before 1900 with the first protests and efforts to conserve natural resources. Harold Hotelling was the first to write about the world's disappearing supplies of minerals, forests and other exhaustible assets in 1931, for that reason a regulation of exploitation was demanded. Many influential thinkers followed Hotelling's message: while profitable in the short term, the exploitation of abundant and cheap natural resources is not viable indefinitely (Lacy & Rutqvist, 2015, p.22).

The idea of circular material flows as an economic model was presented by Boulding in 1966. The actual term 'circular economy' itself is not mentioned in the literature until the 1980's according to two British environmental economists, Pearce and Turner (1990). They state that

the term was first used in the 1980's in the western literature, to describe a closed system of economy-environment interactions. Yuan, Bi & Moriguichi (2006) state that the concept of a circular economy originates from the industrial ecology paradigm, building on the notion of loop-closing emphasized in German and Swedish environmental policy, and Liu et al. (2009) claim that circular economy was originally a Chinese concept. The term 'circular economy' has been linked with a range of meanings and associations by different authors, but what they generally have in common is the concept of cyclical closed-loop systems (Murray, Skene, & Haynes, 2017).

Since the introduction of the circular economy as concept, there is an increasing number of institutions that seek to advance the adoption of circular economy principles such as the Ellen MacArthur Foundation, a charity primarily funded by a group of leading global companies and founded in 2009. The Ellen MacArthur Foundation's biggest goal is to accelerate the transition to a worldwide circular economy. Currently, the foundation has gained significant traction within the community of the World Economic Forum and Young Global Leaders. The United Nations also has been a major advocate, just as other influential non-governmental organisations like Oxfam International. (Lacy & Rutqvist, 2015, p. 23).

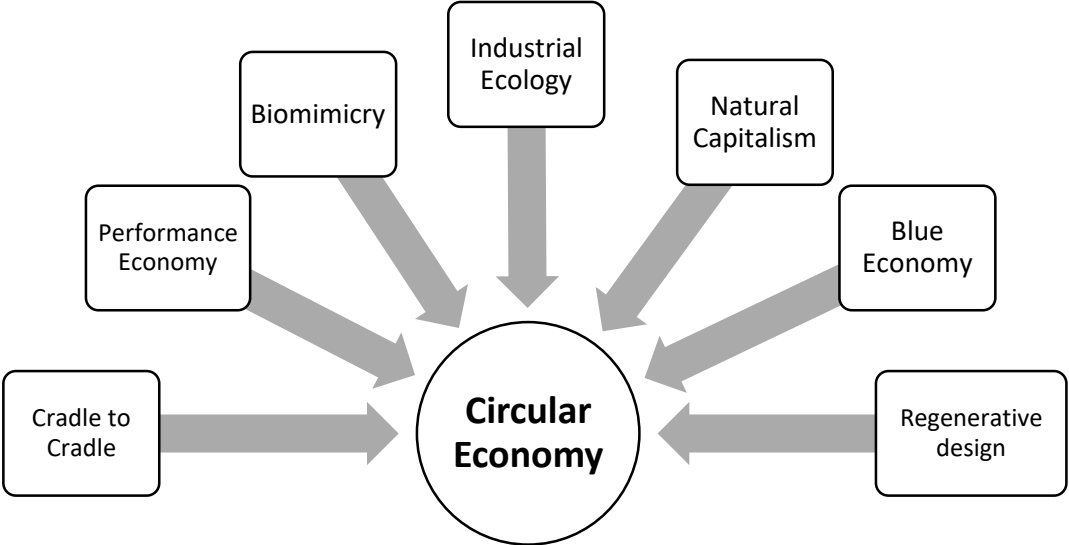


Figure 2. Schools of thoughts that have refined and developed the concept of circular economy.

The development of the term 'circular economy' can be described as a collaborative and iterative process over the course of many years (Lacy & Rutqvist, 2015, p. 23) because several efforts of eminent thinkers and economists have influenced the circular economy and have been instrumental in furthering the debate on strategic resource use. The Ellen MacArthur Foundation has retroactively acknowledged seven schools of thoughts that have refined and developed the generic concept of circular economy (see figure 2). In 1976, Stahel sketched the vision of an economy in loops and its impact on job creation, waste prevention, resource

savings, and economic competitiveness and in 2006 he published his book (first edition) of the idea of Performance Economy. A German chemist and an American architect, Braungart and McDonough, together developed the idea of Cradle to Cradle. Cradle to Cradle used the biological metabolism as a model for developing a technical metabolism flow of materials. Products can be designed for continuous recovery and reutilisation as nutrients within the technical metabolism. Another school of thought, developed by Benyus in 2002, is biomimicry, which can be seen as a new discipline that studies nature's best ideas and imitates these designs to solve human problems. Furthermore, industrial ecology (the study of material and energy flows through industrial systems), natural capitalism (refers to the world's stocks of natural assets), blue economy (an open-source movement bringing together concrete case studies), and the idea of a regenerative design developed by J.T. Lyle are schools of thought that are rooted in the circular economy.

## *2.2. Defining Circular Economy*

The circular economy has been linked with several meanings by different authors, but these authors generally link circular economy with the concept of cyclical closed-loop systems (Murray et al. 2017). When Pearce and Turner (1990) discussed the concept of circular economy, they pointed out the first law of thermodynamics, where total energy and matter remain equal in a closed system. This means that the current open-ended economy could be converted to a circular system considering the relationship between waste residuals and resource use, and also, it should be converted because of the existing environmental problems and resource scarcity. Pearce and Turner (1990) proposed circular economy as an economy in which a closed-loop of material flows exists. The concept has been developed by several authors. An overview of the different definitions of and perspectives on circular economy is presented in table 1 and will be elaborated on below.

Circular economy is seen as a mode of economic development based on the circulation of natural materials expected to lead to a more sustainable and a harmonious society (Feng and Yan, 2007). Circular economy is a sustainable development strategy aiming to improve the efficiency of materials and energy use (Su, Heshmati, Geng, & Yu, 2012). The Ellen MacArthur Foundation (2009) explains circular economy as an industrial model that is restorative and regenerative by design. It relies on system-wide innovation and aims to redefine products and services to design the waste out, while also minimising negative impacts. By emphasizing the transition to renewable energy sources, this circular economy builds social, natural, and economic capital.

Table 2.

*Different perspectives on, and definitions of circular economy.*

<b>Author</b>	<b>Definition of ‘Circular Economy’</b>	<b>Characteristics</b>
<i>Feng &amp; Yan (2007)</i>	‘A mode of development based on the circulation of natural materials to lead to a more sustainable and a harmonious society.’	<ul style="list-style-type: none"> <li>- Development mode</li> <li>- Material circulation</li> <li>- Sustainability</li> </ul>
<i>Su, Heshmati, Geng, &amp; Yu (2012)</i>	‘A sustainable development strategy aiming to improve the efficiency of materials and energy use.’	<ul style="list-style-type: none"> <li>- Development strategy</li> <li>- Sustainability</li> <li>- Improve material efficiency</li> </ul>
<i>Ellen MacArthur Foundation (2009)</i>	‘Restorative and regenerative industrial model that relies on innovation and aims to redefine products and services to design waste out, while minimising negative impacts.’	<ul style="list-style-type: none"> <li>- Restorative</li> <li>- Design out waste</li> <li>- Minimise negative impacts</li> </ul>
<i>Geissdoerfer et al. (2017)</i>	‘A regenerative system that minimises resource input, waste, emission, and energy leakage by closing loops.’	<ul style="list-style-type: none"> <li>- Regenerative system</li> <li>- Closing loops</li> </ul>
<i>Lacy &amp; Rutqvist (2015)</i>	‘Decouple economic growth from the extraction and consumption of natural resources and turn waste into wealth.’	<ul style="list-style-type: none"> <li>- Decoupling</li> <li>- Waste into wealth</li> </ul>

Based on different contributions, Geissdoerfer et al. (2017) defined the circular economy as ‘a regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance and repair, reuse, remanufacturing, refurbishing, and recycling’. Circular economy is not a more of the same approach, in the sense that is calling for increased implementation of “green technologies”. It requires a broader and much more comprehensive look at the design of radically alternative solutions, over the entire life cycle of any product as well as at the interaction between the process, the environment and the economy in which it is embedded (Geng et al. 2014), so that the regeneration is not only material or energy recovery, but instead becomes an improvement of the entire living and economic model (Ghisellini et al. 2016).

In a circular economy materials are reused and raw materials retain their physical characteristics and value as much as possible (Jonker, Stegeman & Faber, 2017). The aim is to keep components, materials and products at their highest value and utility at all times (Ellen

MacArthur Foundation, 2015). Companies that function according to the principles of circular economy no longer focus on driving more volume and minimizing cost through greater efficiency in factories, operations and supply chains. These companies prepare for inevitable resource constraints by concentrating on rethinking services and products from the bottom, to make their operations future proof, without lowering their value for the customers.

For companies it means that they decouple economic growth from the extraction and consumptions of constrained natural resources, like scarce resources with negative footprints, because over time, the dependency on these resources creates a competitive disadvantage. For businesses it's about turning trash into treasure, or waste into wealth (Lacy & Rutqvist, 2015, p 16). Lacy & Rutqvist estimated the economic growth potential on four different types of linear economy waste, when moving to a circular economy in the coming years (see figure 3):

(1) Wasted resources are materials or energy that can't be regenerated continuously, but are consumed and forever gone when used. By eliminating the use of these resources and introducing renewable energy and bio-based fuel, chemicals and materials an economic growth potential will be addressed. (2) Products with wasted lifecycles have short working lives even if there is still demand for them for other users. (3) Products with wasted capability sit idle unnecessarily. (4) Wasted embedded values are components, materials and energy that are not recovered from disposed products.

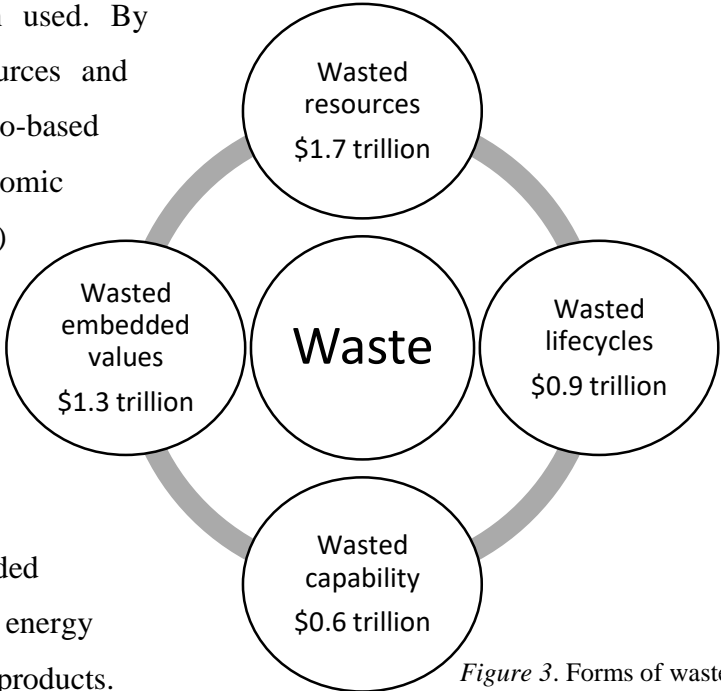


Figure 3. Forms of waste.

It is this waste that adds up to the biggest economic opportunity of our time, that also enables growing businesses without increasingly constraining Earth's natural resources because circular economy transforms raw materials dependent sectors to a future proof state, which eventually contributes to employment opportunities, environmental gains and energy saving (SER, 2015).

The circular economy can be seen from different perspectives and different authors bring different definitions. Table 1 presents a schematic overview of the different definitions with its characteristics. Based on different definitions and characteristics, an overarching definition of circular economy can be formulated. The definition that will be used in this thesis

is the following: 'Circular economy is an industrial model of development where the flow of materials is accommodated in closed loops, energy leakage is minimised, and waste is designed out of the products and processes. This makes the system regenerative and restorative by design.' All in all, circular economy looks like a promising concept, but what exactly is the circular advantage, and more importantly how is it created?

### *2.3. The Circular Advantage*

Lacy and Rutqvist (2015, p 29) sized the overall economic opportunity of circular economy cutting across nations and industries and including all types of waste. By simulating the global economy up to 2050, they expected that supply disruptions, price increases and volatility could cost the global economy \$4.5 trillion by 2030 and this cost rises to somewhere between \$10 trillion and \$40 trillion (worst-case scenario) by 2050. This means that business solutions that target and eliminate linear waste have a value opportunity of \$4.5 trillion by 2030. Additionally, the circular economy contributes positively to a balanced and simultaneous consideration of the economic, environmental, technological and social aspects of an economy, sector, or individual industrial process and the interaction among all these aspects (FAO, 2002; Ren et al, 2013; Birat, 2015; Ellen MacArthur Foundation, 2015). Circular economy deals with the explosive increase in resource demand, and the problems that come with it.

Lacy & Rutqvist (2015, p 24) mention another major advantage of the circular economy. Shifting from a linear to a circular model involves changing the supply logic, products need to be designed in a way that they can easily be recovered and recycled. But, although the supply-side is critical to the circular economy, the true power lies on the demand side. The main business driver in a circular model is how a company engages customers, what role they play during and after a product's use, and how they develop products and evolve resource requirements. Customers who expect companies to be responsible will gravitate toward circular companies. Goods and products produced with business models that are decoupled from constrained resource use are equal or better in quality than those made via the linear model because trading ownership of products for access to the products translates into greater convenience, little maintenance and repair concerns, and more money for the customers. But, maybe the most important part is that customers will feel a greater sense of loyalty and willingness to enter a longer-term relationship with circular businesses (Lacy & Rutqvist, 2015, p 25).

Because circular economy is presented as a promising solution to a myriad of problems, a logical question can be asked: why should companies make the transition now and why

haven't they made the transition say 50 years ago? Lacy & Rutqvist (2015) noticed that at the high level, there are three fundamental drivers of the circular economy. First, because the current economy does not leave enough resources for all forever, it brings resource constraints that are currently becoming more and more evident. Second, because nowadays the technological developments are so advanced, the circular economy is becoming more attractive and viable for businesses. And third, there is a socio-economic opportunity because circular economy not only enables inclusive growth by decoupling constrained resources from growth, it also empowers customers to maximize the value out of products and assets (Lacy & Rutqvist, 2015, p 18).

The question remains, why aren't all companies already actively engaging in the circular economy to gain the circular advantage? To address this issue, first, it has to be made clear what the building blocks of circular economy exactly are, and second, the barriers that block the transition to a circular economy have to be identified.

#### *2.4. Building Blocks and Barriers*

As mentioned previously, to make the transition to the circular economy, first it is essential to know where to make the transition to. So, where to start and what to change to build this new economy? Moreover, what are the building blocks of a circular economy? The Ellen MacArthur Foundation (2015) has identified four essential building blocks for the circular economy based on the experience of working with organisations that are making the transition towards a circular economy. These building blocks are widely accepted and supported (Planing, 2015). An elaboration on each of the building blocks, based on additional literature, will be presented in the following section.

The first is named '*circular economy design*', which is the idea that companies need to build core competencies in circular design to facilitate recycling, cascading and product reuse. A successful circular product design requires advanced skills, information sets, and working methods. The Ellen MacArthur Foundation (2015) mentions several areas that are important for economically successful circular design. These areas include material selection, designed-to-last products, and separation or reuse of products and materials. Without the right capabilities, a company may face high costs to recover and reprocess used goods. The most common mistakes are designing products for circularity, but not adding capabilities or partnerships for managing the end of a product life-cycle, or offering a life cycle service without having the capabilities and technology to add value to continuous customer engagement, or cannibalizing new sales by offering more durable products and being unable to provide related service-based

offerings as a new revenue stream (Lacy & Rutqvist, 2015, p 148). Five areas are especially affected by shifting to a circular business model, these areas need new capabilities to avoid the major risks and successfully make the transition to circular models. These areas are (1) strategy, where you have to manage complex and collaborative circular networks, (2) innovation and product development, where product design has to be adapted to products having many lifecycles and users, (3) sourcing and manufacturing, which means that a company must be able to source circular supplies in large enough volumes of good quality, and to manufacture while protecting the value and quality of resource inputs, (4) sales and product use, where companies have to embrace the concept of continuous customer engagement, and (5) return chains that focus on reverse logistics and return chains. More on those capabilities in the next chapter.

The second building block is called '*reverse cycles*', the idea of this building block is that new skills are needed for the final return of materials to the soil or back into the industrial production system with the goal to decrease the leakage of materials out of the system and, thus, support the circular economy design. A strong return chain can help to reduce costs by bringing back materials that have a lower cost to take back and reprocess compared to sourcing virgin alternatives. The ultimate goal underlying this principle is to keep resources at their highest possible value at all times, even at the end of a product life-cycle. For this it is also important to design a product for reuse, recycling, or component harvesting and to engage customers into bringing back products (Lacy & Rutqvist, 2015, p 165).

The third building block of the circular economy is '*enablers and favourable system conditions*' and refers to the conditions that are needed for widespread reuse of materials and higher resource productivity to become ordinary. This building block emphasizes the importance of the support of policy makers and educational institutions. Examples of these enablers include access to financing, providing a suitable set of international environmental rules and collaboration. Policy plays a critical role in the growth of circular economy, as Carlos Fadigas, CEO of Braskem, stated: "Business has always had to comply with rules, so if the rules change in the right direction, business will change". Lacy and Rutqvist (2015, p 169) combine three elements of a market policy that can stimulate the necessary mind-set and practices. These are (1) financial incentives for companies to prioritize resource productivity, (2) regulation to discourage the generation of waste, (3) information and physical infrastructure that facilitate circular resource flows.

The last building block is about creating innovative '*new business models*' that are required to operate in a circular economy. Business models that seize the opportunities that current business models view as waste. A complete chapter of this thesis is devoted to the

building block of new business models (chapter 3). A schematic overview of the building blocks can be found in figure 4.

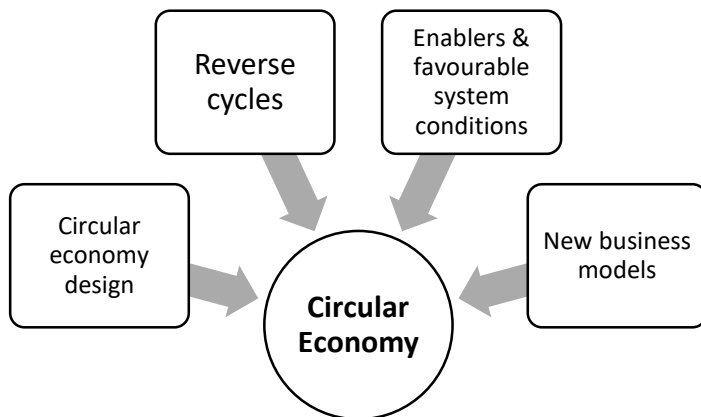


Figure 4. The building blocks of circular economy.

Although the transition to a circular economy is not the main focus of this thesis, this transition from a linear design to a circular design is an immense task and it is noteworthy mention the literature on how to make this transition. Jonker et al. (2017) introduced the ‘Cycles Ladder’, to break down the transition

in five realizable steps, where each phase describes a transformation in organising processes in accordance with the concept of closed loops. The first phase is referred to as *in-house circularity*, where an organisation ensures closure of cycles within the organisation itself. The second phase is referred to as *partial chain integration*, where an organisation shifts its focus to parts of the value chain in which several establishments are involved. The third phase, *material mono-flow cycle*, goes further with a fully closed cycle based on one specific material or resource. Organising the fourth phase is more complicated because there are several *inter-dependent mono-material cycles*. At the fifth stage a further inter-weaving of inter-locking complex cycles and systems is visible, which results in an *organisational-economic system*. In this phase the transition to circular economy has fully manifested itself.

Despite the growing base of support for the circular economy, several barriers can slow down the pace of change. Lacy & Rutqvist, (2015 p 168) mention inconsistent quality of recycled materials, value chains that rely on products to become obsolete, product designs that lack circular thinking, limited tools to track and control products throughout the value chain, a lack of good infrastructure to efficiently recover resources from markets, and linear ways of measuring and encouraging growth.

Rizos et al. (2015) elaborate on different barriers for small-medium-enterprises (SMEs) to embrace the circular economy. These include that, still, managers of SMEs may not have a positive attitude towards ‘green businesses. The extent to which SMEs are willing to adopt ‘green’ measures also depends on the sector in which they operate (Bradford & Fraser, 2007). Also, the cost of ‘green’ innovation and business models has been cited as one of the major barriers to the adoption of sustainability practices by SMEs (Lawrence et al. 2006; Trianni & Cango, 2012). The lack of government support and encouragement through effective legislation

is widely recognised as a barrier (Calogirou et al. 2010; Studer, Welford & Hils., 2006). Next to those barriers, the lack of knowledge about the benefits of circular economy (Rademaekers, Asaad, & Berg, 2011), the administrative burdens stemming from environmental legislation needed for the transition of SMEs to green business practices (OECD, 2010), the lack of technical skills (Iraldo, Testa, & Frey, 2010) and the lack of environmental awareness among suppliers and customers (Meqdadi, Johnsen, & Johnsen, 2012; Wooi & Zailani, 2010) are regarded as barriers.

