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Walking down the non-linear path to the circular economy

*Finding drivers and barriers for the integration of
the circular economy in a public organisation*

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It is said that *“the greater the effort, the greater the sense of pride and accomplishment when finishing it.”* I would lie when saying this thesis was not a great effort. Now, after four years of HBO, one-year premaster and two years for my Strategic Management Master, I am eager to start the next chapter of life while looking back on a wonderful study period in ‘s-Hertogenbosch, Utrecht, Cape Town and finally, Nijmegen.

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Abstract

A lot of research on drivers and barriers for CE integration in businesses and the public domain has been conducted. Unfortunately, despite the potential influence of public organisations through public procurement this research has not been conducted for public organisations. Consecutively, the goal of this research was to find, through qualitative research, the drivers and barriers for CE integration in public companies.

The findings of the research resulted in a framework which categories these drivers and barriers. The results are mostly in agreement with the already existing literature on drivers and barriers on CE in businesses and public domain. In addition, the research concluded that a new driver is of influence for CE in public organisations; the exemplary role of these type of organisations. This driver has not been mentioned in previous literature on the topic. This can be mainly attributed to public function and funding that public organisations fulfil. In addition, several drivers and barriers are perceived differently in the context of public organisations.

The contribution of science of this research is a comprehensive overview of the drivers and barriers that are of influence in the integration of CE in public organisations. In addition, a more comprehensive framework on drivers and barriers on CE integration in private businesses is presented on basis of contemporary literature on the topic. The relevance of this research for practice is the applicability of drivers to speed up the process of integration and otherwise an insight in barriers to overcome challenges for the integration of CE.

Keywords: *Circular Economy, public organisations, non-production organisations, drivers, barriers*

1. Introduction

1.1 Research background

It is commonly known that the human population is growing. Expectations are that planet earth will reach a population of 9.8 billion in 2050, which is an increase of 25% (United Nations, 2017). This is one of the reasons that the global use of materials will also rise with 126% from 79.4 billion tons (Schandl et al., 2016) to 180 billion tons in 2050 (Dittrich, Giljum, Lutter, & Polzin, 2012). Societies are thus becoming increasingly aware of the fact that non-renewable resources are declining and becoming more expensive over time (Antikainen & Valkokari, 2016). As a result, national and supranational governments are introducing policies and legislation in order to accelerate the transition to CE (Kirchherr, Hekkert, et al., 2017). By applying the concept of circular economy, the EU alone could achieve an annual cost saving of 340-630 billion dollars (Ellen MacArthur Foundation, 2012, p. 66).

The '*circular economy*' (CE) concept, despite being less known than the sustainability concept, has gained traction in both society and amongst scholars. This is illustrated by a large increase in publications on CE since the 2000's (Reike, Vermeulen, & Witjes, 2018). A circular economy, as opposed to the linear economy, where there is an input of resources and an output of waste (Pitt & Heinemeyer, 2015; Witjes & Lozano, 2016), is focused on a regenerative system to minimize waste and reuse materials (Geissdoerfer, Savaget, Bocken, & Hultink, 2017).

Unlike a widely accepted definition on the sustainability concept (Dyllick & Hockerts, 2002), this is still not the case for the concept of CE. However, businesses, governments and non-profit organisations are striving to implement the concept into their organisation but experience challenges to do so due to the experienced conceptual vagueness (Reike et al., 2018). Scholars are aware of this struggle and are putting effort in streamlining the concept and reaching a consensus in understanding the concept of CE and its relation to the concept of sustainability (Reike et al., 2018). In their efforts in further operationalising CE, both scholars and practitioners have used several ways to get a better grasp of the concept and how it can be used. This is done through the development of so called 'retention options' – known as the R-imperatives (Kirchherr, Reike, & Hekkert, 2017; Reike et al., 2018) – mapping barriers (Araujo Galvão, de Nadae, Clemente, Chinen, & de Carvalho, 2018; Kirchherr et al., 2018; Ritzén & Sandström, 2017) and drivers for CE (Adams, Osmani, Thorpe, & Thornback, 2017; de Jesus & Mendonça, 2018; Mont, Plepys, Whalen, & Nußholz, 2017; Pheifer, 2017; Rizos et al., 2016). By doing so the field of practitioners is more and more provided with an increasing number of operationalisations and tools to integrate CE in organisations.