### *2.5. Current State of the Circular Economy*

The Netherlands is one of the leaders when it comes to moving towards a circular economy, at present 78% of the waste is recycled, 19% is incinerated and only 3% is used for landfill (Cramer, 2014). But, while some progress has been made, the Netherlands still has some big steps to take if it desires to grasp the full potential of a circular economy, because high recycling rates alone aren't enough for circularity (Bastein et al. 2013).

The starting point for waste management in the Netherlands was a motion accepted in Parliament in 1979, which provided a hierarchy in the waste management approach, also known as the 'ladder van Lansink' (Now the 'ladder van Lansink 2.0'; Lansink & de Vries, 2010). It took more than ten years before policies on waste were developed for thirty priority waste streams. In the 21<sup>st</sup> century waste was more and more seen as a valuable resource that could be used for new products, but closing these loops was still quite a challenge. Cramer (2014) sets out the reasons for why closing these loops was such a challenge. The Netherlands had invested in incinerators to process waste, so to avoid stranded assets it took some time to close these incinerators. Furthermore, the circular economy requires both companies and consumers to separate their waste materials in ways that allows it to bring back materials into the material cycle. There are different forms of bringing back materials or retaining materials into the material cycle. For all these forms different provisions need to be created (CEO, 2016; Appendix A shows 9 forms of circularity, this figure is not undisputed and thus directed to the appendices, but it does give an overview of different forms on how to retain materials in a cycle). There are some front running businesses that aim at closing material cycles, but this does not happen on a large scale. Cramer (2014) also mentions legislation to have a hampering effect on the transition towards circularity in general, for example, EU legislations prohibits using waste as a resource under certain circumstances.

Worldwide, the circular economy has set foot to ground. But, according to a report of the Ellen MacArthur Foundation published in 2012, the circular economy is still in its

pioneering phase. The enormous opportunities of capturing value in a circular economy should stimulate pioneers to build a circular competitive advantage. But, for circular economy to go mainstream, more transformational action such as advancing the current taxation, regulatory and business environment to support the adoption of the circular economy is needed (Ellen MacArthur Foundation, 2012).

Circular economy is presented as a promising concept in economic, environmental and social terms and it is slowly gaining ground in the Netherlands and worldwide. Recycling becomes an increasingly economically viable option and new technologies enable the creation of a circular economy (CEO, 2016). But, there are still many obstacles to overcome to fully grasp the opportunities that a circular economy has to offer.

This chapter has presented an overview on the literature on circular economy. It can be stated that although the roots of circular economy go back several centuries, the concept of circular economy has developed only since the 80's of the previous century. This development can be seen as a process where authors have looked into the concept of circular economy from different perspectives. This results in definitions for the circular economy that vary from each other. The definitions differ in which aspect of a circular economy they emphasize. But, it can be concluded that they all refer to an industrial model where the flow of materials is accommodated in closed loops, energy leakage is minimised, and waste is designed out of the products and processes which makes the system regenerative and restorative by design. The Ellen MacArthur Foundation (2015) has identified the building blocks based on a similar definition of circular economy. These building blocks do make it easier to translate theory into practice.

This thesis will proceed with a chapter on a building block of the circular economy: circular business models. The main research question is about how companies are building their business models for the circular economy. So, logically, first all the relevant literature on circular business models will be discussed.

### **3. Business Models for the Circular Economy**

This chapter will start with a short introduction on business models and then proceed to elaborate the difference between business models in the current linear economy and business models for the circular economy. Chapter 3 then proceeds with elaborating on how circular business models are composed and what competences and technologies are required for circular business models. After all the literature on the circular economy and circular business models is discussed, a critical review will be presented. It will turn out that the literature is quite positive about the circular economy as an idea, but it is also relevant to identify potential downsides of the circular economy. This chapter will end with a synthesis on the first 3 chapters and a further elaboration on the main goal of this thesis, introduced in Chapter 1.

#### *3.1. Introducing Business Models*

Business models define the way a firm does business (Magretta, 2002), it is a description of the way in which creation of value is organised between parties. Choices about the business model define the architecture of a company, but once established, companies often encounter great difficulty in changing business models (Teece, 2010). Companies often have limited capability to innovate the business models they use (Chesbrough, 2010). This leads to a dominant business model logic which can lead firms to miss valuable uses of an innovation (Prahalad & Bettis, 1995).

Moving to a business model for the circular economy can be seen as a radical change, which will require a new way of thinking and doing business (Bocken et al. 2016). The way a firm captures value in a circular business model is different than in a linear business model. The more radical the innovation, the more challenging and the greater the likelihood that changes are required to the current business model (Lofthouse & Bhamra (2007). This means that for the transition to a circular economy, companies face a challenging radical change of their business model.

Companies will encounter complicated issues in the transition to circular business models, issues regarding from the fact that a new economy has to emerge from the current linear economy, while this linear economy fundamentally differs from the circular economy. But, as mentioned before, the focus of this thesis is not on how to make this transition, it is on where to make the transition to. The questions answered in this chapter will be about what business models for a circular economy should look like and how they differ from the current business models.

### *3.2. From Linear to Circular*

The circular economy decouples growth from the use of scarce resources through disruptive technology, and through business models that are based on longevity, renewability, repair, reuse, upgrade, capacity sharing, refurbishment and dematerialization (Accenture, 2017). Central concepts in circular business models are cooperation and value creation between parties in chains and networks (Jonker et al. 2017). In a circular economy waste does not exist and resource loops are closed. So, a company doesn't just sell resources it regards as waste to a company that regards those resources as input, both companies also need each other to arrive at a cycle of successive moments of value creation (Jonker et al. 2017). This requires the transition from an organisation-centric perspective to a network-centric perspective created by companies that collectively aim to close a loop. So, circular business models are about creating value together and sharing this together now or over time based on reusing or remanufacturing materials and products. It means working on a cooperative manner where companies create value over time and on the basis of multiple transactions with the same materials or products instead of the current competition model where volume and price are the key-elements and the moment of transaction is the only interesting element for value creation.

This cooperative manner of doing business leads to a revision of the logic of value creation, the central idea of business models. As the network-centric perspective suggests, in circular economy value creation becomes an inter-organisational task. Based on a number of case studies, Jonker et al. (2017) found three features that are repeatedly present in circular business models. The first one is closing raw material chains, which means that in a circular business model it is desired to use or reuse materials as long as possible, when waste is a raw material it can be used again. The second feature is a shift to services replacing ownership, which means that manufacturers retain responsibility of the materials of products throughout the life cycle. This also means that they develop an interest in the development of long-lasting materials for the products. The last feature is about the utilization of products. A product that consists of components should be designed in a way that it can easily be disassembled so all parts can easily be used as parts of a new product.

As the circular economy stimulates business models that facilitate working with closed loops and sharing collectively created value together, it is in conflict with the current business models that are entirely based on the linear economy and follow the 'input-throughput-output' logic. The new business models will need to formulate an answer to ensure the accountability for the life cycle of manufactured products after the production, to eventually minimize material leakage.

### 3.3. Circular Business Models

The unique point of a circular business model is that it creates value by using the blind spots of the current linear system (Jonker et al. 2017). The leakage of materials via production, use and waste is the foundation of value creation in a circular business model, with ecological value being created at the same time. In the circular economy there're four areas of value creation that have been identified

(Accenture, 2017; see figure 5).

First, by using only resources that can be continuously regenerated the link between resource scarcity and economic activity can be broken. Second, by eliminating idle time of products and increasing the number of users that gain benefit from the same volume of goods, value can be created. Accenture

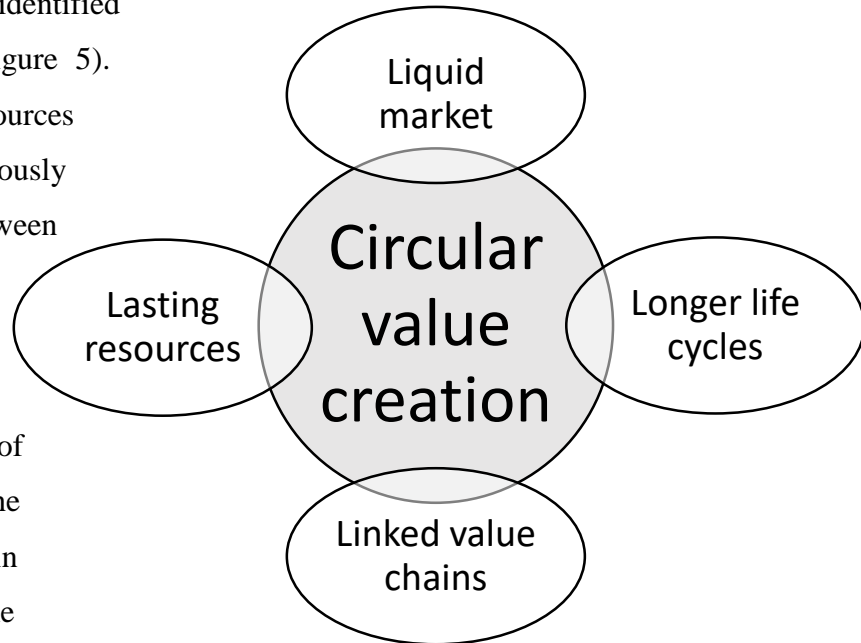


Figure 5. Four areas of value creation in the circular economy.

be created.

Accenture (2017) calls this a liquid market. Third, by designing products to last, a greater demand can be satisfied without needing additional natural resources. Lastly, by minimizing the resource value destruction in a value chain, value can be retained. By reclaiming and linking up waste outputs as inputs in a next life production process value can be created. Circular business models should focus on achieving benefits in these four areas of value creation.

This idea of value creation together with the three features identified by Jonker et al. (2017), which are closing raw material chains, services replacing ownerships, and a more intensive use of functionality, can be translated into five generic building blocks of circular business models.

The first building block is creating cycles. Closing (material) cycles in the production process and in the life cycle of a product is the core concept of a circular economy. The idea of closing loops is that waste can be used as a resource again. Closing cycles can be accomplished within an individual organisation or together with other organisations in the value chain, where for example the waste of one organisation is the input for the other organisation. How many companies are needed for closing a cycle may differ per cycle, also the timespan of closing the

cycle may substantially differ, this depends on the content of the cycle. In a circular economy the central idea is that the main activity of a business revolves around closing cycles. Although a distinction can be made between biological nutrients or technical components of a products, the concept of closing loops applies to both. The technical components of a thrown away cell phone, as well as cow dung should be accommodated into a loop. But, closing loops is not always possible, this will be elaborated on later on in this chapter.

The second building block is striving for value creation. The idea is that operating according to the principles of circular economy results in more than just financial value. Value creation in circular economy is also about social and ecological value. Just closing loops without achieving sustainable profit in the process doesn't qualify. Multiple value has to be created to contribute to an economy that operates within the boundaries of this planet, which is the aim of circular economy.

The third building block is selecting a suitable strategy, which basically means that being successful with a circular economy requires a clear strategy on how to organise the circular enterprise. An important aspect of strategy in circular economy is that the moment of the sale of the product is no longer a central aspect in the value creation. Instead, the delivery of added value throughout the lifespan of a product is a central aspect. Because of that, it is necessary to building a longer-term relationship with the customers for one product.

The fourth building block is designing an organisation that accords with organising between parties. The idea is that not a single business is able to operate in a circular manner all alone. In a circular economy organisations require to work together with partners in chains and networks. This also means that creating multiple value is done in conjunction with other partners.

The fifth building block is developing revenue models. As stated in the strategy, the moment of sale of a product is no longer central in the value creation, turnover is achieved over time, and also by extensively

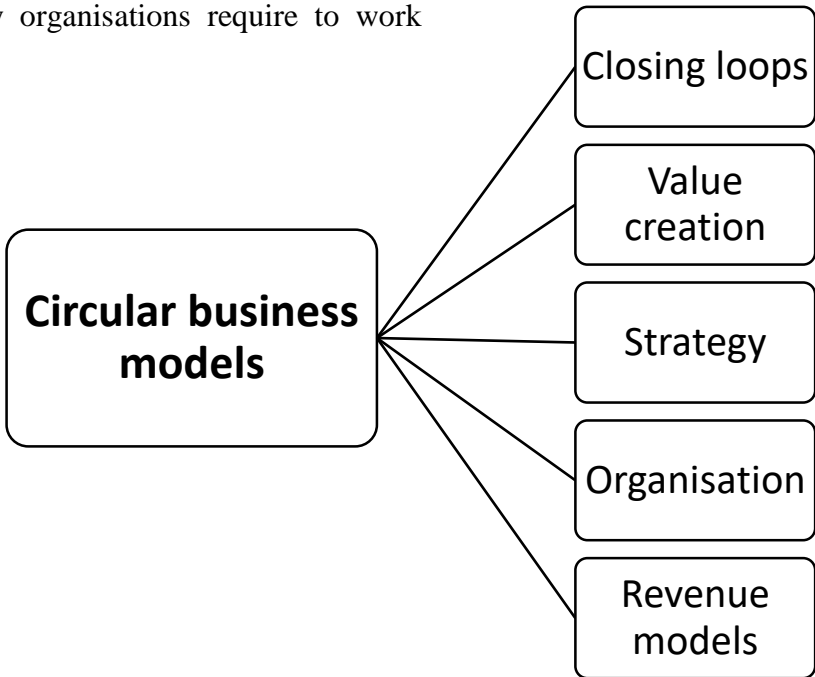


Figure 6. The building blocks of circular business models.

cooperating with other partners in the value chain or network, value is created jointly and so is the revenue. A schematic overview of these building blocks can be found in figure 6.

Lately, various studies on business models for the circular economy have appeared. In their analysis of more than 120 case studies of companies that are generating resources productivity improvements, Accenture (2017) was able to identify five aspects of business models that can help companies to achieve resource productivity gains. These five models can be used singly or in combination and can also enhance differentiation and customer value, reduce cost to serve and own, generate new revenue, and reduce risk (Accenture, 2017).

The models are (1) Circular supplies, provide fully renewable, biodegradable or recyclable resource inputs for circular productions and consumption systems. (2) Resource recovery enables a company to eliminate the leakage of material and thus fully utilize the products. This includes the recovery of embedded value when a product is at the end of its lifecycle. (3) Product life extension allows companies to extend the lifecycle of products and assets and capture value that would otherwise be lost as waste. Value that would otherwise be lost through waste, can be maintained by repairing, remanufacturing, upgrading or remarketing products. (4) Sharing platforms promote collaboration among product users, either organisations or individuals, this facilitates the sharing of underutilization or overcapacity which increases the productivity and user value creation. (5) Product as a services provides an alternative to the 'buy and own' model, products are used through a lease or pay-for-use arrangement by one or many customers.

#### *3.4. Technology and Capabilities for Circular Business Models*

Embracing the circular economy requires major changes in how companies operate, and this will have substantial effects across an organisation. And although new business models offer companies powerful options for embracing the circular economy, it would not be possible to scale many of these business models without the support of innovative technologies. Digital technologies such as mobile technology, machine-to-machine communication, cloud computing, social media and big data analytics, allow real-time information exchanges among users, machines and management systems.

Digital technologies can transform value chains so they no longer need additional resources to grow (Lacy & Rutqvist, 2015, p. 132). Engineering technologies such as modular design technology, advanced recycling technology, and life and material sciences technology, are key to effectively deploying circular business models. Engineering technologies allow new goods to be manufactured from regenerated resources and offer cost-effective solutions for

processing, collecting and returning materials and goods for recycling and remanufacturing (Lacy & Rutqvist, 2015. p 140). Hybrid technologies are a combination of digital and engineering technologies, such as trace and return systems and 3D printing. These technologies allow a company to digitally identify the history, location, status, and application of materials and goods while also supporting ways to physically manage, collect, treat, and reprocess them (Lacy & Rutqvist, 2015, p 144). The same technology categories (digital, hybrid, and engineering) have been identified by Accenture (2017).

As important as technologies are to implementing circular business models, the success of these models hinges on the capabilities that support the new ways of working. There are typically five areas that require new capabilities for companies to successfully make the transition to circular models and avoid major risks (Lacy & Rutqvist, 2015; Accenture, 2017). An overview of the areas of technology and the capabilities that need to be developed to properly work in a circular manner can be found in table 2. The capabilities are discussed below.

Table 3.

*Technologies and capabilities for the circular economy.*

Sort of development	Specific area
<i>Technology</i>	Digital
	Hybrid
	Engineering
<i>Capabilities</i>	Business planning
	Innovation and product development
	Sourcing and manufacturing
	Sales and marketing
	Reverse logistics

The first capability discussed is about strategy and business planning. Operating in a circular manner requires a significant change for this particular capability. The focus shifts from maximizing throughput and sales margin to boosting revenue by participating in continuous service and product loops. Companies are required to participate in collaborative circular networks by engaging customers, service suppliers, retailers, manufacturers and suppliers to succeed. It’s all about managing complex and collaborative circular networks.

The second capability is about innovation and product development. In a circular economy products need to be designed for many lifecycles and users and the environmental effects of the used materials need to be optimized. The products need to be adapted to generate revenues during use instead of only at the point of sale and adaptation to stimulate low-cost return chains and reprocessing are key design challenges.

The third capability is about sourcing and manufacturing. In circular business models companies need to consider if certain material inputs for products are fully restorable or renewable, and what the environmental footprint and toxicity of these materials is. For the manufacturing part the companies have to make sure that the production is efficient and that no resources are lost during the production process. Also, it is important that companies are able to significantly scale up and maintain sourcing volumes from return chains.

The fourth capability is on the customer-facing side, it is about sales and marketing. Companies have to focus on generating greater revenues from services and the use of products instead of customers' purchases. Companies have to combine this with new ways to incentivize customers to dispose their products properly after use. Circular business models require companies to become highly involved in the use and disposal of products. In a circular economy the sales and marketing are all about understanding the use phase of products and using this information to adapt products and services for circular use.

Holding the entire loop together at the end of the process, are the reverse logistics and return chains. The fifth capability is about reducing the costs of logistics and waste management and retaining customers with good return programs. The return programs are followed by quality control and determining the optimal reprocessing chain. These five capabilities are similar to the five capabilities identified by Accenture (2017).

### *3.5. A Critical Review*

The concept of circular economy as it is being portrayed by its supporters is exciting, it is presented as the best way of transforming the economy into a regenerative economic system that is able to exist within the limits of our planet. This is an attractive and idealistic proposition, and such a proposition requires critical reviewing. But, it is surprisingly difficult to find critical reflections on the concept of circular economy. Besides the idealistic proposition, the supporters of circular economy also submit the concept as the new way of organising the economy worldwide. This makes it even more remarkable that the concept of circular economy seems to almost completely lack a critical reflection. Based analytical thinking and some critical articles, an attempt to create a critical reflection on the concept of circular economy is made. But also

in the discussion chapter of this thesis, attention will be paid to criticism on the circular economy and the circular business models, that criticism will be based on this research.

First of all, circular economy is all about closing material loops. But, to what extent is it possible to reuse raw materials over and over again? While glass and plastic theoretically can be recycled indefinitely, other materials can't. The recycling logo, the three arrows going around in an endless loop, does not hold for all materials. Examples of such materials are paper or textile. On average a piece of paper can be recycled five to six times, the maximum amount of recycling a piece of paper is set on 8 (based on numbers of the Environmental Protection Agency). There are also some notable limitations on recycling textile. Textile is usually made of raw fibres of wool, cotton, flax or hemp. It is estimated by the VHT (2013, Dutch Association of Recycling Textile) that 5% to 8% of used textiles is waste and cannot be recycled. The final destination of these textiles is the incinerator. So, even if all paper or textile would be used for recycling, the material loops of paper and textile aren't closed, which makes the lifecycles of these materials finite.

Second, some materials are partially or completely suitable for recycling, but there are also materials, products or other commodities where the circular principles can't be applied to. For example, when going to a restaurant and ordering a dish, once consumed, the lifecycle of those products have come to an end. Leftover food can be turned into energy by using a digester to turn food waste into biogas. But, it is naturally not possible to reuse or recycle consumed food. Another example is energy, once energy is used it can't be recycled or refurbished in to new energy. Energy that lights up a lamp is used and then 'lost' as heat. This reveals the boundaries of the circular economy. Circular economy is not suitable for every situation or domain. Therefore, the circular economy should have evident boundaries to make clear in what domain circular economy can flourish and also in what domain it can't succeed. Instead of proposing the circular economy as the new world economy, proponents of the circular economy should be more specific in providing the useful circular principles for the suitable domains.

Third, material recycling is (almost without exception) assumed to benefit the environment. However, the energy inputs and material losses related to recycling in practice can usurp its environmental benefits (Cullen, 2017). For example, by mass, concrete is the most abundant industrial material. The perceived resources savings by recycling concrete by crushing it to use as aggregate in new concrete, are offset by the extra energy that is required to process a material that is of lower quality than when virgin cement is used. Although energy inputs can be derived from renewable energy sources, currently these renewable sources of energy only contribute for approximately 5% to our primary energy supply (Cullen, 2017). Then, there are

also materials that are currently very expensive to recycle, such as certain metals that are used in electronics, and there might even be materials for which we currently do not possess the technology or know-how to recycle them.