For public organisations one of the ways to make the transition to a more circular oriented organisation is through changing the procurement process. On average, countries within the European Union spent 16% of their gross domestic product (GDP) on the public procurement of goods and

services (Brammer, 2011). This comes down to approximately €1.3 trillion on annual basis. To illustrate; if all public authorities located in the EU would switch to energy from renewable sources they would save more than 60 billion tonnes of CO₂ (Day, 2005). This would bring the EU 12% closer in reaching the Kyoto goal for the emission of greenhouse gases for the EU (Day, 2005). Reasoning from this it can be said that public organisations have substantial purchasing power to achieve environmental goals on societal level (Brammer, 2011). Investing in integrating CE and consecutively facilitate circular oriented procurement in the organisation will thus have a substantial effect in the societal transition in becoming more CE oriented. However, up until now the mapping of drivers and barriers had a limited focus on organisations that engage in public procurement processes but more on CE integration in private production organisations and public domain. Due to the potentially large influence of public organisations it is thus interesting to gain more in depth knowledge of the drivers and barriers that are of influence in public organisations. Following this reasoning, a gap in scientific literature can be found. This gap is the absence of documented drivers and barriers for CE integration in public organisations

1.2 Problem statement

The presented gap in the scientific literature provides a research opportunity to formulate the following research question on this topic:

“What are the drivers and barriers for integrating the concept of circular economy in a public organisation?”

The goal of this research is to determine the relevant drivers and barriers and their effect when integrating the circular economy in the procurement proces in a Dutch university. The research question will be answered through two sub-questions. The first sub-question reads as follows: “What are the drivers that enable the integration of the circular economy concept in a public organisation?” The second sub-question focusses on the opposite: “Which barriers are hampering the integration of the circular economy concept in a public organisation?”

In order to provide an answer to the formulated research question, data will be gathered in collaboration with the Radboud University Purchasing Department (RUPD). This department is seeking to further integrate circular economy within the organisation in which circular procurement is used as a proxy. This is due to the fact that currently, employees that are authorized to purchase products can select from a range of products which include both circular, sustainable and linear economy oriented products. This provides the opportunity to gather data on which drivers and barriers related to CE can actually be found in practice in a non-manufacturing organisation. The drivers and barriers that are found in the organisation will be compared to a pre constructed framework. This framework is based on a literature review of drivers and barriers for CE that were found in private (production) organisations and research within the public domain.

1.3 Thesis outline

The remainder of this report consists out of the theoretical foundation (see section [2](#)) which focusses on three specific topics, firstly; understanding of the CE concept and its operationalisation, secondly; the possible contribution of public organisations to a CE and thirdly the drivers and barriers of CE integration to form the theoretical lens and build the conceptual framework. The third section (see section [3](#)) will focus on the research outline for attaining the aim of this research. The research will be conducted as a case study, in this case, within the Radboud University. The data will consist of qualitative interviews with key persons on this field in the organisation and data analysis on publicly available documents and historical circular and sustainable purchasing data. The data that will be gathered will be used to determine the drivers and barriers that are of influence in the Radboud University during the CE integration process. In section four (see section [4](#)) the results of the interviews, and documents analysis will be discussed and compared with discussed literature. Followed by the discussion of this synthesis in section 5 (see section [5](#)) and a conclusion in section six (see section [6](#)).

2. Literature review

2.1 Circular economy

As described in the introduction, the circular economy gained much traction in the past 5 – 10 years (Reike et al., 2018). While CE has seen increased attention in the past years, the concept is already gaining momentum since the late 1970s (Ellen MacArthur Foundation, 2012). But what does “circular economy” actually mean?

Many definitions with each their own focus and understanding on the concept have been formulated (Geissdoerfer et al., 2017; Kirchherr, Reike, et al., 2017). These definitions can be, and are formulated on different economical levels; macro, meso and micro (Kirchherr, Reike, et al., 2017). While there is no commonly used definition for CE, the most widely used, and somewhat accepted definition is formulated by the Ellen MacArthur Foundation (Geissdoerfer et al., 2017; Kirchherr, Reike, et al., 2017) and reads as follows:

“A circular economy is an industrial system that is restorative or regenerative by intention and design. It replaces the ‘end-of-life’ concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models.” (Ellen MacArthur Foundation, 2012, p. 7)

This definition, does not clearly show the implementation possibilities on different economical levels and is very abstractly formulated. Its focus is on an industrial system and thus has its focus on macro-level. By doing so, this definition makes it hard to integrate a form of CE in organisations. This is substantiated by the fact that the mentioning of business models is more apparent in practitioner formulated definitions than scientific, peer-reviewed literature. Likely because practitioners are more

concerned with a practical approach (Kirchherr, Reike, et al., 2017). The definition formulated by Kirchherr, Reike, et al. (2017) however, focuses on the different economic levels in which CE can play an important role:

“A circular economy describes an economic system that is based on business models which replace the ‘end-of-life’ concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations.” (Kirchherr, Reike, et al., 2017, p. 224)

This definition shows the applicability of CE on different levels which increases the usability and understanding of the definition on different economical levels. In addition, this definition not only focusses on production processes but entire material flows so that non-production organisation can also translate this definition to practical use. The definition formulated by Kirchherr, Reike, et al. (2017) is based on an analysis of 114 definition on the concept of CE. For this research the definition as formulated by Kirchherr, Reike, et al. (2017) is adopted.

In the previous section it became clear that there are plenty definitions on CE. Unsurprisingly, the main critique on the CE concept was that it was lacking conceptual clarity regarding the concept and further exploration of the operationalisation of the CE principle was needed (Reike et al., 2018). Consequently, scholars described different material hierarchies, also known as the R-imperatives or retention options to increase clarity regarding the concept. These retention options, ranging from 3-R's to 9-R's, show that CE is more than just recycling. Reike et al. (2018) use the following hierarchy: (0)Refuse, (1) Reduce (2) Resell, reuse, (3) Repair, (4) Refurbish (5) Remanufacture (6) Re-purpose, (7) Recycle (8) Recover energy, (9)Re-mine. This operationalisation provides organisations with a starting point to further operationalise CE in their own context. As thus gradually becomes clear, CE presents itself as an alternative to the currently dominant ‘linear model’ (Lewandowski, 2016). In contrast to the linear economy, CE is focused on creating a closed material loop in the economic system that minimises (virgin) resource input and waste (Geissdoerfer et al., 2017). The CE loop is shown in figure 1.

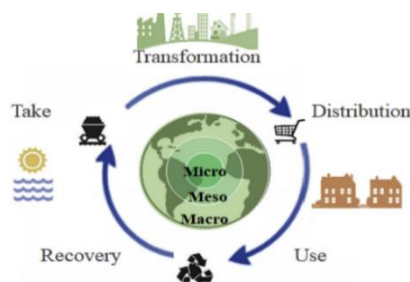


Figure 1: Circular Economy Cycle. Adopted from: Prieto-Sandoval, Jaca, and Ormazabal (2018)

2.2 Circular economy in relation to organisations

In the previous section, it is explained that widely known definitions on CE often focus on a macro level, this makes it challenging for organisations to integrate CE into their businesses due to the lack of comprehensive knowledge on creating CE oriented business models (Lewandowski, 2016). Not only are organisations lacking knowledge of the CE concept but the absence of appropriate tools and a shared language for integrating CE makes it difficult to operationalise the concept (Antikainen & Valkokari, 2016; Bocken, Olivetti, Cullen, Potting, & Lifset, 2017; Preston, 2012). Besides, switching from a linear economy to a CE means a two sided approach, one side for policymakers and the policies that they design, and on the other side the businesses that need to introduce CE in their business models (Lewandowski, 2016).

To integrate the CE principles in an organisation Laubscher and Marinelli (2014) identify six key areas that need to be taken into account when integrating CE principles in a production company. These key areas are: (1) *Sales model*, (2) *Product design/material composition*, (3) *IT / Data management*, (4) *Supply loops*, (5) *Strategic sourcing for own operations* and (6) *HR/incentives*. These six key areas cover the business processes of an organisation and provide a starting point for integrating CE in organisations (Laubscher & Marinelli, 2014). When zooming in on the supply loops, where recycled materials are used to produce new products. This provides an opportunity for public organisations to have an impact on both their organisation and on a broader scale: society as a whole. These organisations acquire an extensive amount of their supplies through procurement processes. By focussing on purchasing circular products through procurement; public organisations can have an extensive impact on society wide policy goals (Brammer, 2011; European Commission, 2017), in this case the transition to circular economy (Dijksma & Kamp, 2016).