These arguments raise a fourth issue that needs to be addressed is: is the circular economy enough for the growing resource demand? The reduction of natural resources used per percentage of growth, or in other words, a relative decoupling of economic growth from the use of natural resources, is not sufficient to address the resource scarcity issue according to Tim Jackson (2017). Jackson (2017) introduced the myth of decoupling, where it is vital to distinguish between ‘relative’ (doing more with less) and ‘absolute’ decoupling. If fewer resources are used to produce one unit, but the production volume keeps on increasing, the absolute impact the production has on natural resources will continue to increase even if the relative impact decreases. This is also referred to as the circular economy rebound. One of the few critical articles on circular economy is published by Zink and Geyer (2017), who state that circular economy proponents have tended to view the world from a purely engineering system perspective, which caused them to overlook the economic part of the circular economy. The core concept of closing material loops to preserve products, parts, and materials should prevent primary production, but Zink and Geyer (2017) argue that circular activities can increase overall production which can offset their benefits. This effect is called the circular economy rebound, which occurs when circular activities cause increased levels of production, and thus reduce the benefits, even though the per-unit-production impacts are lower in circular activities. An evident example is the virtualization of media delivery, the video-on-demand has lower per-use impacts than physical video delivery but it has also increased the consumption of video content tremendously (Walgrave, 2015).

There are two mechanisms identified by Zink and Geyer (2017) by which secondary production can lead to rebound. First, the secondary goods may be insufficient substitutes for primary goods because they are less desirable to users or of inferior quality to primary goods. For example, smartphones that have been refurbished rarely compete in the same market with primary smartphones. The second mechanism happens when secondary production activity impacts prices. Because of the lower quality of some secondary materials, the goods are sold with a discount compared to the primary materials. Downstream producers that work with secondary materials are relatively wealthier (the income effect) and can purchase more secondary materials and make more products than before. Eventually, they make more products of lower quality that will need to be sold at a discount to end users. As a result, more goods are now produced, sold, and used. It is argued that the substitute and income effect are hard to

tackle, because the strategies to avoid circular economy rebound are unlikely to be attractive for profit firms.

Two important notions can be deduced from this critical review on the circular economy. First, while the circular economy is gaining its momentum, there are authors that question if circular economy really is the game changer it pretends to be (Holemans, 2016). It is worrying that certain companies claim to accelerate the transition towards circularity, receive prizes for their considerable efforts and achievements, and simultaneously rely upon a system of endless consumption and economic growth (Holemans, 2016). This raises the question if in practice, companies are really looking in the same direction and pushing for the same transition as the theoretical concept of circular economy intends to. Besides that, the circular economy is a promising opportunity for improving a more sustainable use of limited resources, by providing a framework to do more with less. But it fails to ask the question, why we need more in the first place.

Second, when circular economy is presented as a practical reality, without a careful explanation of its limits and the circumstances under which it can succeed, the circular economy is just repackaging the principles of industrial ecology in a reductive manner, potentially misleading consumers and stakeholders (Cullen, 2017). Circular economy proponents often fail to consider the issue of material losses and the need for additional energy input to sustain circularity, to the extent that the circular solution merely shifts the impact from the resources to the energy domain. And aside from implicit assumptions about renewable energy sources, this is a domain where the circular economy offers little insight (Cullen, 2017).

### *3.6. Literature Synthesis*

This paragraph provides a synthesis of the first three chapters. The most important matters that have been discussed in the previous chapters will be combined in order to draw conclusions on this theoretical section. This will eventually direct the research questions of this thesis.

The first chapter has emphasized the explosive increase in resource demand and the global threat of climate change. It has elaborated on the current linear growth model, which is the term that is used to describe how our current world economy operates. The take-make-dispose model is simply no longer feasible, because the earth's resources are limited, and so is its ability to absorb waste. An important factor in the creation of this problem is the linear growth model. This model isn't suitable for the increasing resource demand, and continuing to operate according to this model will almost certainly cause the earth to run out of resources.

So, it is proposed that the world should make a transition to a more sustainable model, a model that is able to cope with the increasing resource demand. This model should be more efficient in the sense that resources are fully utilized and waste is reduced as much as possible. By closing resource loops to make sure that no resources are lost as waste, the circular economy is presented as an economic model which enables the world economy to operate within the boundaries of our planet. This concept has a broad theoretical foundation and is based on multiple schools of thought (figure 2). The theoretical development of the concept of circular economy has started in the 1980s, and over the years its process of development has been collaborative and iterative, resulting in circular economy being the refined theoretical concept as it is described in Chapter 2.

So far, it makes sense a new economic model is required to use the scarce resources on this planet more efficiently. But, based on the literature above, a careful conclusion can be drawn that the implementation of the circular economy in practice falls far behind compared to the theoretical development. The state of the circular economy as it emerges from a pilot study of Jonker et al. (2017) shows a sober reality which is confirmed in Chapter 2 of this thesis. Circular economy in practice does not reflect the refined theoretical concept of the circular economy. Although there is a loud debate about sustainability together with a growing base of support for the circular economy within organisations, a remarkable gap between the theory and practice of the circular economy exists. And this doesn't make sense, as the refined concept of circular economy is presented as the solution for a resource scarcity threat that can affect almost all companies that work with raw materials in the near future. So, why does this gap exist? It is this gap that offers opportunities for research, and it is also this gap that has given rise to the critics on the concept of circular economy.

Although there hasn't been much criticism (yet) on the concept of circular economy, there are some noteworthy limitations that have to be taken into account when companies try to embrace the principles of the circular economy. The circular economy is not suitable on all domains of the world economy, not all materials can be recycled or reused and for most materials it is impossible to completely close the material loop. To this day, most products aren't designed to be efficiently remanufactured when they return from being used to a company, and even worse, most products don't even return to the company. It might be a costly and technologically challenging process to redesign products to easily extract the components and to create the provisions for products to return to the company.

One might wonder if the circular economy is the way to go for the future, cause if we make a shift to a new economic model, shouldn't it tackle the problem at its source? Meaning

that it should focus on reducing the extreme resource demand instead of stimulating an ever growing resource demand and just become more efficient in dealing with it. But still, the circular economy deserves a change in practice, because to ensure that circular economy won't be misused as concept, it is important to carefully explain the limits of the circular economy, together with the circumstances under which it can succeed. A practical realistic concept has to be developed. Because above all, without the composition of a practically realistic circular economy, the theoretical concept of circular economy might just be another trend that will soon go out of fashion.

For a circular economy to be successful, its participants, the companies, have to operate according to the circular principles. The way companies operate is described in a business model. More specifically, a business model is the way a company creates value, and this radically changes when shifting from a linear to a circular business model. Circular business models create value by using the blind spot of the current linear system. By minimizing the leakage of materials via production, use, and waste, a circular business model creates value for the business together with ecological value.

The current phase of the circular economy is described as the pioneering phase by the Ellen MacArthur Foundation (2012). It refers to a phase where the first companies, the circular pioneers, are trying to implement the circular principles or where existing companies with circular business models emerge. These circular pioneers are building or adapting their business models to operate according to these circular principles and for this adaptation companies have to rethink and recreate the way they create value in their company. This process is considered to be very challenging. All the more reasons to find out how the circular pioneers are building their circular business models and thus, how they are creating value while operating in a circular manner.

These circular pioneers are the population of this research. They are the first that are shifting from linear to circular business models or composing a circular business model from scratch, in other words, they are the first to accept the challenge of translating the theory of circular economy into practice. When addressing the gap between theory and practice, logically, the circular pioneers are the biggest source of information about this gap. But what is it, we exactly want to know from these companies? The next part will elaborate on and elucidate the research question. An overview of the main research question, and the sub-questions can be found in table 3.

From here, this thesis will proceed with a methodological reflection on how to analyse the data and why this method is chosen to answer these questions.

## **4. Methodology**

This chapter concerns the research design and data analysis of the study that has been conducted. First it'll be made clear how the research questions will be answered and the chosen research design will be justified. Subsequently, the dataset will be discussed. The dataset exists out of 69 interview reports that have been written based on interviews with 69 different companies. Paragraph two will elaborate on how the interviews have been conducted and translated into interview report. Afterwards, a thorough explanation of the data analysis will be given and finally research ethics will be discussed and a quality assessment is presented.

### *4.1. Research Design*

The main goal of this research is understand how the circular economy, and more specifically, how circular business models are working out in practice. Moreover, this study aims to clarify how the circular pioneers are creating value while embracing the circular principles. An extensive analysis of 69 interview reports has been performed in order to achieve results that create a broad image of circular business models in practice. In addition, the exploratory nature of this study provided the opportunity view the circular economy from a practical perspective, without the guidance of strong theoretical expectations. Exploratory research is most appropriate for this study, due to the active search for patterns that explain the investigated phenomenon.

The main research question is: how are companies currently composing their business models for the circular economy? This type of question gives the researcher space to answer with an extensive description of patterns or processes that are relevant for this case. These patterns can only be found through qualitative research. The idea of this research is that organisations talk about the circular economy from their own perspective and convictions. Only then it is possible to learn how companies are composing their circular business models in practice. Quantitative research methods are not suitable for this research question because quantitative research methods aim to answer narrow research questions that can be answered with yes or no. Also, they don't give the opportunity to discover patterns that weren't thought of before, because it doesn't allow companies to talk about their circular business models from their perspective. This makes quantitative research methods unsuitable for this study.

With qualitative research, companies can give their own significance or meaning to the circular economy and their business models. Companies are given space to elaborate on what they find important with regards to circular business models. Qualitative research provides a method to understand the process of composing circular business models in practice within

different companies by providing answers to questions like ‘how’ and ‘why’ (Eisenhardt, 1989). This is desired for this research and it would not be possible in a quantitative research. Altogether, the present research question is ideally suitable for qualitative research (Bleijenbergh, 2015). From here, this chapter will proceed with describing the details of the dataset. Subsequently, the procedure of the analysis will be carefully described. This chapter will conclude with a paragraph on research ethics and quality assessment.

#### *4.2. Data*

The data used for this research solely stems from semi-structured interviews. The data has been collected by a number of students who conducted 69 semi-structured interviews with companies about circular business models. The 69 interviews have been gathered in two studies. In a pilot study, 36 interviews have been conducted with companies that were engaging in circular activities. In a follow-up study, 33 interviews have been conducted with more carefully selected companies based on their activity regarding circular business models. An overview of the participating companies with a short description can be found in appendix B.

The students have been instructed in advance on how to conduct the interviews. The interviews were semi-structured, but had an open character, meaning that there was a possibility to discuss certain topics more profound when deemed necessary. To structure the interviews, a predetermined interview protocol has been used. The interview protocol for the pilot study and the follow-up study slightly differ from each other, but they are both based on the five building blocks of circular business models, (1) closed loops, (2) value creation, (3) strategy, (4) organisation, and (5) revenue models and they both include a questions about the circular economy in general. The main difference is that the interview protocol for the follow-up study mentions these building blocks more explicitly. The interview protocols can be found in appendix C and appendix D (in Dutch).

All students followed on of the two interview protocols while conducting the interviews, also, the interviews have been recorded with permission of the interviewees. The contact details and recordings are treated confidentially. For every interview, the interviewer wrote an interview report of 1200 to 1500 words. The recordings have been used to write these reports. The reports are a summary of the interviews and contain the answers of all the questions that have been asked. The reports have been compiled in way that the most salient answers are elaborated on the most. The interview reports follow the structure of the interview protocol and thus use the building blocks of circular business models to structure the report. The reports have been written within 48 hours after conducting the interview, and the interviewee had the

opportunity to make adjustments or contributions to this interview report. With the approval of the interviewee, the report can be used for further research. Finally, this resulted in a dataset containing 69 reports that been made and structured in identical ways, this makes the dataset suitable for a content analysis. The procedure of the content analysis will be elaborated on in Paragraph 3 of this chapter.

It should also be mentioned that for this thesis, only the interview reports have been used and not the verbatim of the interviews as they were not available for the researcher. This could lead to ambiguity concerning the context of certain citations and this has to be taken into account when interpreting these citations.

As mentioned, the data is collected by other students, so it can be considered as a secondary dataset. This brings several advantages and disadvantages. When interpreting the data, it is important to take into account that there is limited population control in a secondary dataset, just as there is limited information about the data set, and the context in which the data was collected may not always be clear (Fielding, 2004). Also, because the dataset exists only of interview reports, there is no triangulation of sources. Other qualitative methods of data collection (observations and documents) didn't fit within the framework of this thesis. These limitations have to be taken into account when analysing the data and when drawing conclusions from the analysis.

But on the other hand, the rich dataset consists of 69 interview reports, which would have taken a lot of time to collect and transcribe. So, using this rich dataset has saved a lot of time for the researcher, and led to saturation of the data. The secondary dataset has given access to a large number of companies that would otherwise be an enormous activity to access. A common argument in qualitative research is also that an analysis is more convincing when there is less interaction between the population of the study and the researcher (Fielding, 2004), and in this case there is no interaction between the studied population and the researcher at all.

But the fact is that the data has been collected and put into a report by others. It is a matter of trust that this is done on a professional way by the students. Thus, an assumption of this study is that the collected data has been translated into an interview report in a professional and reliable way by the students that have been selected by Professor Jonker.

The circular pioneers that cooperated with this research, cooperated on a random base. Consequently, this results in a diverse data set where companies differ from each other in numerous ways. They differ in the activities they execute, some companies operate in a business to business manner, and others operate in a business to consumer manner. The organisations also operate in different sectors, work with different materials or offer different services, differ

in size and location and the organisations are in different stages regarding the extent to which they operate according to the circular principles. This results in a heterogeneous data set with a lot of information about lots of different situations, which can also be seen as a limitation of this data set, it is not specific at all. It takes into account all situations, all companies and every company has its own way of working and follows its own idea of the concept of circular economy and circular business models. When analysing the data, this has to be taken into account.

#### *4.3. Analysis*

Data analysis implies the systematic search and categorisation of the data to create and find patterns in the data (Boeijs, 2005). A content analysis is systematic and can be applied to huge quantities of data when the data is well documented, this makes a content analysis suitable to the current dataset. The only relevant weakness of a content analysis is that separating units of analysis by coding them could lead to inaccuracy when interpreting the data, as citations without a context could be misleading (Kracauer, 1952). This is dealt with by always trying to clarify the context of each citations when it is used to answer the research questions.

There are two forms of qualitative content analysis that fundamentally differ from each other. On the one hand: a deductive approach of content analysis. Characteristic for this approach is that strong theoretical expectations guide the analysis. On the other hand: an inductive approach. The starting point of this approach is that the researcher performs a content analysis without (strong) guidance of any theoretical expectations about the phenomenon. In this case, the content analysis will not be guided by strong theoretical expectations, because the perspective in this research is not from theory, it's from practice. This makes this research fundamentally explorative and the qualitative content analysis will be performed through an inductive approach. Meaning that the empirical material will be analysed without the guidance of strong theoretical expectations about the circular economy and business models. In accordance with the inductive nature, this research does not start with hypotheses or preconceived notions. It involves an attempt to discover, understand, and interpret what organisations have to say about circular business models in practice.

To sensitize to more fruitful lines of inquiry, sensitizing concepts are formulated. The aim of the analysis is to answer the sub-questions, and subsequently, to answer the main research question. Logically, the sensitizing concepts are derived from these sub-questions (table 3) and the sub-questions are formulated based on the literature, as explained in Chapter 3 Paragraph 6 (see table 4 for a graphic overview. Sensitizing concepts (originally introduced

Table 4.

*Schematic overview of the sub-questions, themes, & sensitizing concepts.*

1	<b>Sub-question</b>	<i>What does the concept of circular economy constitute according to companies?</i>					
	<b>Theme</b>	<b>Practical definition</b>					
2	<b>Sub-question</b>	<i>What challenges do circular pioneers encounter when embracing the circular economy?</i>					
	<b>Theme</b>	<b>Challenges</b>					
	<b>Sensitizing Concepts</b>	Financial barriers	Policy barriers	Organising barriers	Circular boosts	Awareness	Reason
3	<b>Sub-question</b>	<i>How do companies work with the concept of closing loops?</i>					
	<b>Theme</b>	<b>Closing loops</b>					
	<b>Sensitizing Concepts</b>	Reuse	Raw materials	Products	Reverse cycles	Chain management	
4	<b>Sub-question</b>	<i>How do companies create value with a circular business model?</i>					
	<b>Theme</b>	<b>Circular value creation</b>					
	<b>Sensitizing Concepts</b>	Financial value		Ecological value	Social value	Societal value	
5	<b>Sub-question</b>	<i>How do companies align their strategy with a circular business model?</i>					
	<b>Theme</b>	<b>Circular strategy</b>					
	<b>Sensitizing Concepts</b>	Goal setting	Customer relationship	Competitive advantage	Focus	Geographic scope	Temporal scope
6	<b>Sub-question</b>	<i>How do companies organise their circular business model?</i>					
	<b>Theme</b>	<b>Organisation</b>					
	<b>Sensitizing Concepts</b>	Cooperation	Reorganisation	Partnerships	Knowledge		
7	<b>Sub-question</b>	<i>How do companies make money with a circular business model?</i>					
	<b>Theme</b>	<b>Circular revenue models</b>					
	<b>Sensitizing Concepts</b>	Profitability	Revenue models		Shared revenue		

by Herbert Blumer in the 1950's) are viewed as a starting point for a qualitative study (Glaser, 1978; Padgett, 2004). Where a definitive concept refers precisely to what is common to objects by a clear definition in terms of fixed bench marks or attributes, a sensitizing concept lacks such specification of attributes and bench marks. It gives the user a general sense of reference and guidance in approaching empirical material, and thus a sensitizing concept merely suggest directions along which to look (Blumer, 1954 in Bowen, 2006). As explained in Chapter 3, the questions and, thus, the sensitizing concepts are based on the building blocks of circular business models, while keeping in mind what the dataset has to offer.

By answering the sub-questions by analysing the empirical data from the interviews, it should be possible to answer the main research question of this thesis. Consequently, the idea is that by answering the main research question in terms of patterns and processes that are characteristic for how companies are composing a business models for the circular economy, it is possible to contribute to achieving the main goal of this thesis, namely to understand how the circular economy, and more specifically, how circular business models are working out in practice.

The used technique for the content analysis is template analysis, which can be seen as a form of inductive qualitative content analysis (Boeije, 2005). This form of analysis is based on the Grounded Theory-approach, which has an advanced methodological tradition (Glaser & Strauss, 1967; Corbin & Strauss, 2008) and sensitizing concepts provide a theoretical foundation for the development of grounded theory (Bowen, 2006). A priori, a coding ‘template’ is made, which summarises themes that have been identified as important in the dataset. These themes are based on the research questions, and for these themes sensitizing concepts are developed. However, these concepts may be modified or dispensed with if they do not prove to be appropriate or useful to the actual data examined. This means that the coding template is formed through an iterative process, and is based on the literature and the interview reports. The coding template and sensitizing concepts can be found in Appendix E.

Once the first template with sensitizing concepts has been defined, the first step is to start analysing the empirical material with an open view and mark any segments that appear to be of relevance to the research questions with open codes. The open codes are concepts that are actually used in the text or accurately describe the piece of text. By systematically labelling the interviews reports with concepts that will vary from specific to abstract concepts patterns and linkages will emerge from the data. During the process of open coding, notes of the process are made. By explicitly capturing parts of the thinking process, the researcher will be able to get a better grip of the empirical material. Systematically keeping track of the findings enables researchers to reflect on the thinking process during the process of analysing.

After labelling all relevant segments of the text with open codes, the template can be updated by categorising the open codes. Every open code belongs to a sensitizing concept, any irregularities that arise in the template can be addressed here. This process is also referred to as axial coding, where linkages between the open codes are sought to distinguish the axial codes in the interview reports. These axial codes are the sensitizing concepts and reduce the material.

Eventually, a final template that consists of sensitizing concepts, open codes and the associated pieces of texts will be formed (Appendix E). The template serves as the basis for the

interpretation and illumination of the dataset. The building blocks aren't independent entities, but interrelated components of a whole concept, so overlap between open codes from different themes may occur.

This provides all the necessities needed for the next phase of this content analysis procedure: selective coding. From here it is possible to compare the pieces of text that fall under the same sensitizing concept. One way to get a better grasp on what companies say about a particular building block and make patterns emerge is by counting the open codes. When an open code is used a lot, it means that a lot of companies talk about the same concept. Another way to recognize the patterns is to simply compare the pieces of text with same codes to each other. Both forms of selective coding will be used to analyse this dataset and answer the formulated questions as complete and precise as possible. The patterns that emerged from the analysis will be presented in the results chapter and interpreted in the discussion chapter. To structurally analyse the data, the software program ATLAS.ti is used.

#### *4.4. Research Ethics & Quality Assessment*

Regarding the ethical issues of a research, the following can be stated: Before conducting the interviews, all respondents have been informed about the procedure and have given written permission to use the interview for research purposes. All data is collected with the approval of the respondents. The contact details of the respondents and the recording of the interview will never be shared with other parties. The recordings will only be used to work out the interview report. Every respondent had the opportunity to approve the report that has been made about the interview with them. If asked for, the data will be treated anonymously. All respondents have the opportunity to ask questions about the project to the project manager.