2.3 Circular procurement

Public procurement is defined as “*the acquisition of goods and services by government or public sector organization*” (Uyarra & Flanagan, 2010). With regard to circular public procurement (CPP), this refers to the possibilities of procurers to procure products that promote the general principles of CE (Alhola, Ryding, Salmenperä, & Busch, 2019). Alhola et al. (2019) describes how public entities can

use four main approaches to implement circular procurement to achieve a closed loop material cycle: (1) Procurement of improved products or services in circular terms, (2) Using new business concepts promoting circular economy, (3) Procurement of new circular products and (4) Development of circular ecosystems. Practically this means that a procurer promotes six retention options: reuse, repair, refurbish, remanufacture, retrieve and recycle (Van Geet, 2014).

Approximately 16% of GDP of European countries is attributed to public procurement. This comes down to more than €1.3 trillion that is annually spend on procurement (European Commission, 2017). In addition, countries that fall under the Organisation for Economic Co-operation and Development (OECD), are estimated to spend between 8% and 25% of their GDP on public procurement (Brammer, 2011). Following out of these significant monetary investments in public procurement, it is clear that public procurement can play an essential role in a demand oriented innovation policy (Aschhoff & Sofka, 2009; Edler & Georgiou, 2007). As a result, public procurement can have a large influence on achieving policy goals that have society wide impact (Brammer, 2011). Public organisations can use this potential by incorporating social, environmental and economic (people, planet, profit) specifications in the procurement process. This can have indirect positive effect on product development and on consumer demand for more sustainable products because it creates an increased demand for suppliers, reduces their market risk and creates incentives to move towards a sustainable business model (Parikka-Alhola, 2008; Walker & Brammer, 2012). Organisations that participate in procurement processes ultimately have an extensive impact on national and even on European level and can use this influence to promote CE and enforce a transition to circular business models in supply chains.

2.4 Drivers and barriers

In the previous paragraph it was discussed that public organisations can have a significant societal impact through public procurement. When zooming in on organisations that want to make the transition to a more circular procurement process, both drivers and barriers can be identified. Several authors have written on the topic of CE based drivers and barriers. These articles focus on-either drivers or barriers (Araujo Galvão et al., 2018; Kirchherr, Hekkert, et al., 2017; Kirchherr et al., 2018; Ritzén & Sandström, 2017) individually and to a lesser extent on both simultaneously (Adams et al., 2017; Mont et al., 2017; Pheifer, 2017; Rizos et al., 2016). Even fewer authors focus on using a complete categorisation for the drivers and barriers related to CE (de Jesus & Mendonça, 2018; Tura et al., 2019). For this research, the categorisation by Tura et al. (2019) is used due to the extensive literature analysis that is conducted and the extensiveness of the categorisation. The categorisation from de Jesus and Mendonça (2018) exists out of four categorisations; *technical*, *economic/financial/market*, *Institutional/regulatory* and *social/cultural*. Whereas this research adopts the main categories *Environmental*, *Economic*, *Social*, *Institutional*, *Technological* and *informational*, *Supply chain* and

Organisational (Tura et al., 2019). Furthermore, complementary literature on drivers and barriers is analysed to draw a more comprehensive framework, the additional literature is discussed in the upcoming sections.

2.4.1 Drivers

Drivers are factors that influence a particular development in a positive manner. Drivers in the sense of CE are factors that motivate or steer organisations and the public domain towards the integration of CE. As mentioned previously, the basis for the categorisation is created by Tura et al. (2019) with additions based on additional literature analysis.

2.4.1.1 Environmental

Adopting CE results in a reduction of the negative impact that organisations have on the environment through their processes due to the reduction of waste (Andersen, 2006; Esposito, Tse, & Soufani, 2017) by applying retention options (Reike et al., 2018) to maximise resource usage (Andrews, 2015; Ghisellini, Cialani, & Ulgiati, 2016; Linder & Williander, 2017). More specifically, adopting CE can result in a reduction of the use of scarce resources (Lacy & Rutqvist, 2016; Moreno, Braithwaite, & Cooper, 2014).