Next to the ethical issues regarding the participants of this research, it is also important to elaborate on how the validity of this research is substantiated. The traditional criteria for a quality assessment of a quantitative research are internal and external validity, reliability and objectivity. These criteria can be translated into alternative criteria for qualitative research. These are credibility, transferability, dependability and confirmability. Each criterion will be discussed with respect to this research in order to clarify how the quality of this research has been guaranteed.

Credibility involves establishing that the results are credible or believable from the perspective of the participant in the research. To have a credible research means to demonstrate a good fit between constructed realities of respondents and the reconstructions attributed to them (Symon & Cassell, 2012, p 206). This criterion has been improved by giving the

participants the opportunity to edit and approve the report that has been made from the interviews. The participants have made use of this opportunity, for the analysis it was possible to see what has been changed to these interview reports by the interviewees.

The transferability refers to the degree to which results can be generalized to other context or settings. This can be achieved by providing enough detail about the specific research cases, to provide the reader the opportunity to judge what other context might be informed by the findings (Symon & Cassell, 2012, p 207). Appendix B provides a short description of all the participating companies. In this research, the context of the participating companies is very heterogeneous.

The idea of dependability emphasizes that researchers need to account for the ever changing context within which research occurs. The traditional quantitative criterion of reliability is based on the assumption of repeatability or replicability. It is concerned with if some other researcher would observe the same thing from the same results. But, the idea of dependability states that the researcher is responsible for describing the changes that occur in the particular setting and how these affect the way the research approached the study. First of all, the interview protocol has been adjusted for the second set of data collection. The reason for this is to improve the quality of the data gathered and to make better use of the building blocks of circular business models. This means that the first 36 interviews slightly differ from the second 33 interviews. Second, although the students have been trained to conduct the interviews in advance, they still might differ in the way the interviews have been conducted and translated into an interview report. Each student brings in their own perspective and opinions on the circular economy which could influence or bias the way the data is collected. This can be seen as a limitation of the dataset, but on the other hand it ensures that the dataset as a whole isn't biased into one direction because it has inputs from several perspectives.

The last criterion is confirmability, which basically states that each researcher brings a unique perspective to the study. Confirmability is the degree to which the results could be confirmed by others. Several strategies can help to improve confirmability. The procedures for checking and rechecking the data throughout the study can be documented, or the researcher can take the role of a 'devil's advocate' to review the results and actively search for and describe instances that contradict the prior observations. Also, a data audit can be conducted to examine the data collection and analysis procedure, and to judge the potential biases. During the performance of the analysis, reflecting on the process has helped to ensure the achievement of these criteria and to ensure good research practices.

## 5. Results

This chapter provides the results of the research. Findings are based on the analysed interview reports. All the themes presented in Paragraph 6 of Chapter 3 (and Appendix E) will be covered in this part, but before that, the first paragraph will elaborate on the number of times codes and concepts have been used. Subsequently, in each paragraph one of the sub-questions will be addressed in the order of the themes in table 4. Each paragraph starts with presenting the principal findings and concludes with an answer to the concerning research question.

The results will be presented based on the codes that have been used. Only the relevant codes will be presented and elaborated on. In this case relevant means relevant to the circular economy. For example, when talking about cooperation, companies talk a lot about trust and transparency. But trust and transparency are not solely bound to cooperation in a circular business model, it is just as important to have trust and transparency in a cooperation in a linear economy as in a circular economy. These codes describe a general cooperation, not a circular cooperation. The principal findings of the analysis provide insights into the circular economy and circular business models in practice.

The codes that are presented are elaborated on to make clear what the content is of a piece of text labelled with a specific code. Appendix E presents the complete set of codes that have been used, the numbers behind the codes represent how often the code has been used. Finally, a complete graphic overview of all the used codes and their relations with the sensitizing concepts can be found in figure 7.

### *5.1. Counting the Codes*

Counting how often each code is used provides insight in what the most salient themes are. When looking at the building blocks of circular economy, it is interesting to find that codes that belong to closing loops and circular organisation have been used more often than codes that belong to the other themes. A schematic overview can be found in table 5. Closing loops (310 citations) and circular organisation (317 citations) have way more citations than circular strategy (170) and circular value creation (193). Circular revenue models come somewhere in between with 242 citations. The average in table 5 indicates how often each concept is really used, controlled for the broadness of the concept. The number of codes used for revenue models need to be interpreted differently, because companies were asked to fill in a checklist and mark which of the eleven revenue models they use, instead of just describing the concept. Based on these numbers, companies have more to say about circular organisation and closing loops than about circular value creation. Also, circular strategy is spoken of the least, by far.



In the following paragraphs, the open codes will unravel the sensitizing concepts and draw an image of what the concept constitutes in practice. The numbers behind the open codes represent the number of citations that are labelled with this code and the number behind the concepts represents how many citations belong to that concept.

Table 5.

*Counting the codes of the building blocks.*

Theme	# Codes	# Citations	Average # citations/code
<i>Closing Loops</i>	20	310	15.5
<i>Value Creation</i>	17	193	11.4
<i>Circular Strategy</i>	22	170	7.7
<i>Circular Organisation</i>	22	317	14.4
<i>Revenue Models</i>	15	242	16.1

5.2. Circular Economy in Practice

The first sub-question to be answered is: *What does the concept of circular economy constitute according to companies?* A graphic overview of the codes that have been used to label the companies’ descriptions of the circular economy can be found in figure 8. The most salient codes will be explained below. Subsequently, these codes will be used to formulate an answer to the sub-question.

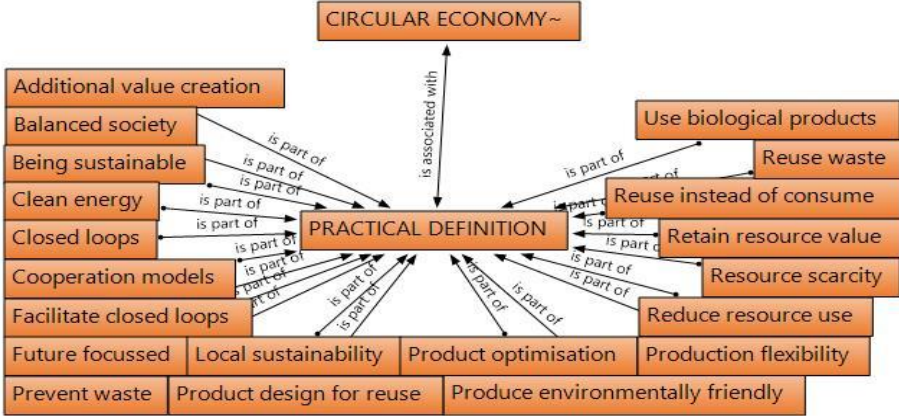


Figure 8. Practical definition of the circular economy

According to the companies, circular economy is about using or Reusing products instead of consuming or wasting them (28), which refers to descriptions that contain elements of product and resource use instead of consuming and wasting the products or resources. A great description for this code comes from Mr. Roland Holst who writes: “Continuously reuse or reevaluate things without consuming them, but just using them instead”.

Another frequently used code is 'Prevent waste' (20), this code refers to definitions of the circular economy that include the reduction or prevention of waste. An accurate description of this code is given by Mr. van Gorp from Creating heroes: "Circular economy is trying to prevent the emergence of waste, and if something is considered to be waste, it should be reused in the chain". Which also describe the code 'Reuse waste' (15). The waste output for one company may be the input for another company, or companies are even capable of using waste flows for other purposes all by themselves.

The code 'Closed loops' (17) labels descriptions that include the explicit notion of closing loops. For example, Mr. Prins from Groengeld states: "It's a way of working and living where you keep your resources in closed loops". In closing loops, some companies also mention it is important to retain the value of resources. The code 'Retain value' (14) refers to using resources on the highest level possible, and prevent down cycling, but there are also companies who argue that it doesn't matter at what level resources are being reused, as long as they are being reused.

'Product optimisation' (11) refers to the idea of fully utilizing products. By providing product maintenance product life cycles can be extended and resources can be used more optimal in order to fully utilize every product and resource. The codes 'Being sustainable' and 'Producing environmentally friendly' are both used 6 times and respectively refer to be able to sustain over a longer period of time and to reduce the ecological footprint in production processes and business management.

Some other aspects that are mentioned a few times are 'Designing a product for reuse' (5) and circular economy is a way of dealing with 'Resource scarcity' (4). The remaining codes are used less than 4 times, and will not be elaborated on in this part. In practice, these codes don't seem very relevant because of the few times the codes have been used to label a part of the text. This doesn't mean that these codes describe citations that aren't relevant to the circular economy, it just means that these codes describe citations that aren't used a lot in practice.

To provide an answer to the sub-question, in practice, circular economy is seen as a concept that is all about reusing products instead of consuming and wasting them, it's about preventing products to become waste and about reusing those products that have become waste. By closing loops, the value of resources can be retained and products usage can be optimised. Additionally, being a sustainable company, producing environmentally friendly and enabling reuse by proper product design can also be seen as aspects of the practical definition of circular economy. Next to this definition, also a number of companies explicitly mention that the circular economy addresses the imminent resource scarcity.

### 5.3. Challenges

The sub-question concerning this theme is: *What challenges do circular pioneers encounter when embracing the circular economy?* Most companies have described their experiences in working with a circular business model. Companies have encountered several issues in embracing the circular principles, but they have also dealt with their issues and, to this day, they successfully continue to exist. The reasons for companies to overcome these barriers and go circular differ. A graphic overview of the codes can be found in figure 9. Challenges is an interesting theme as it unravels where circular economy has its bottlenecks in practice. To answer the question, the most salient challenges will be presented, additionally the most promising solutions and ways to boost the circular economy that have been mentioned by the companies will be discussed.

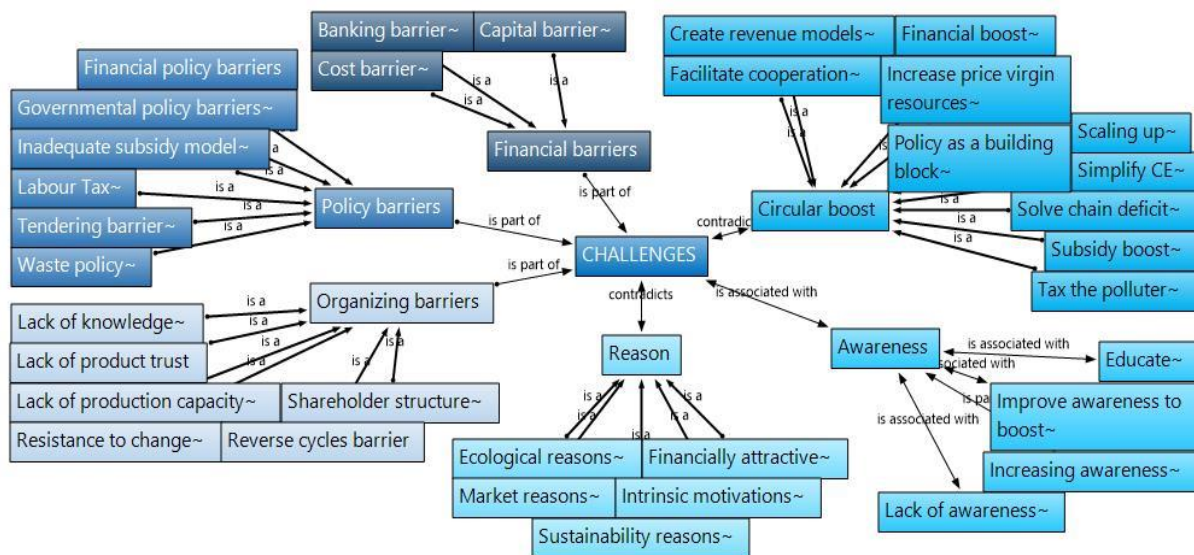


Figure 9. Challenges in a circular economy.

Three distinct types of barriers can be identified. ‘Policy barriers’ (71) are rules and legislation that shackle the development of a circular economy, and hinder companies in operating with a circular business model. Financial barriers (47) include barriers that concern monetary issues that circular pioneers experience when operating with a circular business model. ‘Organising barriers’ (31) include barriers that hinder a company in organising a circular business model. A more specific explanation of the open codes that belong to the barriers can be found in Appendix F. Based on the codes and the linkages between them, some main issues can be identified. These will be presented below.

The type of barriers that seem to hinder companies the most, are policy barriers. For an economy to be circular, adaptations have to be made to waste policy and labour tax. Currently there are strict rules on materials that have been labelled as waste. These often make it hard or

even impossible for companies to transport or reuse waste. This undermines the circular economy, as 'waste' is the potential for the circular economy.

The circular economy is perceived to be a labour intensive economy, as it requires extra edits to reuse used materials and products. The current taxes on labour make it nearly impossible for circular pioneers to make it profitable to reuse materials and products. So, instead of paying for labour, circular pioneers propose a tax system where the government raises taxes on the use of virgin resources. This stimulates companies to reuse resources and decrease virgin resource use. Logically, it's a matter of time before the prices of virgin resources will increase, as scarcity will increase over time, but legislation could accelerate this process. Additionally, by raising taxes on the company that actually pollutes the environment, it is possible to make green products cheaper than products that have a negative ecological footprint, making green products more attractive for the consumers.

Circular pioneers also often experience monetary issues. A circular business model needs money to start, and this money is earned back over a longer period of time. A circular business model with a corresponding revenue model doesn't rely on conventional sales, so the costs of a product are not earned back with sales, they are earned back over the lifetime of a product. Circular pioneers encounter grave difficulties in gaining investments from banks or other financial institutions, and because the circular pioneers should earn their money over a longer period of time, it is hard for circular initiatives to develop into a successful company. This might also be the reason that a lot of companies still use conventional sales as their revenue model. The organising barriers will be addressed in Paragraph 7 about circular organisation.

An interesting concept is 'Awareness' (95), which refers to the awareness of companies and consumers with respect to the problems that the current linear economy is causing. And although the awareness is increasing, apparently, not everybody notices the enormous amount of trouble that continuing in a linear economy will dispense. This lack of awareness is perceived to be a barrier for a transition to the circular economy and companies emphasize the need for a better education to improve the awareness of the public to boost the circular economy.

Despite these barriers, these circular pioneers have chosen to operate in a circular business model. Their reasons differ from ecological and intrinsic motivations to financial and market reasons. It is quite remarkable that most companies go circular because of ecological reasons, and far less companies go circular because of market or financial reasons. Market reasons refer to companies that noticed an opportunity in the market and went circular to seize that opportunity. Financial reasons refer to companies going circular because this is financially more attractive for them. The circular pioneers seem to be taking part in the circular economy

for the good cause. But economy is about money, without making money, a company will cease to exist on short term.

Although companies slightly differ in their motives to go circular, most do have to overcome equivalent barriers in doing so and most would benefit from the same ‘Circular boosts’ (131). The circular economy would profit from a ‘financial boost’ (16) as money is often earned later on, investments are required to start operating and earn money. Also, more suitable revenue models should be developed. ‘Create revenue models’ (6) refers to the idea that it has to be made explicit, tangible and thus financially clear what the advantages of a circular business model are, and how money can be earned with a circular business model. The circular economy would also profit from ‘solving the chain deficit’ (5), which refers to including the costs of processing a product after its lifetime into the price of a product. Lastly, the circular economy should be simplified (5) for practice, which basically means that the concept of circular economy has to be made so simple, that everyone and every company can understand and implement it. It is argued that circular economy is being spread in a scientific language that isn’t understandable for the big public, which results in companies not using the ideas of the circular economy, or companies interpreting the ideas in the wrong way which leads to the circular economy becoming a hollow concept.

To answer the sub-question that belongs to this theme: The challenges are mainly policy and finance related. The current policy regarding waste and labour tax isn’t fit for the circular economy and it is hard to gain investments from banks and other financial institutions because they don’t have any interest in circular initiatives (yet). Changing the policy from labour tax to virgin resource tax, and taxing the polluter could be a major step in the right direction for the circular economy, but this has to be an international policy which makes it a complicated matter. A result from the current policy is that circular business models are almost exclusively used by idealists, meaning that the circular pioneers are in it for the good cause, and not for the financial advantages, because these are hindered by current policies. Additionally, the theoretical concept of circular economy currently seems too complex to directly implement in practice, which results in the circular economy being reduced to practical and simple principles.

#### *5.4. Closing Loops*

The sub-question to be answered is: *How do companies work with the concept of closing loops?* Closing loops concerns the phenomenon of keeping raw materials in their chain and not throwing away any waste, so leakage is minimized. A complete graphic overview of the concept of closing loops can be found in figure 10. To come to an answer to the sub-question, first the

relevant codes will be presented and explained. Subsequently, the information of the codes will be connected to formulate an answer on the question.

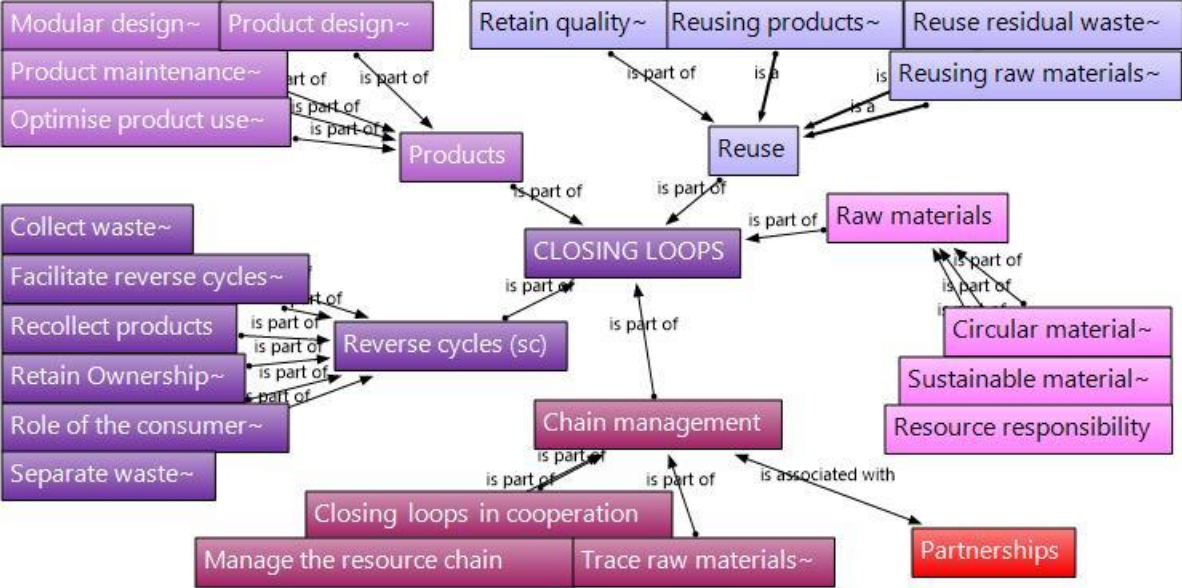


Figure 10. Closed Loops.

The concept ‘Reuse’ (99) includes four forms of reusing that have been identified in the dataset. ‘Reusing products’ (20) refers to the process of reusing a used product over and over again, this can include maintenance or repairs to the product. ‘Reusing raw materials’ (45) differs from reusing products in that it explicitly refers to the reuse of raw materials, thus instead of reusing a complete product, parts or materials of these products are being reused for the same or for other purposes. ‘Reuse residual waste’ (30) refers to the use of waste that emerges from normal business processes. By finding new applications for these waste flows, the materials are optimally used. For example, when constructing aluminium products, aluminium waste will emerge from the production process. When this aluminium waste is used for other purposes, waste is reduced. But this doesn’t mean that a material loop is closed, especially when another company uses the waste flows. The materials get out of sight and might just as well get wasted after the company has used them.

Another concept in closing loops is ‘Products’ (79). In order to close loops, circular pioneers pay attention to how they design their products. ‘Product design’ (21) concerns the design of a product in a way that stimulates reusing. This means that the process of disassembling certain products has to be made as easy as possible, so that reusing parts or materials of the products can be done efficiently, but also to make it possible to easily repair or transform a product. A specific way of designing a product is the ‘Modular design’ (10). This design enables products to be demountable, to repair a product easily and to adapt a product to

different circumstances when necessary. A circular product design really facilitates closing material loop, but the number of products that actually have a circular design is minimal.

‘Product maintenance’ (38) refers to all the efforts circular pioneers make to extend the lifetime of a product. By providing product maintenance for customers, using quality material and repairing broken parts instead of throwing them away, materials are used more optimally. The code ‘Optimal product usage’ (10) refers to fully utilizing the products, so sharing products and not letting them sit idle and reusing them as often as possible. And if they can’t be reused for their original purpose, reuse them for other purposes.

The concept of ‘Reverse cycles’ (59) is important to be able to close loops. It refers to everything that has to be done to recollect products, materials or waste. Six codes have been used to identify what companies say about the concept of reverse cycles, but the number of companies that have actually established reverse cycles is small. Waste processors stimulate reverse cycles by collecting waste (7). Some companies also recollect their products by themselves (7). For this, the ‘Role of the consumer’ (2) is important to recollect products, because the customer often owns the products, the return of the products to the companies depends on the goodwill of the customer. One way for a company to stimulate or obligate customers to return their products is to retain legal ownership of the products, even when their products are at their customers (10), or by putting deposit money on the products.