2.4.1.2 Economic

A driver for CE is its financial attractiveness, by using products in a more sustainable way by either prolonging the lifetime or by the use of second-hand items lower costs are incurred (Mont et al., 2017). Additionally, Tura et al. (2019) mention in their framework that CE can result in lower costs because it results in a reduction of both waste and energy costs through decreasing waste streams and energy usage (Andersen, 2006; Esposito et al., 2017; Ghisellini et al., 2016; Murray, Skene, & Haynes, 2017; Rizos et al., 2016) and has a potential for finding synergies between processes (Dong et al., 2016). Besides the potential for cost reductions, CE also provides the opportunity for new business models through innovation and business development (Andersen, 2006; Pheifer, 2017). CE also provides the opportunity for existing business models to increase business growth, value creation and increasing margin and profits (Ellen MacArthur Foundation, 2012; Linder & Williander, 2017; Schulte, 2013).

2.4.1.3 Social

Tura et al. (2019) argue in their framework that stricter environmental regulation and increased market internationalization are examples of social drivers (Zhu, Geng, Sarkis, & Lai, 2011). However, stricter environmental regulations are an example of an institutional drivers and is therefore placed under the category institutional. Surprisingly, Tura et al. (2019) do not mention the specific cultural context in which this driver is mentioned, namely the Chinese manufacturing context. This limits the applicability of the driver to other contexts since the integration of CE is seen as highly dependent on contextual factors (Bechtel, Bojko, & Völkel, 2013; Kirchherr et al., 2018). A social driver for CE is also the increase in the worldwide awareness of the need for CE (Mathews & Tan, 2011; Pheifer, 2017).

Besides, it is also mentioned that CE could drive employment opportunities (European Commission, 2014) and could increase the qualities of life (European Commission, 2014).

Another driver which is not mentioned in the CE literature is the moral aspect of the circular economy. However, the moral aspect of CE is acknowledged in the sense that one can distinguish a right and wrong and the handling of materials (Gregson, Crang, Fuller, & Holmes, 2015). In addition, the moral and ethical aspect is also mentioned in the sustainability literature as a driver for pursuing sustainability (Lozano, 2012). Due to the interconnectedness of both concepts (Geissdoerfer et al., 2017), this driver can also be of influence for CE.

2.4.1.4 Institutional

Regulatory guidelines established on a national or supra national level (e.g. the European Union) which are directional are proved to be enhancing towards CE (Dong et al., 2016; Geng, Fu, Sarkis, & Xue, 2012; Q. Liu, Li, Zuo, Zhang, & Wang, 2009). Moreover, subsidies (Dijkema & Kamp, 2016; Rizos et al., 2016), supportive taxation (Dijkema & Kamp, 2016), global (quality) standards (ISO 14000 certifications) and goals (European Commission, 2014) are also seen as a driver towards CE (Dong et al., 2016; Liu & Bai, 2014).

2.4.1.5 Technology and information

The development of new technologies can pose as a driver for CE (Lacy & Rutqvist, 2016; Mathews & Tan, 2011). New technologies can provide better alternatives for current polluting or inefficient technologies and can overcome or prevent current challenges (de Jesus & Mendonça, 2018; Ghisellini et al., 2016). Within the framework the authors also argue that the use of information sharing platforms enables better information transparency, cooperation between stakeholders and information sharing (Ellen MacArthur Foundation, 2012; Pheifer, 2017).

What is not mentioned in the framework is that it is believed that when the level of education of people increases, their awareness on CE increases as well (Q. Liu et al., 2009). The last informational oriented driver that is absent in the framework is the knowledge (Rizos et al., 2016) and consequently awareness (Pheifer, 2017) and commitment on the topic of CE. This driver is an important aspect in the transition to CE (de Jesus & Mendonça, 2018)

2.4.1.6 Supply chain

When CE is adopted, organisations become less dependent on new supplies, already available resources will be utilized more efficiently (Andrews, 2015; de Jesus & Mendonça, 2018; Esposito et al., 2017; Ghisellini et al., 2016). Furthermore, by becoming less dependent on virgin resources and increasing the use of non-virgin materials price volatility decreases (Moreno et al., 2014; Schulte, 2013).

2.4.1.7 Organisational

The last drivers of the framework of Tura et al. (2019) are organisational drivers. They argue that through the adoption of CE, and ultimately embracing a more environmental minded image, organisations can achieve an increase in their goodwill and a “green” image amongst its stakeholders (Ambec & Lanoie, 2008; Geng et al., 2012). The integration of CE in the organisational goals, strategy, and KPIs incentivises making the transition towards a CE minded organisation (Pheifer, 2017; Tura et al., 2019). In addition, in time, circular business models can be more cost efficient than linear business models (Linder & Williander, 2017).