The code ‘Facilitate reverse cycles’ (11) involves companies that mention they facilitate reverse cycles by collecting waste or organising reverse cycles. More on the explicit organisation of reverse cycles in the paragraph about circular organisation. To make sure reverse cycles are efficient, it is important to ‘Separate waste’ (22). When waste is separated by sort, it improves the efficiency of the process of reusing waste. Waste processing companies are able to facilitate closing loops by reclaiming certain products, separating the materials and making them suitable for reuse. Trash can companies are an example of companies that play a facilitating role in closing loops. Mushbin is a trash can company that stimulates waste separation by making modular trash cans that can be adapted to what kind of waste is thrown away. They have a project for a library in a university where they have made trash cans with three inputs, one for coffee cups, one for plastic and one for waste. This makes it easy to reuse these separated materials.

Reusing materials, products or waste is currently often done by companies in-house. The concept of ‘Chain management’ (34) includes everything that has to do with managing or working together with your partners to close loops. The concept hasn’t been used very often, suggesting that circular pioneers are often trying to close loops in-house. The code ‘Closing

loops in cooperation' (17) has been used a number of times, this code concerns descriptions of companies working together with each other in order to close certain material loops. This often refers to a company using waste flows of another company for their own production processes. But, this doesn't necessarily mean that loops are being closed, it only means that waste materials are being used elsewhere, but what happens to them afterwards is unknown. For that reason, some circular pioneers are developing tools to keep track of the resources that have been used (9). This way it is possible to know where certain materials are so that they can be reused when possible.

The concept of 'Raw materials' (39) refers to the type of materials that are being used. Not all materials are fit for reuse, so circular pioneers use 'Circular material' (10) in order to become a circular company. This means that they have to choose the resources that possess the capability of being reusable, sometimes this requires investing in research and innovation to find those materials. There are also companies that choose for 'Sustainable material' (18), which refers to materials that can be produced in a sustainable way and without leaving a negative footprint on the Earth. The circular pioneers experience a 'Resource responsibility' (11) which makes them more careful about using resources.

Based on the above, an answer to the sub-question can be formulated, the question was: How do companies work with the concept of closing loops? The number of loops that are actually being closed is small. There are some companies that are able to close material loops in-house, but most pioneers just prevent that certain materials become waste by accommodating them in new production processes. These new production processes can be outside the company, consequently, the circular pioneers lose sight of the materials and companies are unaware what happens with the materials afterwards. So, circular pioneers are often able to find new functionalities for their waste flows, but that doesn't mean loops are being closed, it does contribute to utilizing certain resources. To completely close loops, partners in the value chain need to establish a circular business model as well.

In addition to reusing materials, circular pioneers are busy with product maintenance in order to extend the lifetime of products and thus preventing products and materials to become waste. There are some companies that already implement the circular way of thinking into their product design. An example of this is the modular design. But overall, the product design should be taken more into account in order to be able to close loops more effectively.

Other companies try to reclaim their materials from waste processors and other companies try to organise reverse cycles to reclaim their sold products and to reuse the products or reuse parts of the products. This does contribute to closing loops, but most of the time reverse

cycles aren't fully established, meaning that materials don't always return. It is remarkable that although companies seek a lot of cooperation, they often try to close material loops themselves and don't really use cooperation to close loops.

5.5. Circular Value Creation

The sub-question to be answered is: *How do companies create value with a circular business model?* The challenge for this theme is to determine how, and what kind of value is created because a company is operating according to a circular business model. Four types of value creation have been identified and confirmed while unravelling the empirical data. The results on these four types of value creation will be presented below, a graphic overview of the concept of value creation can be found in figure 11.

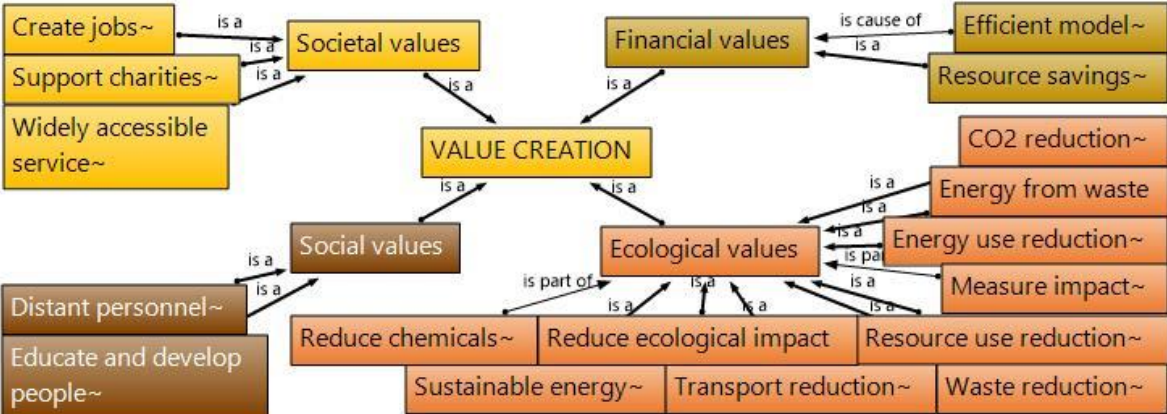


Figure 11. Circular Value Creation.

The reasons why circular pioneers operate with circular business models clearly has its impact on the value that is eventually created. Most circular pioneers engage in the circular economy for ecological reasons, the most frequently mentioned group of open codes belongs to the concept 'Ecological values' (143). For ecological values it is hard to identify what values are being created exclusively because a company is operating with a circular business model.

Ecological values are values created that improve the environment and reduce the ecological footprint of a company such as 'CO2 reduction' (20), which refers to reducing the emission of CO2, the most salient greenhouse gas. It is possible that companies don't directly reduce the emission of CO2 by themselves or directly because of their circular business model, but indirectly by reducing the use of virgin resources or by reducing transport (9). 'Energy reduction' (9) refers to reducing the use of energy in the production process. Companies name several tools to reduce their energy usage, which results in using less fossil fuels and thus less CO2 emissions. Some companies also explicitly decide to become ecological sustainable, by using or producing only sustainable forms of energy (10) and by reducing or completely

eliminating the use of (toxic) chemicals (7) in productions. Last, there are also companies that just mention to ‘Reduce their ecological impact’ (10). From this dataset alone, it remains unclear which ecological values can directly be attributed to circular business models.

A value that can be directly attributed to a circular business model is the reduction of the use virgin resources (24). By preventing products or resources to become waste, less virgin resources are needed, and used resources can be used for a second life. This is a core concept in the circular economy, and reduces the pressure on earth’s collection of materials and earth’s capacity to process waste.

Another idea of the circular economy is that of turning waste into wealth. The code ‘waste reduction’ (42) refers to companies stating that they are operating in a way that prevents the production of waste. The idea is that on one hand during the production process a minimal amount of waste is generated, and on the other hand that all the resources and leftovers of production processes are accommodated in new production processes. To get a grasp on the true impact on the environment, some companies developed tools to measure the impact. The code ‘Measure impact’ (9) refers to these tools.

The social values that are being mentioned in the dataset cannot be attributed to a circular business model, as conventional businesses are also offering jobs to personnel with a distance to the labour market, and conventional businesses can also educate and develop people. The same goes for societal values such as supporting charities and making a service widely accessible. The creation of jobs can partly be credited to a circular business model, because the circular economy is labour intensive. Financial values aren’t mentioned very often, but they are definitely a consequence of the circular business model. Companies refer to it as being an efficient model. For example, recycling aluminium is cheaper than the extraction of (virgin) aluminium. Also, by reusing materials and resources, virgin resources become unnecessary and companies can achieve the same with less resources.

The sub-question is quite complex to answer. Companies are creating multiple values, but this is not a characteristic of circular business models alone. Circular pioneers mainly aim to create ecological value and to reduce their ecological footprint. Values created through circular business models are those of reducing the use of virgin resources and waste reduction by reusing resources and reducing waste during the production processes. Based on this dataset, it isn’t always possible to exactly determine what values are created exclusively from the circular business models. But, not all ecological values are (directly) caused by a circular business model.

Values that are directly created by a circular business model are the financial values that are being mentioned by a few companies. Although only few companies acknowledge to also financially profit from a circular business model, the circular business model is seen as an efficient model to earn money by using less resources than before. Also, money can be earned because reusing materials can be cheaper than using virgin resources. The aim of circular pioneers mainly seems to be contribute to a more sustainable environment, and financial values are subordinate. But it's frequently mentioned, that the green story alone won't do the trick. It is remarkable that, when talking about value creation, financial value in circular business models almost seems a neglected topic. More on this in Chapter 6 Paragraph 4.

5.6. Circular Strategy

The sub-question to be answered is: *How do companies align their strategy with a circular business model?* A graphic overview of the concepts and codes used to unravel the concept of circular strategy can be found in figure 12. Generally, strategies for circular business models remain a neglected topic in practice, and what is said about strategy often has little to do with the circular economy. The relevant concepts and open codes that have been identified will be elaborated on below.

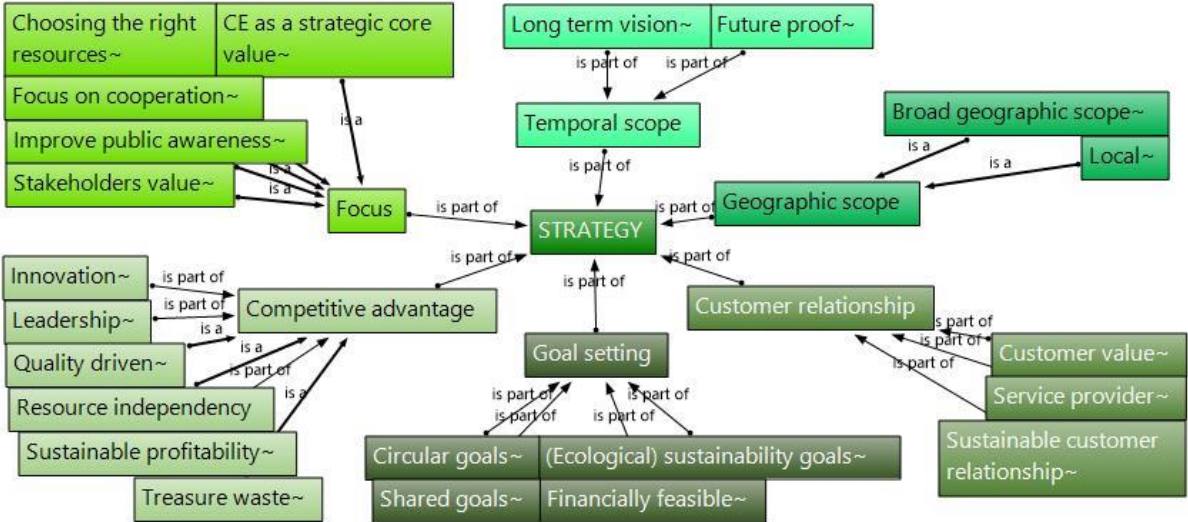


Figure 12. Circular Strategy.

The concept of ‘Customer relationship’ (33) is key in the circular economy. The concept has been unravelled with three open codes. ‘Customer value’ (4) refers to the extra value that is created by a company for a customer. For example, Tshared, clothing retailer, has a limited production, which means that there clothing is only available for a limited group of buyers, this makes the shirts more special and thus valuable for customers. The code ‘Service provider’ (10) refers to the switch from being only a product seller to being a service provider. For example,

Philips used to sell x-ray machines to hospitals. But now they have made a shift to selling the x-rays. So, instead of selling a product, Philips offers a service of providing x-rays for a hospital. The code 'Sustainable customer relationship' (19) refers to building a relationship with the customers that is focussed on a longer term. For example, Delta sells couches with 10-year warranty and also provides additional maintenance services. Their goal is to build a sustainable customer relationship, so that customers will return the products to the company when they have reached the end of their product lifecycle.

The concept of 'Goal setting' (23) is not new in the circular economy. But there are some circular pioneers that have set 'Circular goals' (4), which means they want to achieve a certain amount or percentage of circularity in the near future. For example, Logge wants to be completely circular by 2025. 'Ecological sustainability goals' (5) refer to companies that have set goals in the area of sustainability. Some have made these goals more explicit than others, for example Roelofs (furnisher of public space) has set the objective to completely operate climate neutral by 2030. But, for some companies the main goal is, logically, to be a financial healthy company. The code 'financially feasible' (8) refers to emphasizing the financial attractiveness of circular business models instead of constantly emphasizing the 'green story'. As Mr. Jans from Foenix states, "emphasizing the idealistic message of the circular economy alone isn't enough, doing so will only attract idealists and that won't bring in any money". So, a circular business model should be about earning money, and not about an idealistic thought.

The concept 'Competitive advantage' (38) refers to how circular pioneers are trying to gain a competitive advantage over their competitors. The most frequently used code in this category is 'Innovation' (19), which refers to finding new applications for materials or creative solutions for waste flows. Two interesting codes that have been identified are 'Resource independency' (5) and 'Treasure waste' (6). Being resource independent is a consequence of operating in with a circular business model, this also applies to treasuring waste. A few circular pioneers also mention 'Sustainable profitability' (4), which refers to being profitable and being able to sustain this profit for a longer period of time.

The last concept in a strategy is the 'Focus' (39) of a company. The focus is a broad concept that includes general activities of a company that direct the way of doing business. Open codes that have been used for this concept possess two features: they are general activities and there are more circular pioneers who share this focus. Some companies state that the circular economy is a 'strategic core value' (7) for them, meaning that everything they do can be traced back to the concept of circular economy. Some other companies have more specific focusses, like 'Choosing the right resources' (8), which refers to a company making sure it

collects only sustainable and circular material to be able to operate in a circular manner. The ‘Focus on cooperation’ (5) refers to companies explicitly looking for partners to operate in a circular manner. An example is looking for a partner to close a certain material loop. Then there are also companies who actively try to improve the knowledge of the public about the advantages of the circular economy. They are trying to ‘improve the public awareness’ (9) in order to gain more customers for their sustainable organisations.

Lastly, ‘Stakeholder value’ (6), refers to prioritizing creating value for all stakeholders instead of creating value for shareholders only. This includes the employees, people living nearby, but also the environment and climate.

To answer the sub-question of this theme, there are some minor examples of circular pioneers who specifically adapted their strategy for a circular business model. Examples are building a sustainable customer relationship and setting circular goals. But overall, it can’t be stated that circular pioneers align their strategy with a circular business model. Strategy is a neglected building block for circular pioneers. A discussion about the lack of strategy is presented in Chapter 6 Paragraph 3.

### *5.7. Circular Organisation*

The sub-question to be answered is: *How do companies organise their circular business model?* To unravel the concept of circular organisation, 4 different sensitizing concepts are used. A complete graphic overview of the concept ‘Organisation’ can be found in figure 13. Only the codes that are relevant for circular business models will be elaborated on.

‘Reorganisation’ (69) concerns all elements that differ according to circular pioneers in their circular organisation compared to a linear organisation. Organising reverse cycles (21) is the most important issue to organise for circular pioneers. In order to actually become circular, the output, products or materials, eventually have to return to the company as new input. The concept of reverse cycles has already been elaborated on in Paragraph 4 from the perspective of closing loops. A few notions from an organisational perspective are mentioned below. Organising reverse cycles requires a reorganisation of certain functions (6) such as the purchase, sales and marketing department. Additionally, companies are trying to organise a complete product service system (8), which refers to being a service provider instead of just delivering the products they produce. Also, the circular economy is perceived to be a labour intensive economy, especially when reverse cycles are organised, companies have to put extra effort in preparing used materials for reuse. So, manual labour (5) will increase in circular companies because of the more intensive method of taking care of products and materials.

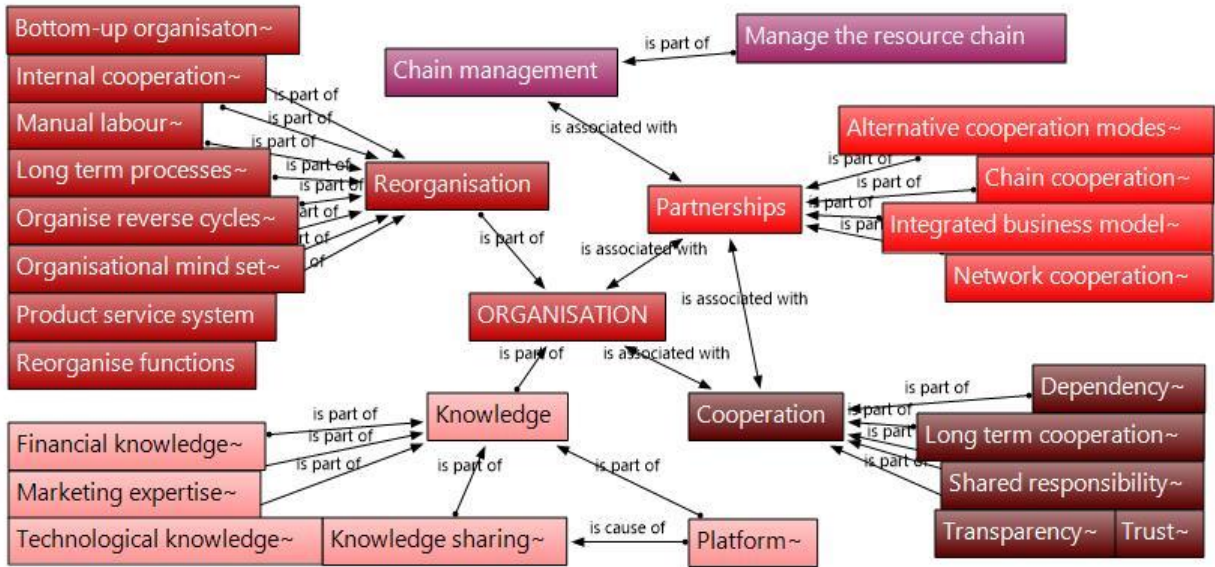


Figure 13. Circular Organisation.

Cooperation is the most salient topic in all the interviews, but not all sorts of cooperation contribute to a circular economy. The relevant codes of cooperation for a circular business model will be presented based on two concepts. ‘Partnerships’ describe the environment and form of the cooperation, and ‘Cooperation’ refers to the characteristics of cooperation within the circular economy. Together, these concepts have 163 citations which emphasizes the importance of cooperation for circular pioneers.

‘Partnerships’ (72) has been unravelled with five open codes. ‘Chain cooperation’ (47) is the most frequently used code and refers to cooperation between chain partners. Most circular pioneers describe their forms of cooperation as a value chain where each company in the value chain adds value to a certain product. The issue with value chains is that it requires all companies in the value chain to be circular, in order to enable a companies to be circular and close loops. In practice, chain cooperation often doesn’t contribute to closing loops. Next to cooperation within the value chain, ‘Network cooperation’ (30) often occurs, mostly to share knowledge and ensure good communication between several companies in favour of finding new functionalities for waste flows and developing new forms of cooperation. There are also some circular pioneers that are creating new or ‘Alternative modes of cooperation’ (7), this refers to new ways of cooperation with other parties, even with competitors. For example, the ultimate goal for Logge (construction company) is to create a group of partners with whom they make an integral cost price calculation, so to be completely transparent to each other, maintain margins that are jointly agreed upon and go to a client with one price. This also refers to a specific form of cooperation, an ‘Integrated business model’ (10) which is seen as an ideal

cooperative business model for circular pioneers. An integrated business model can include an integral calculation of the cost price of a certain product. The last two codes refer almost exclusively to ideas, and not to current realities.

‘Cooperation’ (92) refers to the characteristics of cooperation that are described by the circular pioneers, but mainly this doesn’t differ from cooperation in the linear economy. Some circular pioneers do experience ‘Dependency’ (14), meaning that they are dependent of their partners. For example, if one company organises the waste collection and separates the waste for different companies so that the waste can be reused again, the other companies are dependent of this company for their input.

The last concept used for circular organisation is ‘Knowledge’ (84), this concerns all knowledge that is required to actually organise a circular business model. Circular pioneers explicitly mention that ‘Sharing knowledge’ (39) is essential in organising a circular business model for a successful cooperation and to find new functionalities for certain material and waste flows. Currently, 12 companies mention they work with a platform to share knowledge with other companies. This (online) platform establishes a sort of network where cooperation and the exchange of knowledge can take place. ‘Technological knowledge’ (24) refers to the knowledge about certain machinery or material processing that companies need to be able to work circular. Without the technological developments of today, it wouldn’t be possible for a lot of materials to be reused. Although technological knowledge has contributed to the possibility to reuse materials, it has also increased the complexity of products which makes it hard to repair or disassemble them. For companies it is important to be up to date regarding the current technological knowledge, as well as it is to innovate in order to improve the efficiency of reusing materials. Circular pioneers also mention to need additional organisational knowledge. Marketing expertise (8) refers to everything that has to do with purchase and sales. Because circular economy brings different revenue models, the circular pioneers have to adapt their marketing to these revenue models.

To answer the research question for this theme: Although cooperation is spoken of a lot, circular pioneers mainly organise their circular business models alone. They do cooperate, but this actually resembles cooperation in a linear economy. Circular pioneers seem to be capable in organising their own companies for the circular economy, but for closing loops they are dependent of their partners in the value chain. Currently, most forms of cooperation don’t contribute to closing loops. This is why most companies only close material loops by themselves. Companies are making progress by establishing platforms and stimulate knowledge sharing. Organising reverse cycles remains an aspect where companies are struggling with to

organise. Finding partners that are better capable to organise reverse cycles could improve establishing them.

5.8. Circular Revenue Models

The question for this theme is: *How do companies make money with a circular business model?* To discover what companies say about circular revenue models, three sensitizing concepts have been used. A graphic overview of the concepts and codes that belong to circular revenue models can be found in figure 14.

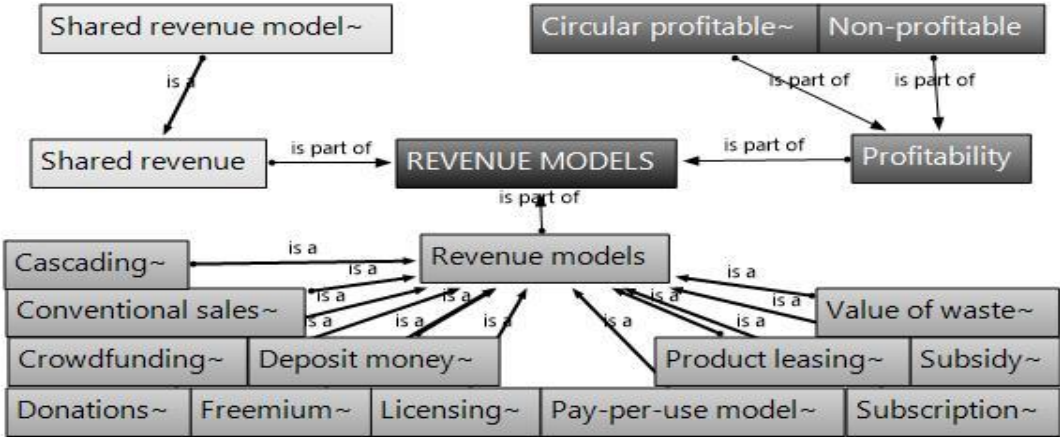


Figure 14. Circular Revenue Models.

The first concept used is profitability, which refers to how profitable companies with a circular business model are. The code ‘Circular profitable’ is used 32 times and means that there are 32 companies with a profitable circular business model. Some companies make a good profit, and some make just enough to stay alive, but that’s enough for now. There are 4 Companies explicitly mentioned that they currently have a ‘non-profitable’ circular business model. Circular economy is also about cooperating and maybe even sharing revenues. A shared revenue models (9) concerns a model where partners in the value chain cooperatively sell their products and then share the revenues.

The concept of revenue models has been used to identify all the models that are being used by the circular pioneers. Revenue models describe the way a company earns its money. One company can use more than one revenue model. Table 6 shows a schematic overview of the revenue models and the number of times they have been used, sorted from high to low. It is remarkable that most companies claim to operate circular but still earn their money with conventional sales. This also makes the code circular profitable less useful. Because, if companies claim to operate with a circular business model, but still have conventional sales as their main revenue model, they can be profitable, but they definitely aren’t circular profitable.

Conventional sales undermine the circular economy, because producers also sell their responsibility for the materials and resources, making it hard to reclaim them and thus making it hard to close loops. Conventional sales replace the responsibility of closing loops to the consumers, which makes it an interesting topic to discuss if the consumer is ready or will ever be ready for that responsibility? More on this topic in Chapter 6 Paragraph 3. But, even though the majority still earns their money through conventional sales, there are several companies that mention to earn their money through revenue models that are suitable for the circular economy. Subscription and product leasing are also frequently used revenue models.

Table 6.

*Revenue models used by circular pioneers.*

<i>Revenue model</i>	<i>Times used</i>
Conventional sales	44
Value of waste	30
Subscription	26
Product leasing	21
Cascading	17
Licensing	12
Donations	10
Crowdfunding	10
Deposit money	8
Pay per use model	8
Subsidy	7
Freemium	5

To answer the sub-question for this theme, how do companies make money with a circular business model? Generally, most companies can't afford themselves to operate with only a circular revenue model, thus they make their circular business model a little less circular by earning money with conventional sales. This way conventional sales remain the dominant revenue model, even for circular pioneers. There are some circular pioneers that successfully earn money with a circular revenue model, but the dataset does not contain enough information to draw useful conclusions regarding this topic.

### *5.9. Composing Circular Business Models*

The main research question in this master thesis is: *How are companies currently composing their business models for the circular economy?* A schematic overview of the contributions of each sub-question to answering the main question is presented in table 7. A summary of the answers of the sub-questions together can be found in Appendix G. Based on these answers, an answer to the main research question can be constructed.

Although the theory about the circular economy and circular business models is quite sophisticated, in practice the circular pioneers only use the simple aspects of this theory. The complexity of the language in which the theories are spread are argued to be a barrier for the practical development of the circular economy. This results in companies reducing the circular

economy to the aspects they understand and can practically apply to their own organisation. So, instead of creating a complete circular business model, companies often move to recycling, waste reduction, or just using green products with the goal of eco-efficiency: creating a positive ratio between created value and environmental impact. Thus, circular economy is often reduced to waste management.

Circular pioneers have a lot to say about organisational aspects in the circular economy. But this is mainly about cooperation that resembles cooperation in a linear economy. They do cooperate a lot with other companies, but most of the time cooperation happens in the form of a value chain. Through this cooperation they are able to accommodate their waste material flows to new productions processes and reduce the resources that end up as waste. Although this extends the lifetime of certain materials and products, it can't be categorised as closing a loop, when waste flows are being used by other companies, the first company makes sure to reduce waste, but the second company might not be working according to the circular principles which eventually doesn't result in a closed loop.

So, a bottleneck of the current circular business models in practice is the point where companies lose sight and ownership of their materials or products. Because conventional sales is still the dominant revenue model, circular pioneers lose the responsibility over materials when their products are sold to the next party in the value chain, making it hard to reclaim those materials. Also, companies keep struggling with organising reverse cycles. Finding partners that are better capable to organise reverse cycles could improve establishing them. Some companies are working on organising reverse cycles and have made minor steps in returning resources into their cycles with the help of waste processing companies. But this hasn't been fully established yet. Simultaneously, the circular strategy also falls behind in composing circular business models in practice. Most circular pioneers don't explicitly mention a circular strategy or struggle to formalize a circular strategy.

Based on the motives of the pioneers to go circular, it can be stated that they focus on achieving certain ecological values. As a result, the companies mostly create ecological value through waste and energy use reduction, and the created financial value remains small. Consequently, circular business models as they currently exist in practice, only seems to be attractive for idealists. Most of the time, circular business models as they exist in practice aren't more than a company making sure that it reduces waste, or accommodates waste flows in new production processes, or collects waste that eventually can be reused. Companies with a fully circular business model are an exception and aren't supported by policy, financing, and have to deal with parties in the value chain that aren't ready for the circular principles.

Table 7.

*Contributions to answering the main research question.*

<i>Theme</i>	<i>Contribution to the main research question</i>
<b>Practical definition</b>	<ul style="list-style-type: none"> <li>- Circular pioneers only use the practical and understandable aspects of circular business models.</li> <li>- In practice circular economy is reduced to reusing products, waste reduction or eco-efficiency.</li> </ul>
<b>Challenges</b>	<ul style="list-style-type: none"> <li>- Policy hinders the development of circular business models.</li> <li>- Financial institutions hardly finance circular business models.</li> </ul>
<b>Closing loops</b>	<ul style="list-style-type: none"> <li>- Actually closing loops often only happens in-house.</li> <li>- Many activities are about extending the lifetime of products and resources.</li> <li>- Waste reduction and accommodating waste flows into new (external) production processes happens frequently.</li> </ul>
<b>Circular strategy</b>	<ul style="list-style-type: none"> <li>- A strategy for a circular business model remains a neglected issue .</li> </ul>
<b>Circular value creation</b>	<ul style="list-style-type: none"> <li>- Creating ecological value is a main focus.</li> <li>- The value created resembles the reason why most circular pioneers engage in circular activities.</li> <li>- Financial value is currently only a small proportion of the value that is being created.</li> </ul>
<b>Circular organisation</b>	<ul style="list-style-type: none"> <li>- Companies struggle with organising reverse cycles.</li> <li>- Companies are capable of organising closed loops in-house or within the boundaries of the company.</li> <li>- Value chain cooperation contributes to waste reduction and not closing loops because partners in the value chain aren't ready.</li> <li>- Network cooperation contributes to knowledge sharing and finding new functionalities for waste flows.</li> <li>- Cooperation often doesn't contribute to closing loops.</li> </ul>
<b>Circular revenue models</b>	<ul style="list-style-type: none"> <li>- Conventional sales is still the dominant revenue model.</li> <li>- A bottleneck of circular business models arises when companies lose ownership of the products or resources, which happens through conventional sales.</li> </ul>

## 6. Discussion & Conclusion

This thesis has tried to gain further insights in how the idea of circular economy works out in practice by studying circular business models in practice. The practical goal was to learn how companies are actually creating value through a circular business model. Theoretically, it is about the transition in value creation. To achieve this goal, a study has been conducted by analysing 69 reports of interviews with circular pioneers. This analysis has been guided by the main research question: How are circular pioneers currently composing their circular business models? Which has been split up into 7 sub-questions, that have been answered in the previous chapter. The answers have emerged from a qualitative content analysis (template analysis), where sensitizing concepts have been used to guide the analysis. Now that the answers have been given, Paragraph 1 and 2 will discuss what these answers actually add to the knowledge of circular business models, in other words, what does this thesis actually contribute? Table 7 already shows some interesting points that emerged from the analysis, these will be discussed in this chapter. This thesis has studied how a theoretical concept has worked out in practice, so this discussion will first elaborate on what the results theoretically mean by comparing the theory of the first three chapters with the results. Subsequently, practical matters that have emerged from the results will be discussed. Paragraph 3 presents a discussion on the relation between circular economy and sustainability. Finally, recommendations and opportunities for future research, and a critical reflection on this thesis will be presented in the last two paragraphs.

### *6.1. Circular Business Models in Theory versus Practice*

Based on the results of the analysis, it can be concluded that thinking about the circular economy is way ahead of the circular economy in practice. Circular economy has been developed so extensively in theory, that organisations never had the chance to jump on board and develop with it. Although the theoretical and practical definition show a lot of resemblance (table 8), it is clear that, by taking a look at the number of codes that have been used, there is little consensus about the definition of circular economy in practice. Basically, all the pioneers describe circular economy according to how they claim to operate in a circular way. For one company this is preventing the creation of waste in their production process, for others it is reusing waste products. It is conceivable that the scientific language in which the circular economy is spread, is too complicated for the broad public (entrepreneurs and companies) to translate into direct practical action. So, instead of completely embracing the circular economy,

companies choose specific aspects of the circular economy. These are the aspects they understand and can apply to their way of doing business.

Table 8.

*Circular economy: Theory versus Practice.*

<p><b>Theoretical definition</b> Chapter 2</p>	<p><i>‘Circular economy is an industrial model of development where the flow of materials is accommodated in closed loops, energy leakage is minimised, and waste is designed out of the products and processes. This makes the system regenerative and restorative by design.’</i></p>
<p><b>Practical definition</b> Chapter 5</p>	<p><i>‘Circular economy is about reusing products instead of consuming and wasting them, it’s about preventing products to become waste and about reusing those products that have become waste, so by closing loops the value of resources can be retained and product usage can be optimised. Additionally, being a sustainable company, producing environmentally friendly and enabling product reuse by proper product design belong to the circular economy.’</i></p>

This complexity issue leaves the circular pioneers in a gap between an ideal theoretical picture of the circular economy and the linear reality. This results in circular pioneers being idealists, who try to address the issues concerning resource scarcity and climate change through the circular principles. Consequently, mostly ecological values are created and the financial values that are created are minimal. Also, the circular pioneers only implement the aspects of circular business models that they can understand. As a result, the complex theoretical concept of circular economy has been simplified in practice by the circular pioneers, eventually circular economy is often reduced to waste management. The promising concept of circular economy, a completely new way of organising the world economy, is only described in theory, but how circular value is created in practice remained unclear. This thesis can add knowledge to how circular business models actually create value in practice, as it is the main topic of this thesis.

Every company creates value, otherwise they wouldn’t exist. It is remarkable that circular pioneers mostly emphasize the ecological values that are created because of their circular business models. Other created values such as social and societal values are not a consequence of circular business models, but a consequence of the goodwill of companies to contribute to these aspects of society in addition to their circular business models. Only the creation of jobs is a direct consequence of a circular business model, because the circular

economy is labour intensive. But, as mentioned before, this isn't attractive for companies because of the taxes on labour.

Financial values should be created in circular business models, but only few companies talk about the economic aspect of their circular business model. There are some companies that recognize that a circular business model is an efficient way of doing business, and that it can save a lot of resources. Although in theory there is a lot of financial gain attached to the circular economy, in practice the circular pioneers barely emphasize the financial advantages. Until now, most of the companies engage in circular economy and sustainability for the good cause, not for the financial benefits. But, as *Dutch Awareness* states, it is important that both the government and the consumer are willing to join the revolution to circular economy, and this can only be achieved by organising the circular economy from an economic perspective. 'You won't get there with just the green story'.

In Chapter 3 the four areas of value creation in a circular business model are presented. Figure 5 shows that circular business models are capable of creating value by using the blind spot of the linear economic system. The four areas of value creation (Accenture, 2017; see figure 5) can only partly be identified in the interview reports of the circular pioneers. It can be stated that, in practice, value is created through circular business models by linking value chains and partly by using lasting resources. But only using lasting resources doesn't make it circular, materials also need to return to the company one way or another to eventually reduce the use of virgin resources. The idea of liquid markets cannot be identified in the interview reports, and increasing the life cycles of products is partially supported by the interview reports. As mentioned before, some companies keep the circular way of thinking in mind when designing products, and it seems that circular pioneers do pay quite some attention to product maintenance. To reduce the use of virgin resources, Accenture (2017) states that products need to be designed to last. But, as most circular pioneers still earn their money through conventional sales, designing products to last longer reduces how frequently a company sells its products and thus reduces profitability, unless the selling price is increased.

A clear strategy on how to organise and achieve these forms of value creation could improve the position of the circular pioneers. But, as presented in the results, in practice, strategy seems to be a neglected building block for the circular economy. Little attention is paid to a circular strategy. This limited strategical attention could hinder the organisation of reverse cycles. Although the circular economy is labour intensive, it is also service focussed. The idea is that instead of selling resources in the form of products, companies use resources to provide a service for customers. By paying more attention to the relationship with customers

and by offering extra services, a sustainable customer relationship can be built. This can eventually contribute to reclaiming used products from customers.

But on the other hand, is that what customers want? An intensive relationship with all the producers of products they use? Service contracts for every product, from shaver to television? And is a clear strategy really necessary for the circular pioneers? How many conventional businesses don't even have a strategy but are successful anyway? These topics are interesting topics for future research.

Another theoretical characteristic of circular business models is that a company doesn't just sell resources it regards as waste to a company that regards those resources as input, both companies also need each other to arrive at a cycle of successive moments of value creation (Jonker et al. 2017). As the results have presented, closing loops often happens in-house and companies that do sell their waste to other companies lose sight of the materials. To improve this aspect, it requires companies to make a transition from an organisation-centric perspective to a network-centric perspective created by companies that collectively aim to close a loop. Consequently, circular pioneers can't build a circular economy on their own.

Lastly, the barriers that circular pioneers encounter, overlap with the barriers that have been identified in Chapter 2 Paragraph 4. The lack of governmental support and encouragement through effective legislation is widely recognised as a barrier (Calogirou et al. 2010; Studer, Welford & Hils., 2006) and this is confirmed by the circular pioneers. The labour tax, waste policy and lack of financial support are specific barriers that emerged out of this dataset. But also the barriers regarding the lack of environmental awareness among suppliers and customers (Meqdadi, Johnsen, & Johnsen, 2012; Wooi & Zailani, 2010) and barriers concerning the cost of 'green' innovation and business models (Lawrence et al. 2006; Trianni & Cango, 2012) can be identified in the current dataset.

## *6.2. Practical Boundaries*

This paragraph will discuss the practical contributions of this thesis. It can be concluded that circular business models in practice aren't very successful now, because of the fact that the environment isn't suitable for circular companies yet due to unready partners in the value chain and a hindering policy. Therefore, most of the time the circular business models in practice aren't completely circular yet. Knowledge that this thesis can add will be discussed below.

The results show that, even for the circular pioneers, the dominant revenue model is conventional sales. It is remarkable that most companies want to be circular, but still use conventional sales to earn their money. The big issue with conventional sales and the circular

economy is the responsibility for the materials and resources of the product that is being sold. After the sale of a product, producers don't have any responsibility about the product anymore. This isn't necessarily a bad situation. But we live in a society of consumption, where people seemingly experience minimal responsibility about the products they buy, not so much in using them, but more in what happens after using them. For the circular economy, people who buy a product should also be responsible for leaving it in good hands after they are done using it. Meaning that when someone is done using a certain mobile phone, it should make sure the phone ends up at a mobile phone producer that is able to reuse the materials or resources of that phone. In reality, most of the people throw their phone into the trash can, making it hard to ever use any of those parts again and thus they contribute to exhausting the Earth's resources.

To break through this habit of throwing stuff away, change is necessary on both ends. Buyers need to start feeling the responsibility for the materials and resources they buy. Sellers should provide the reverse logistics to make it as easy as possible for buyers to eventually return the materials. Another way to overcome this issue is the change of revenue models. By using revenue models where companies retain ownership of their products, they have the possibility to be aware of where their materials are, and they are able to reclaim their materials after a customer is done using it. This sounds attractive for companies, but why should customers want this? In some cases, it might be attractive for customers to buy the service and not the ownership of a product. For example, when buying products that could need expensive maintenance, it could be attractive to buy the service the product is delivering and keep the responsibility of maintenance for the company by giving them the ownership of the product. Currently, this leasing system successfully works for cars, but it's not likely to be suitable for all products (think about clothing or headphones).

This doesn't make these products unfit for the circular economy, but there are currently no revenue models that stimulate these products to be accommodated in closed loops. And as mentioned before, conventional sales replace the resource responsibility to the big public, so buyers need to start feeling the responsibility for the materials and resources they buy. But implementing a worldwide cultural change is idealism at its finest, leaving companies the choice to develop strong reverse logistics or to create new revenue models that help them to return sold products into their loops.

Besides the issues with conventional sales, this study has also made clear some boundaries of the circular economy in practice. Lacy and Rutqvist (2015) estimated an opportunity of \$4,5 trillion by eliminating all waste out of the current economy. And several authors claim that a complete implementation of the circular economy would contribute in

solving a myriad of issues (FAO, 2002; Ren et al, 2013; Birat, 2015; Ellen MacArthur Foundation, 2015). But, as discussed in the critical review of the introduction, presenting the circular economy without a careful explanation of its limits and the circumstances under which it can succeed leads to the circular economy being a utopia. So, what are these boundaries?

The example of the circular hamburger can be applied to all sorts of food. The circular economy isn't clear on this matter. This example can be compared to the use of energy from non-renewable and renewable resources. Once oil is converted into energy to move a car, the oil is lost and the energy is lost in the movement of the car, just like once a hamburger has been eaten, the hamburger is lost in the stomach of a person that gains energy from it. There is no closing of loops possible there. For these cases it is important that the energy comes from a renewable source. Oil can be replaced by solar or wind energy, these are sustainable forms of energy that don't exhaust any of the Earth's capacity. For a hamburger, the products that are used need to be produced in a way that they don't exhaust the Earth's resources.

Another boundary of the circular economy can be explained by using the example of Gerrard Street, one of the participating companies of this study. Gerrard Street produces headphones and their customers can rent these headphones. Their product design is modular and their business proposition is 'care-free access to high-end audio'. Customers don't have to worry when a headphone breaks down, because Gerrard Street will take care of it immediately. When someone rents a headphone, they'll pay a fixed amount of money each month for the service and for using the headphone. It's a really good example of a circular revenue model. But for whom is this offer attractive? The amount that customers pay each month is independent of how much the person uses the headphone. Customers that use headphones every day pay just as much as customers that use headphones only once a week. Logically, when someone decides he needs headphones, but thinks he'll only use them a few times a month, he'll probably buy headphones instead of renting them. As he only uses them sporadically, he's better off paying for a product that will probably be usable for years, instead paying each month for a service he barely uses. For Gerrard Street this is fine, as they mainly focus on customers that really care about music and thus often use their headphones. But this example does illustrate a potential problem with the circular revenue models. The idea is that customers pay for a service instead of for a product, but at the same time it is nearly impossible to keep track of how much a customer uses a service. This often results in charging the monthly fee based on maximum usage, which makes it unattractive for a lot of potential customers.

This example sets a boundary for the circular economy from an economic perspective. The circular revenue models, such as product leasing or subscriptions, are suitable for certain

products that often require service or are meant for intensive usage, but this is not for every product or every consumer. Of course there are examples where these revenue models fit the situation, but it is for a good reason that companies mention that revenue models need to be further developed to stimulate the circular economy for all.