Surprisingly, Tura et al. (2019) do not mention several other drivers within the organisational context. For example, top management commitment as a driver for CE which is mentioned in both CE (Bechtel et al., 2013; Mont et al., 2017) and sustainability literature (Lozano, 2012). Effective CE communication, which spreads knowledge and awareness, is also seen as an important driver in implementing CE (de Jesus & Mendonça, 2018; Ilić & Nikolić, 2016; Pheifer, 2017). Mindset and commitment of the staff of businesses and organisations are an important aspect in the transition to a CE model (Rizos et al., 2016). However, it seems logical that Mindset and commitment is influenced by the knowledge that staff has regarding the topic.

2.4.2 Barriers

Barriers are factors that influence a particular development in a negative way. Barriers in the context of CE focuses on barriers that deny or limit the process of the integration of the circular economy principles in organisations. The same categorisation in the drivers section from Tura et al. (2019) is adopted with additions from additional literature research. Logically, no environmental oriented barriers for CE are identified. As a result, this category is not included in the upcoming section.

2.4.2.1 Economic

The first economic barrier is the high upfront costs that are associated with CE (de Jesus & Mendonça, 2018). It appears that with the integration of CE additional investments are needed due to requiring new logistical systems, training of employees and equipment is needed (Mont et al., 2017; Preston, 2012) as well as costs of developing new technologies (Gumley, 2014). In addition, the difficulty of measuring the long-term benefits of CE pose a barrier as well. This can be attributed to the fact that economic gains from CE cannot be directly measured as is the case with the linear economy (Bechtel et al., 2013; Ritzén & Sandström, 2017; Rizos et al., 2016). This makes it difficult to justify these investments, especially since the limited available funding and financial support for CE (Ilić & Nikolić, 2016; Kirchherr et al., 2018; Pheifer, 2017; Rizos et al., 2016; Xue et al., 2010).

The barrier which is not mentioned in the framework is the low prices of virgin materials in production processes. The lower price of virgin materials compared to the costs related to the use of recycled or reused materials (Preston, 2012) provides a barrier for organisations or business in integrating CE due to that products that are made of virgin material are cheaper (Kirchherr et al., 2018).

2.4.2.2 Social

A barrier identified on the social level is the culture and behaviour of consumers and employees. Employees can sympathize with problems the planet is currently facing, in special environmental issues, but as a consumer, they are less eager to spend more on the socially or environmentally responsible products (Pheifer, 2017). This implies that individuals can sympathize with and even actively support organisational goals but when in the position of a consumer will not follow up on their formerly taken stand. The framework also mentions the lack of incentives as a social barrier. In this research the reasoning of Kirchherr et al. (2018) is followed and combined with the regulatory barrier mentioned in the next section.

2.4.2.3 Institutional

Barriers from a regulatory perspective are identified as obstructing or absent laws and regulations (Mont et al., 2017; Pheifer, 2017; Rizos et al., 2016). This framework mentions complexity of regulations as barrier, which is only based on research in a specific sector in Australia (Gumley, 2014). While CE drivers and barriers are recognized as dependent on specific context (Bechtel et al., 2013; Kirchherr et al., 2018). Additional research learned that this barrier is also present in the European Union (Kirchherr et al., 2018). Another institutional barrier is the absence of incentives for striving for CE while there are incentives for linearity and the current legislation is based on the linear model (Gumley, 2014; Pheifer, 2017). Limited circular procurement by organisations has also been identified as a barrier by (Kirchherr, Hekkert, et al., 2017). This leads to limited funding for CE and will result in companies not being able to develop and demonstrate the possibilities of CE (Eijk, 2016). When taking in mind the purchasing power of public organisations this can set a change in motion to set the stage for other businesses and organisations (Witjes & Lozano, 2016). In this framework Tura et al. (2019) mentions municipal government officials' awareness on CE as a barrier for CE. However, according to Xue et al. (2010) this can be appointed to the specific Chinese political style. Because this barrier is specific for China it is not included in this framework.

2.4.2.4 Technological and informational

Tura et al. (2019) mention in their framework that the lack of technology, knowledge and information slows the integration of CE (Bechtel et al., 2013). This is substantiated by other authors as well (Adams et al., 2017; Ballard, 2005; de Jesus & Mendonça, 2018; Kirchherr et al., 2018). Due to widely established linear technologies there is a lack of technical know-how that hinders the transformation to CE business models (Rizos et al., 2016).