Another issue with the circular economy is also discussed in the critical review in Chapter 3. A truly ‘circular’ economy doesn’t really exist, as it is impossible (for most materials such as paper or yarn) to minimize the leakage of materials to zero. This means that there will always be waste and there will always be a need for new virgin resources. An example of this can be given by two companies that participated in this research, Tshared and Dutch Awearness. These companies produce t-shirts, sell them, reclaim them and produce new t-shirts from the used t-shirts. This ‘closed’ loop is not infinite, the yarn of one t-shirt can only be used 4 times to (re)produce a t-shirt. After that, the yarn has lost its quality and can’t be used to produce a quality t-shirt.

So, the first challenge is to close loops as much as possible, but then the challenge is to only use those resources that can be replenished by the Earth. The circular economy is about closing loops, but not all loops can be truly closed. So, instead of only focussing on closing the material loops, another matter of attention should be to choose the right resources (also mentioned by some circular pioneers). The idea of using energy from renewable resources instead of using energy from non-renewable resources should also be applied on resources.

The illustrations of some boundaries of the circular economy show that the circular economy in practice is in need of research to carefully construct the boundaries of the circular economy in practice. Based on the two paragraphs above, it can be concluded that the current economic environment is not suitable for the circular business models, and ambiguity about the concept of circular economy in practice exists. Companies haven’t really figured out how to really create value through the circular principles, besides the ecological values. Besides, the circular pioneers often do not have a completely circular business model. This makes it clear that for the circular economy to succeed, extra stimulation is necessary.

### *6.3. Circularity and Sustainability*

In practice, there is only a thin line between sustainability and circular economy. A circular economy is a sustainable economy, but does this also go the other way around? To clarify the confusion between the two concepts with respect to this study, the essential question to be asked is: does it really make a difference when companies mention to be a sustainable company on one hand or a circular company on the other? The circular economy has been

explained extensively in the first three chapters, but the essence of the circular economy is that it's a sustainable economy. Where the linear economy is running out of gas, the circular economy can sustain because of the circulation instead of the consumption of resources. It creates resource independency and eliminates resource scarcity issues. Is it possible for a company to operate on a sustainable (resource) basis, without fitting into the circular economy? Logically, it couldn't be possible. No company that is working with any type of tangible resources can be sustainable when it remains resource dependent and thus keeps on exhausting the planet's resources, and the only way to be resource independent is to close material loops, alone or by cooperating with partners.

This basically means that companies can already be sustainable by only using materials that are able to be reused. Even if they don't reuse them all by themselves, other companies could grab the opportunities of processing the used materials. For example, Paperfoam composes sustainable packaging from sustainable materials, but they don't close the material loop. Once the product is sold, Paperfoam doesn't take any responsibility for the product any longer. But, other parties are able to prepare 99% of the material that is used in the packaging for reuse. Paperfoam is not really a circular company all by itself, but it does fit in a circular economy. All that has to be done by other parties is to organise the material flows, establish the reverse logistics and make sure no resource ends as waste.

So, what does this mean for the circular economy? Basically, sustainable companies are the building blocks of the circular economy, without sustainable companies (those who use sustainable / circular material) the circular economy has no starting point to emerge from. But to become really sustainable, and thus circular, it is necessary to organise the material flows and make sure they eventually become organised as circles.

#### *6.4. Recommendations and Future Research*

Based on this research, the following issues have to be dealt with to improve the existence of circular business models in practice. First, the complexity of the circular economy in theory has to be reduced for practice, so that the implementation of circular principles is stimulated. This should also enable researchers to find out which principles do, and which principles don't work in practice, moreover it can't be expected that a completely new way of organising the world economy is only described in theory. This could be the job of researchers and scientists, but it's also a job for consultancy agencies and circular networks. Another task for consultancy agencies might be to create an overarching circular network to stimulate

cooperation and enable the accommodation of more waste flows, this could improve the waste reduction that is currently being created.

Next, an important role must be assigned to the (international) governmental institutions. Not only policies to stimulate circular initiatives need to be developed, also policies that apply to the entire economy have to change. The current policy is fully dedicated to a linear economy, which also improves the market positions of companies with linear business models. The current policy creates an unfair competition, where circular pioneers compete with a disadvantage compared to the conventional businesses. The circular economy has to be organised from an economic perspective, meaning that circular businesses have to be profitable, or even better, more profitable than the conventional businesses. Ideally, for the circular economy to flourish, labour taxes are reduced and resources taxes increased. Waste material flows aren't labelled a waste, but as resources for new productions processes so that it is easier for companies to deal with and trade waste. Policy sets the boundaries for the economy, but there is a global economy and the issue with policy is that it differs around the globe. Making the necessary policy changes in the Netherlands, doesn't necessarily result in a circular economy in the Netherlands, it can also result in companies looking for solutions in foreign countries. Closing materials loops often requires more parties, which could also be foreign parties, so making policy for the circular economy has to be an international matter. A worldwide policy to stimulate the circular economy is, for now, way too ambitious, as countries differ in their opinion about the need for a circular economy (For example, USA and China). So for now, only small steps can be taken by local governmental support.

Together with policy, financing institutions have to develop a policy in order to support circular initiatives. The circular pioneers agree almost unanimously that it is too complicated to gain financial support, and that most banks or financing institutions don't have any financing options for circular business models. Additionally, circular companies have to be able to earn money in a way that suits a circular business model. Or in other words, circular companies have to be able to create value through a circular business model that is equal to or more than the value created through a conventional business model. As mentioned before, conventional sales don't fit in a circular business model, but leasing or subscriptions as a revenue model doesn't work for all products. More research is necessary to find out how companies can best align their revenue model with their circular business model or more research is necessary to improve the number of customers that return their bought products to the right place. For all kinds of products and services, it has to be made clear which way is more effective, align the circular

business model with the right revenue model, or improve the reverse logistics and keep relying on conventional sales. Future research could focus on this issue.

Future research should also improve the clarity of the boundaries of a circular economy. What is, and what isn't suitable for a circular economy in practice? Or, what is the role of companies that don't work with tangible resources? How does their role in a circular economy change compared to their role in a linear economy and how can they implement a circular business model?

### *6.5. Reflection*

The current study made use of a qualitative content analysis to identify patterns about the circular economy in practice. This approach is ideally suited for the research goal to identify these patterns in practice. The approach really fits the research questions that have been formulated for this study, because it enables to answer questions that start with how. There are a lot of interview reports that have been analysed which makes this research well-grounded. But there hasn't been triangulation of research methods, meaning that the research is solely based on reports of interviews with other people. Future research that does include other methods than interviews could be done to confirm the findings of this research. Observations on how companies actually work could provide additional information on how companies actually compose circular business models.

With regard to the research process, the data gained through the interviews have been treated very carefully and confidentially. But the quality of the interview reports differed, which is a consequence of the fact that the data is collected by more than one person. Interview reports all should have approximately the same size, but the sizes differed. Also, the content of the reports wasn't always comparable, which basically means that not all the students have translated the interviews into interview reports the same way. This could influence how often certain topics are being addressed. But the large number of interview reports could work as a buffer for that limitation.

Another issue that has to be mentioned is that the extent to which some companies were actually working with a circular business model was low, meaning that it wasn't always easy to identify what was really circular about the company, and what can be used to for the results. Uncertainties in the dataset have not been taken into the analysis.

The limitations presented above have been taken into account while analysing and interpreting the data and should not have influenced the outcomes of this thesis significantly.

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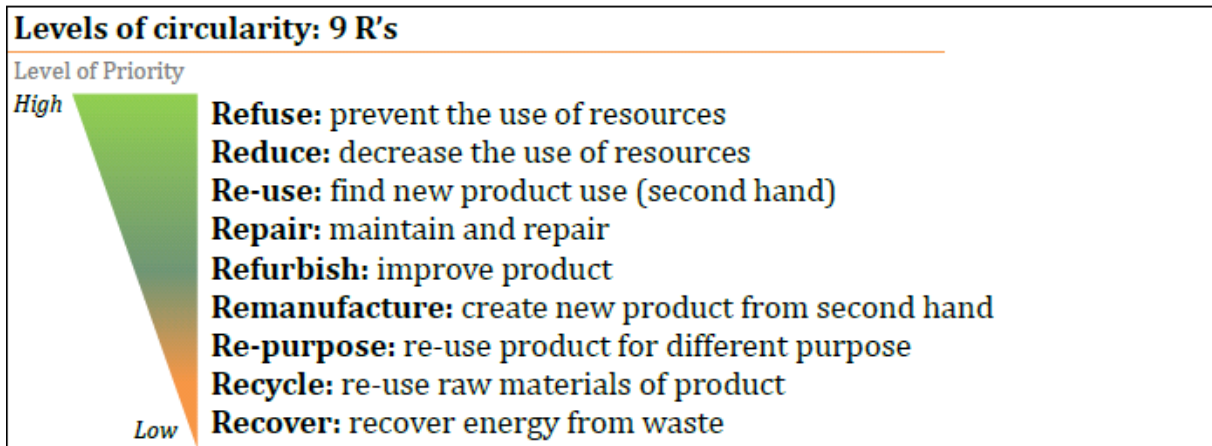
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## 8. Appendices

### Appendix A – 9 Levels of circularity



The nine levels of circularity are not undisputed. For example, it is argued that refuse or reduce don't have anything to do with circularity, for that reason there are also authors who talk about the 7 levels of circularity.

Appendix B – Participating companies / persons

#	Company	Interviewee	Interview protocol
1	AVR	Simon Fans de Vries	Pilot
<b>Company description:</b>	Processor of residual waste into energy.		
2	Compoworld	Jasper Klarenbeek	Pilot
<b>Company description:</b>	Private-public sector cooperation to prepare innovation for the market, in this case Composite.		
3	Creating Heroes	Patrick van Gulp	Pilot
<b>Company description:</b>	Service provider for sustainable companies.		
4	De Klik Biomassa	Martine Groenwegen	Pilot
<b>Company description:</b>	Reuse organic residual waste as efficient as possible.		
5	deA	Arien Scholtens	Pilot
<b>Company description:</b>	A provider of local sustainable energy in Apeldoorn.		
6	Dekker duurzaam	Arjan Dekker	Pilot
<b>Company description:</b>	Separating construction and demolition waste, in order to stimulate closing material loops.		
7	Delta	Friederich Meijer	Pilot
<b>Company description:</b>	Trader.		
8	-	Roland Holst	Pilot
<b>Company description:</b>	Project development.		
9	Dijkhuis Aannemers	E.J. Dijkhuis	Pilot
<b>Company description:</b>	Contractor		
10	Eeko Group BV	G. van Klaveren	Pilot
<b>Company description:</b>	Support companies by taking care of their environmental cares by offering services for collecting cartridge, used mobile phones.		
11	Emodz	Henk Meiborg	Pilot
<b>Company description:</b>	Operates in the world of new mobility and sustainable energy.		
12	EnergiePrestatieLoket	Eddy van Haren	Pilot
<b>Company description:</b>	Offers people with a distance to the labour market jobs in the construction industry, mostly highly educated construction workers and architects to work with ecologically responsible materials.		
13	Gemeente Dalfsen	Thijs Mosterman	Pilot
<b>Company description:</b>	Policy concerning waste and sustainability.		
14	Giesbers Wijchen	Paul van Doorn & John de Beijer	Pilot
<b>Company description:</b>	Construction industry		
15	Groengeld	Frances Prins	Pilot
<b>Company description:</b>	Support companies in becoming 'greener'.		
16	Huismerk Energie	Bert Hendriks	Pilot
<b>Company description:</b>	Delivers 100% green energy that is generated locally.		
17	-	Charlotte Extercatte	Pilot
<b>Company description:</b>	-		
18	Otto Koedijk Houtdraaier	Otto Koedijk	Pilot
<b>Company description:</b>	Designer and producer of wooden items with local wood.		
19	Oudman Trade BV	Abel Oudman	Pilot
<b>Company description:</b>	Producer and seller of fireplaces and heaters.		
20	Overijssels Particulier Grondbezit	Joukje Bosch & Femke Maes	Pilot
<b>Company description:</b>	Supporting members in sustainable maintenance of their properties.		

21	Roelofs	-	Pilot
<b>Company description:</b>		Furnisher of public space.	
22	Roof2Roof	G. Bijker	Pilot
<b>Company description:</b>		Builder of roofs with recycled roof materials to reduce the usage of virgin resources.	
23	Rova	Dhr. Groenhuis	Pilot
<b>Company description:</b>		Waste collector and processor.	
24	Saxion	Gerrit Bouwhuis	Pilot
<b>Company description:</b>		Textile department.	
25	Seecr	Marjanne van Aarendonk	Pilot
<b>Company description:</b>		Software company.	
26	SpaarSaam	Robert Colijn	Pilot
<b>Company description:</b>		A marketplace for sustainable energy.	
27	StegginkInfra	Giel Euverman	Pilot
<b>Company description:</b>		Small engineering firm that works in the area of civil engineering.	
28	Stichting Kringloopwinkel Steenwijk	Ineke de Jong	Pilot
<b>Company description:</b>		Thrift store	
29	Straw Block Systems	Pim Hondeveld	Pilot
<b>Company description:</b>		Developer of prefab construction material from renewable sources.	
30	Tarmo Beheer BV	Dhr. Schoenaker	Pilot
<b>Company description:</b>		Advise and guide organisations to a sustainable and responsible company. Also a production company?	
31	Thomas Vorm Omgeving	Thomas van Bergen	Pilot
<b>Company description:</b>		Environment designer.	
32	TVA Service Center	Yvonne Koolhaas	Pilot
<b>Company description:</b>		Service centre to prevent products to end as waste, by repairing or refurbishing the products.	
33	Van Benthem Veevoeders & Kunstmest	Ed van Benthem	Pilot
<b>Company description:</b>		A compound feed factory that uses by-products of other processes as raw materials to make flour blends and cuttings as animal food.	
34	Vitens	Birgitta Kramer	Pilot
<b>Company description:</b>		Water company that wins, purifies and delivers drinking water of the highest quality.	
35	Wageningen UR	Erik van Seventer	Pilot
<b>Company description:</b>		Food & Bio-based research.	
36	Canon Europe	Walter Tobé	Follow-up
<b>Company description:</b>		Producer of printers.	
37	Dutch Awareness	Rien Otto	Follow-up
<b>Company description:</b>		Clothing retailer.	
38	Foenix	Arjin Jans	Follow-up
<b>Company description:</b>		Circular provider of products.	
39	Gispen	Rick Veenendaal	Follow-up
<b>Company description:</b>		Producer and supplier of trading merchandise	
40	Hermeta	Estéban van Zeijl	Follow-up
<b>Company description:</b>		Producer of aluminium products.	
41	Logge Circulair	Jaap Logge en Cheryl Djoegan	Follow-up
<b>Company description:</b>		Interior construction company that works with circular materials.	
42	Modulo Milieustraten	Ron van Ommeren	Follow-up
<b>Company description:</b>		Waste collector.	

43	Paperfoam	Mark Geerts	Follow-up
<b>Company description:</b>		Producer of sustainable packaging.	
44	Pooling Partners	Ingrid Faber	Follow-up
<b>Company description:</b>		Pooler of wooden pallets.	
45	Q-Vention	Hugo van den Elzen	Follow-up
<b>Company description:</b>		Circular construction company.	
46	Tshared	Jeroen van der Heide	Follow-up
<b>Company description:</b>		Circular clothing retailer.	
47	Ubbink	Jasper Klomps	Follow-up
<b>Company description:</b>		Roof construction.	
48	Van Houtum	Bas Gehlen & Jos Manders	Follow-up
<b>Company description:</b>		Producer of hygiene paper and dispensers.	
49	Vlaskglas Recycling	Cor Wittekoek	Follow-up
<b>Company description:</b>		Collect glass waste and process this waste to reuse it.	
50	Zutphen Energie	Jan Fikken	Follow-up
<b>Company description:</b>		Local sustainable energy provider.	
51	AND Cheesetrade BV	Dave Bakker	Follow-up
<b>Company description:</b>		Recover cheese and butter from the dairy industry.	
52	ARN Recycling	Martijn Boelhouwer	Follow-up
<b>Company description:</b>		Tries to reuse materials from car wrecks at the highest possible level.	
53	Boa Nova	Riccardo de Waal	Follow-up
<b>Company description:</b>		Gift distributor to gas stations.	
54	Bundles	Marcel Peters	Follow-up
<b>Company description:</b>		Electrical household machines renting company.	
55	Desko	Tessa van der Meer	Follow-up
<b>Company description:</b>		Furniture renting company.	
56	Dutch Spirit – Inspire Workwear	Erik Toenhake	Follow-up
<b>Company description:</b>		Circular clothing retailer.	
57	Gerrard Street	Tom Leenders	Follow-up
<b>Company description:</b>		Sells headphones by giving customers a subscription on their headphone.	
58	Herso	Rik Ruigrok	Follow-up
<b>Company description:</b>		Circular woodworker	
59	Lune	Wido van den Bosch	Follow-up
<b>Company description:</b>		Designer and producer of trash bins for waste separation.	
60	Mushbin	Wesley de Bie	Follow-up
<b>Company description:</b>		Designer and producer of trash bins for waste separation.	
61	Paperwise	Peter van Rosmalen	Follow-up
<b>Company description:</b>		Processor of agriculture waste into paper.	
62	Philips	Markus Laubscher	Follow-up
<b>Company description:</b>		The big Philips.	
63	Recover-E	Jan-Paul Immel & Tom Houben	Follow-up
<b>Company description:</b>		Recovers electrical products for reusing.	
64	ReFood	Johan Nobbe	Follow-up
<b>Company description:</b>		Collector of organic waste to produce new products instead of burning waste.	

<b>65</b>	Renewi	Hanneke Agterhuis	Follow-up
<b>Company description:</b>	Circular company that collects and processes several materials to close loops.		
<b>66</b>	SNEW	Martijn van Engelen	Follow-up
<b>Company description:</b>	Circular electrical machines company, provides maintenance and repairs to products and provides products a second lifetime.		
<b>67</b>	Van Hulley	Jolijn Creutzberg	Follow-up
<b>Company description:</b>	Circular clothing retailer that works with women who have a distance to the labour market.		
<b>68</b>	Velto	Wilbur van der Velde	Follow-up
<b>Company description:</b>	Circular chair retailer, or service provider.		
<b>69</b>	Ynova Innovation Company	Jacqueline Hofstede	Follow-up
<b>Company description:</b>	Consultancy company.		

### *Appendix C – Interview Protocol Pilot study (Dutch)*

*Met de eerste serie vragen willen we graag weten welke betekenis de circulaire economie heeft voor u en waarom u met uw organisatie hiermee aan de slag bent gegaan.*

1. Er zijn heel veel verschillende opvattingen in omloop over wat de circulaire economie is. Kunt u vertellen wat u (vanuit uw perspectief) onder de circulaire economie verstaat?
2. Wat zijn voor u belangrijke aanleidingen om aan de CE te gaan werken.
3. Kunt u nog even kort aangeven op welke (bedrijfs-) activiteiten u het principe van de circulaire economie toepast en waarom juist deze belangrijk zijn voor u?
4. Wat is voor u de specifieke business propositie waar u in het kader van de CE aan werkt? Kunt u dat in een woord of een oneliner benoemen?

*De kern van de CE wordt gevormd door met oude en nieuwe partijen samen te werken aan en bepaalde vorm van waarde creatie. Deze samenwerking vraagt om een nieuwe generatie business modellen. We noemen deze business modellen voor de circulaire economie (BMCE). In de volgende vragen willen we hierop ingaan.*

5. Wat verstaat (in het algemeen) u onder een business model? En wat is volgens u kenmerkend voor een business model gericht op de circulaire economie?
6. Helpt dat model om een bepaalde (Materiele? Biologische? Andere?) kringloop te sluiten en zo ja welke is dat dan?
7. Wat zijn belangrijke bouwstenen (onderdelen) van een business model voor de circulaire economie (BMCE)? Waar bouwt u aan met uw business model? Kunt u aangeven welke principes van de CE hierbij concreet tot uiting komen? Met welke partijen werkt u samen in uw CE business model?
8. Kunt u aangeven hoe deze onderdelen en partijen met elkaar samenhangen? Indien dat handiger is: kunt u het misschien tekenen?

*Let op: zorg dat je blanco A3's papier en viltstiften bij je hebt. Niet vergeten naam respondent, bedrijf en datum op de tekening te vermelden (discreet). Tekeningen zorgvuldig bewaren (bij voorkeur in een map)*

9. Wat zijn voor u de drie belangrijkste verschillen met een (conventioneel, lineair) business model?
10. Welke barrières ziet u om het door u gewenste BMCE tot ontwikkeling te laten komen. U kunt denken aan gebrek aan kennis, het missen van specifieke competenties, een bepaalde (besturings-) structuur of ...? Kunt u een aantal van die barrières noemen? Ziet u barrières binnen uw eigen organisatie? Ziet u een mogelijkheid om een van die barrières weg te nemen?

*Door het stellen van de volgende vragen willen we graag meer te weten komen hoe het BMCE waar u mee werkt, tot stand is gekomen en hoe dit functioneert.*

11. Welke partijen zijn betrokken bij de ontwikkeling van uw BMCE; met wie van die partijen werkte u al mee samen en wie zijn nieuw?
12. Hoe ziet de vorm van de samenwerking eruit? Als in een waardeketen, een netwerk, een waarde-cyclus of ...?
13. Hoe kwam die samenwerking tot stand? Kende u de partijen al vooraf of heeft u gaandeweg ontdekt met wie u samen deze kringloop kan sluiten?

U heeft eerder aangegeven naast economische ook andere waarden te creëren. Doen alle partijen dat in gelijke mate of creëren partijen in de cyclus verschillende waarden die eerder aanvullend op elkaar zijn?

14. Hoe zorgt u in de praktijk voor het delen van ideeën en doelen tussen de partijen die hier bij betrokken zijn? Zijn hier mogelijk bepaalde activiteiten voor ontwikkeld?
15. Wat gaat er goed en minder goed in de samenwerking? Waar loopt u tegen aan in de praktijk van die samenwerking.
16. In BMCE's zien we nieuwe verdien-modellen ontstaan. Er wordt o.a. gewerkt met o.a. functionele lease, freemium's en licenties. Kunt u aangeven van onderstaande lijstje welk u gebruikt, al dan niet in combinatie met elkaar.
- Freemium (al dan niet met betaalde upgrade's) (bijvoorbeeld Spotify)
  - Licenties (bijvoorbeeld Apps)
  - 'Pay per View' (bijvoorbeeld Videoland)
  - Abonnementen als dan niet met statiegeld
  - Conventionele verkoop
  - Functionele huur of lease (huren van zit-comfort of licht)
  - Cascadering
  - Crowdfunding
  - Donaties
  - Afval (als waarde)
  - Gratis
  - .... (aangeven of er zaken ontbreken)
17. Is het BMCE wat u (met elkaar) heeft ontwikkeld levensvatbaar/rendabel? Is er (met andere woorden) sprake van een duidelijk verdien model?
18. Geldt dit verdien-model alleen voor u als organisatie of geldt het ook tussen de partijen met wie u dit BMCE realiseert. Als dat laatste het geval is: op basis van welke afspraken worden dan de inkomsten verdeeld?
19. Kunt u het proces schetsen hoe u uw BMCE heeft ontwikkeld; zijn in dat proces misschien een aantal cruciale momenten in aan te wijzen?
20. Wat ziet u als de belangrijkste resultaten van een BMCE?
21. Als u kijkt naar uw huidige governance (besturings-) model, is dit dan veranderd ten opzichte van de tijd dat u nog niet met CE actief was? Kunt u aangeven wat er dan veranderd is? Andere structuur? Meer partijen? Nieuwe afspraken met deze partijen? Hoe is de controle geregeld?
22. In het onderzoek worden een aantal randvoorwaarden onderscheiden - zoals wet- en regelgeving, financiën, techniek, maatschappelijke ontwikkelingen - die een positieve of negatieve invloed hebben op de ontwikkeling van het BMCE. Hieronder staan vijf aspecten. Kunt u voor een of meerdere van deze aspecten kort aangeven wat die invloed is geweest in positieve of negatieve zin.
- a. Wet- en regelgeving
  - b. Financiering
  - c. Subsidie
  - d. Invloed techniek
  - e. Maatschappelijke ontwikkelingen
23. Kunt u aangeven welke drie veranderingen in de komende 3 a 5 jaar gewenst of noodzakelijk zijn om de CE een maatschappelijke en economische 'boost' te geven?
24. Zijn we bepaalde zaken vergeten te vragen die belangrijk zijn en die u alsnog kwijt zou willen?

## Appendix D – Interview Protocol Follow-up study (Dutch)

### Vragen interview

*Met de eerste serie vragen willen we graag weten welke betekenis de circulaire economie heeft voor u en waarom u met uw organisatie hiermee aan de slag bent gegaan.*

1. Er zijn heel veel verschillende opvattingen in omloop over wat de circulaire economie is. Kunt u vertellen wat u (vanuit uw perspectief) onder de circulaire economie verstaat?
2. Wat zijn voor u belangrijke aanleidingen om aan de CE te gaan werken?
3. Kunt u kort aangeven op welke (bedrijfs-) activiteiten u het principe van de circulaire economie toepast en waarom juist deze belangrijk zijn voor u?
4. Wat is voor u de specifieke business propositie waar u in het kader van de CE aan werkt? Kunt u dat in een woord of een oneliner benoemen?

*De kern van business modellen in de CE bestaat uit vijf bouwstenen. In de volgende vragen willen we hierop ingaan.*

### Kringlopen

5. Op het sluiten van welke kringlo(o)p(en) richt u zich in uw bedrijfsvoering met name?
6. In welke mate is het bijdragen aan het sluiten van die kringlopen van belang voor de kern van uw bedrijfsvoering?
7. In welke mate is samenwerking met andere partijen voor het sluiten van die kringlopen van belang en hoe ziet die eventuele samenwerking eruit?
8. Kunt u aangeven hoe kringlopen met elkaar samenhangen en eventueel ook de samenwerking om die ketens te sluiten? Indien dat handiger is: kunt u het misschien tekenen? *Vraag de respondent het model te tekenen. Niet vergeten naam respondent, bedrijf en datum op de tekening te vermelden (discreet). Tekeningen zorgvuldig bewaren (bij voorkeur in de bijbehorende map)*

### Waardecreatie

9. Kunt u omschrijven welke waarden naast financiële waarden (dat komt bij verdienmodel) u met uw businessmodel creëert? *Vraag door naar de details, de voorbeelden en de uitvoering hiervan.*
10. Welke verduurzaming levert uw businessmodel op?
11. Kunt u ook aangeven op welke manier u dat doet?
12. In welke mate is het voor u of uw stakeholders van belang dat u meerdere waarden creëert? Legt uw organisatie daarover ook verantwoording af?

### Strategie

13. Kunt u vertellen hoe in uw strategie CE tot uiting komt?
14. Is er voor u een wezenlijk verschil tussen een ‘normale’ strategie en een CE-strategie? Waar blijkt dat uit?
15. In welke mate bent u in uw strategische plannen afhankelijk van uw (keten-) partners? Hoe gaat u om met die eventuele afhankelijkheden?
16. Waar stopt in uw ogen uw (strategische) verantwoordelijkheid voor eventueel reststoffen/materialen of de restwaarde van uw producten?

### Organisatie

17. Wat zijn voor u de drie belangrijkste verschillen met de organisatie van een conventioneel (lineair) business model?
18. Wat is er nodig om het door u gewenste BMCE te organiseren? U kunt denken aan kennis, specifieke competenties, een bepaalde (besturings-) structuur of ...? *NB: het gaat hier niet om de omgevingsfactoren.*

19. In het onderzoek worden een aantal randvoorwaarden onderscheiden - zoals wet- en regelgeving, financiën, techniek, maatschappelijke ontwikkelingen - die een positieve of negatieve invloed hebben op de ontwikkeling van het BMCE. Hieronder staan vijf aspecten. Kunt u voor een of meerdere van deze aspecten kort aangeven wat die invloed is geweest, in positieve of negatieve zin.

- a. Wet- en regelgeving
- b. Financiering
- c. Subsidie
- d. Invloed techniek
- e. Maatschappelijke ontwikkelingen

### **Verdienmodellen**

20. In BMCE's zien we nieuwe verdien-modellen ontstaan. Er wordt o.a. gewerkt met o.a. functionele lease, freemium's en licenties. Kunt u aangeven van onderstaande lijstje welk u gebruikt, al dan niet in combinatie met elkaar.

*Deze vraag staat ook op de bijlage, zodat de geïnterviewde eenvoudig kan aankruisen*

- Freemium (al dan niet met betaalde upgrade's) (bijvoorbeeld Spotify)
- Licenties (bijvoorbeeld Apps)
- 'Pay per View' (bijvoorbeeld Videoland)
- Abonnementen als dan niet met statiegeld
- Conventionele verkoop
- Functionele huur of lease (huren van zit-comfort of licht)
- Cascadering
- Crowdfunding
- Donaties
- Afval (als waarde)
- Gratis
- .... (aangeven of er zaken ontbreken)

21. Is het BMCE wat u (met elkaar) heeft ontwikkeld levensvatbaar/rendabel? Is er (met andere woorden) sprake van een duidelijk verdien model?

22. Geldt dit verdien-model alleen voor u als organisatie of geldt het ook tussen de partijen met wie u dit BMCE realiseert? Als dat laatste het geval is: op basis van welke afspraken worden dan de inkomsten en kosten verdeeld?

23. Hoe ziet de vorm van de samenwerking eruit? Als in een waardeketen, een netwerk, een waarde-cyclus of ...?

24. Wat gaat er goed en minder goed in de samenwerking? Waar loopt u tegen aan in de praktijk van die samenwerking?

25. Kunt u aangeven welke drie veranderingen volgens u in de komende 3 a 5 jaar gewenst of noodzakelijk zijn om de CE een maatschappelijke en economische 'boost' te geven?

Appendix E – ‘Coding Template’

<b>Circular economy</b>	
<b>Sensitizing Concepts</b>	<b>Codes</b>
<p><b>Practical definition</b> (147)</p>	Additional value creation (1)
	Balanced society (3)
	Being sustainable (7)
	Clean energy (2)
	Closed loops (18)
	Cooperation models (2)
	Facilitate closed loops (2)
	Future focussed (2)
	Local sustainability (1)
	Prevent waste (20)
	Produce environmentally friendly (6)
	Product design for reuse (5)
	Product optimisation (11)
	Production flexibility (1)
	Reduce resource use (2)
	Resource scarcity (4)
	Retain resource value (14)
Reuse instead of consume (28)	
Reuse waste (15)	
Use biological products (3)	
<p><b>Circular business models</b></p>	<b>Closing loops (310)</b>
	<b>Circular value creation (193)</b>
	<b>Circular strategy (170)</b>
	<b>Circular organisation (316)</b>
	<b>Circular revenue models (242)</b>



<b>Difficulties</b> <b>(433)</b>	
<b>Sensitizing Concepts</b>	<b>Codes</b>
<b>Financial barriers</b> (47)	Banking barrier (15) Capital barrier (27) Cost barrier (5)
<b>Policy barriers</b> (71)	Financial policy barriers (2) Governmental policy barriers (26) Inadequate subsidy model (11) Labour tax (6) Tendering barrier (8) Waste policy (18)
<b>Organising barriers</b> (31)	Lack of knowledge (9) Lack of product trust (4) Lack of production capacity (3) Resistance to change (11) Reverse cycles barrier (3) Shareholder structure (3)
<b>Overcome barriers / Circular boosts</b> (131)	Create revenue models (6) Facilitate cooperation (8) Financial boost (16) Increase virgin resource prices (7) Policy as a building block (47) Scaling up (10) Simplify CE (5) Solve chain deficit (5) Subsidy boost (18) Tax the polluter (9)
<b>Awareness</b> (93)	Educate (15) Improve awareness to boost (25) Increasing awareness (34) Lack of awareness (19)
<b>Reason</b> (60)	Ecological reasons (17) Financially attractive (11) Intrinsic motivation (17) Market reasons (8) Sustainability reasons (7)

Closing loops (310)	
Sensitizing Concepts	Codes
Reuse (99)	Retain quality (4)
	Reusing products (20)
	Reusing raw materials (45)
	Reusing residual waste (30)
Raw materials (39)	Circular material (10)
	Sustainable material (18)
	Resource responsibility (11)
Products (79)	Modular design (10)
	Product design (21)
	Product maintenance (38)
	Optimise product use (10)
Reverse cycles (59)	Collect waste (7)
	Facilitate reverse cycles (11)
	Recollect products (7)
	Retain ownerships (10)
	Role of the consumer (2)
Chain management (34)	Separate waste (22)
	Closing loops in cooperation (17)
	Manage the resource chain (8)
	Trace raw materials (9)



## Circular value creation (193)

Sensitizing Concepts	Codes
Financial value (11)	Efficient model (6)
	Resource savings (5)
Ecological value (143)	CO2 reduction (20)
	Energy from waste (3)
	Energy use reduction (9)
	Measure impact (9)
	Reduce chemicals (7)
	Reduce ecological impact (10)
	Resource use reduction (24)
	Sustainable energy (10)
	Transport reduction (9)
Waste reduction (42)	
Social value (25)	Distant personnel (20)
	Educate and develop people (5)
Societal value (14)	Create jobs (8)
	Support charities (3)
	Widely accessible service (3)



<b>Circular strategy (170)</b>	
<b>Sensitizing Concepts</b>	<b>Codes</b>
<b>Goal setting</b> (23)	Circular goals (4)
	(Ecological) sustainability goals (5)
	Financially feasibility (8)
	Shared goals (6)
<b>Customer relationship</b> (33)	Customer value (4)
	Service provider (10)
	Sustainable customer relationship (19)
<b>Competitive advantage</b> (38)	Innovation (19)
	Leadership (4)
	Quality driven (4)
	Resource independency (5)
	Treasure waste (6)
<b>Focus</b> (39)	CE as a strategic core value (7)
	Choosing the right products (8)
	Focus on cooperation (5)
	Improve public awareness (9)
	Stakeholders value (6)
	Sustainable profitability (4)
<b>Geographic scope</b> (11)	Broad geographic scope (3)
	Local (8)
<b>Temporal scope</b> (26)	Futureproof (7)
	Long term vision (19)



<b>Organisation (317)</b>	
Sensitizing Concepts	Codes
<b>Cooperation</b> (92)	Dependency (14)
	Long-term cooperation (2)
	Shared responsibility (7)
	Transparency (29)
	Trust (16)
<b>Reorganisation</b> (69)	Bottom-up organisation (3)
	Internal cooperation (4)
	Long-term processes (5)
	Manual labour (5)
	Organisational mind set (17)
	Organise reverse cycles (21)
	Product service system (8)
	Reorganise functions (6)
<b>Partnerships</b> (72)	Alternative cooperation modes (7)
	Chain cooperation (47)
	Integrated business model (10)
	Network cooperation (30)
<b>Knowledge</b> (84)	Financial knowledge (1)
	Knowledge sharing (39)
	Marketing expertise (8)
	Platform (12)
	Technological knowledge (24)



## Circular revenue models (242)

Sensitizing Concepts	Codes
<b>Profitability</b> (35)	Circular profitable (32)
	Non profitable (4)
<b>Revenue model</b> (198)	Cascading (17)
	Conventional sales (44)
	Crowdfunding (10)
	Deposit money (8)
	Donations (10)
	Freemium (5)
	Licensing (12)
	Pay-per-use (8)
	Product leasing (21)
	Subscription (26)
	Subsidy (7)
Value of waste (30)	
<b>Shared revenue</b> (9)	Shared revenue model (9)

## *Appendix F – Barrier codes*

### **Policy barriers:**

‘Governmental policy barriers’ are mentioned 23 times, these include several policies and ways of governmental working that block circular activities for companies. An example is the unwillingness of the government to rent or lease products, a revenue model that is associated with the circular economy.

The code ‘waste policy’ (18) labels the text parts that refer to the national policy on waste that hinder companies to work with waste. Currently there are strict rules on materials that have been labelled as waste. These rules sometimes make it hard or even impossible for companies to transport or reuse waste.

The code ‘labour tax’ (6) refers parts of text where companies mention that labour tax should be reduced and resource tax should be increased. The circular economy is seen as a labour intensive economy. So when a company reduces the use of virgin resources and increase the reuse of resources, more work is needed than when virgin resources are used. By decreasing the taxes on labour and increasing the taxes on virgin resources a more profitable environment for circular companies is created.

The code ‘inadequate subsidy model’ (11) refers to parts of the text where companies are negative about gaining a subsidy. Too often gaining a subsidy takes a lot of time and thus money. The complex policies on subsidies have made incredibly hard for circular pioneers to gain a subsidy for their sustainable companies.

The code ‘tendering barrier’ (8) is used in the construction industry, where tendering hinders the trust building, long-term cooperation and sustainable innovation. The European tendering policy is focussed on short-term and circular pioneers in the construction industry argue that this is interferes with the grow of a circular economy.

### **Financial barriers:**

The code ‘capital barrier’ (27) refers to a lack of capital to fully operate circular. This makes it difficult for start-ups to get their company up and running. Another form of a financial barrier is labelled with the code ‘banking barrier’ (15). This code refers to the experience that circular pioneers have with gaining a loan or an investment from banks or investment institutions. Companies often face. Companies often face a hard time in gaining investments from banks or other investment institutions because they don’t have an adequate financing model for circular business models.

The last financial barrier identified is labelled with the code ‘cost barrier’ (5). This code refers to the idea that in the beginning it is often more expensive to develop as a circular company. This results in products that are costly, and customers are often price-driven, meaning that they’ll often just choose the cheapest options.

### **Organisational barriers:**

The code ‘resistance to change’ (11) is self-explanatory and refers to the resistance of organisations, governments and society to change.

The code ‘lack of knowledge’ (9) refers to a lack of technological or organisational lack of knowledge, it also refers to a lack of knowledge with partners or the lack of knowledge sharing because of patents.

The code ‘lack of product trust’ (4) refers to customers that are concerned with products that have reused parts or materials. Companies experience this lack of trust with their customers when they are products that are reused or contain reused parts or materials. This reduces the sales and thus the profit of a circular company.

The code ‘lack of production capacity’ (3) refers to the lack of production capacity for organisations. Because of the labour intensity of the circular economy, not all companies can fulfil this need for labour.

The code ‘reverse cycle barriers’ (3) refers to issues with reclaiming used products. An essential part of the circular economy is closing loops, so it is important that products that have been used don’t end on a dump or in the incinerator. The products have to return to the company in order for a company to reuse the materials. But, too often customers don’t return products and the materials end up being gone forever when burned in the incinerator.

The last code for organising barriers is the ‘shareholder structure’ (3). This code refers to companies having to satisfy shareholders on the short term, which often interferes with a long-term vision. The focus of shareholders is on short-term profit while the focus of a circular business is on sustainable profit. Based on the number of times codes

## *Appendix G – Summary of the answers to the sub-questions*

### **1. What does the concept of circular economy constitute according to companies?**

*‘Circular economy is about reusing products instead of consuming and wasting them, it’s about preventing products to become waste and about reusing those products that have become waste, so by closing loops the value of resources can be retained and product usage can be optimised. Additionally, being a sustainable company, producing environmentally friendly and enabling product reuse by proper product design belong to the circular economy.’*

This practical definition is based on the coding template. Companies seem to only mention the aspects of the theoretical definition that they can understand and translate into practice. This makes that there isn’t a lot of consensus between the circular pioneers about the practical definition of circular economy.

### **2. What challenges do circular pioneers encounter when embracing the circular economy?**

The challenges are mainly policy and finance related. The current policy regarding waste and labour tax isn’t fit for the circular economy. Also it is hard to gain investments from banks and other financial institutions because they don’t have any interest in circular initiatives (yet). Changing the policy from labour tax to virgin resource tax, and taxing the polluter could be a major step in the right direction for the circular economy, but this has to be an international policy which makes it a complicated matter.

### **3. How do companies work with the concept of closing loops?**

How circular pioneers fill in the concept of closing loops differs. Some are trying to keep materials in the value chain by accommodating waste that emerges from the production process into different products, other companies try to reclaim their materials from waste processors and other companies try to organise reverse cycles to reclaim their sold products and, consequently reuse the products or reuse parts of the products. In addition to reusing materials, circular pioneers are busy with product maintenance in order to extend the lifetime of products and thus preventing products and materials to become waste. There are some companies that are already implement the circular way of thinking into their product design. An example of this is the modular design. But overall, the product design should be taken more into account in order to be able to close loops more effectively. Circular pioneers are often able to find new functionalities for their waste flows, but that doesn’t mean they close the loops,

they contribute to utilizing certain resources. This is only the first step to completely closing loops.

#### **4. How do companies create value with a circular business model?**

Circular pioneers mainly create value by reducing their ecological footprint. The value creation resembles the reasons why circular pioneers engage in circular business models: to reduce their ecological footprint. From these interviews only, it isn't always possible to identify the sources of ecological values that are being created. But it is to be mentioned that the circular business model isn't always (directly) the cause for the ecological values that are being created. The circular business model is directly the cause of efficiently earning money by using less resources and money can be earned because the reusing is cheaper than using virgin resources. But only few companies acknowledge this value being created.

#### **5. How do companies align their strategy with a circular business model?**

Basically, it can't really be stated that circular pioneers align their strategy with a circular business model. There are some minor examples of adaptations of a strategy specifically for a circular business model, but overall, strategy is a neglected building block for circular pioneers.

#### **6. How do companies organise their circular business model?**

Circular pioneers talk a lot about organisation aspects in the circular economy. But this is mainly about cooperation that resembles cooperation in a linear economy. Circular pioneers seem to be capable in organising their own companies for the circular economy, but they are dependent of their partners in the value chain. This is why most companies only close material loops by themselves. Companies are making progress by establishing platforms and stimulate knowledge sharing. Organising reverse cycles remains an aspect where companies are struggling with to organise. Finding partners that are better capable to organise reverse cycles could improve establishing them.

#### **7. How do companies make money with a circular business model?**

Generally, most companies can't afford themselves to operate with only a circular revenue model, thus making their circular business model a little less circular. Conventional sales is still the main revenue model for the circular pioneers because it seems that the circular pioneers still experience a hard time being profitable with only circular revenue models.