2.4.2.5 Supply chain

A supply chain barrier is ‘operating in a linear business model’ (Kirchherr et al., 2018; Pheifer, 2017). Even if an organisation or company wants to commit to, and fully integrate CE, it is still dependent on its business partners in the supply chain (Witjes & Lozano, 2016). For the integration of CE, an organisation is for a large part dependent on its stakeholders both upstream and downstream. A lack of cooperation (Rizos et al., 2016), knowledge and awareness amongst these stakeholders can pose as a barrier for shifting to CE (Chee Wooi & Zailani, 2010).

2.4.2.6 Organisational

A ‘hesitant company culture’ (Kirchherr et al., 2018), in other literature referred to as ‘company environmental culture’ (Araujo Galvão et al., 2018; Rizos et al., 2016), is mentioned as an organisational barrier. A hesitant corporate culture can be identified by organisations in which CE is not integrated into the strategy, mission, vision, goals & key performance indicators (Pheifer, 2017). A hesitant corporate culture blocks the transition to CE because management and/or employees are not receptive for this transition in a professional context. This due to silo-thinking, hierarchical systems and a reluctance to change that hamper flexibility and innovation (Bechtel et al., 2013; Liu & Bai, 2014). The needed resources and commitment to fuel this transition will thus not be made available.

2.5 Research framework

The literature discussed in the previous section provides the theoretical lens with which this research is conducted. Due to the often heard critique that CE suffers from conceptual vagueness (Reike et al., 2018), it is important to get a grasp on the concept of CE and how it can be used in practice through retention options (Reike et al., 2018). Despite the large potential of circular procurement there is limited focus from authors on CE implementation in public organisations.

When integrating CE, organisations can encounter various barriers and drivers which can be distributed over several categories. Surprisingly, only two articles doing so were encountered (de Jesus & Mendonça, 2018; Tura et al., 2019). Other articles focus solely on either drivers or barriers and often without a categorisation. For this research, the foundation of the framework is based on the model developed by Tura et al. (2019). In this framework there are seven different categories in which corresponding drivers and barriers are represented. Based on additional literature research several drivers and barriers were included. With regard to drivers for CE; moral and ethical drivers (Lozano, 2012), a higher level of education (Q. Liu et al., 2009), knowledge (de Jesus & Mendonça, 2018; Pheifer, 2017; Rizos et al., 2016), CE business model more cost effective (Linder & Williander, 2017), Top management (Araujo Galvão et al., 2018; Bechtel et al., 2013) and mindset and commitment from staff (Rizos et al., 2016) were added into the framework. In addition, Tura et al. (2019) mentioned

market internationalization and worldwide awareness as the same driver, while these are two separate drivers. In the constructed framework they are presented as such.

With regard to the barriers for CE, four barriers were added on basis of additional literature research; low prices of virgin materials (Kirchherr et al., 2018; Preston, 2012), limited circular procurement (Bechtel et al., 2013; Eijk, 2016; Kirchherr, Hekkert, et al., 2017; Witjes & Lozano, 2016) and a strong focus on linear business models (Rizos et al., 2016). The changes and additions result in the research framework as displayed in table 1.

Category	Drivers	Barriers
Environmental	<ul style="list-style-type: none"> Reduction of negative impact on environment through waste reduction and maximizing resource usage (Andersen, 2006; Andrews, 2015; Esposito et al., 2017; Ghisellini et al., 2016; Lacy & Rutqvist, 2016; Linder & Williander, 2017; Mont et al., 2017; Moreno et al., 2014; Reike et al., 2018) 	N/A
Economic	<ul style="list-style-type: none"> Cost reduction by efficiency and prolonging product lifetime (Mont et al., 2017) Reduction in waste and energy costs (Andersen, 2006; Esposito et al., 2017; Ghisellini et al., 2016; Murray et al., 2017; Rizos et al., 2016) Finding synergies between processes (Dong et al., 2016) Development of new business models (Andersen, 2006; Mont et al., 2017) Increase business growth for existing business models (Ellen MacArthur Foundation, 2012; Linder & Williander, 2017; Schulte, 2013) 	<ul style="list-style-type: none"> High upfront costs (Bechtel et al., 2013; de Jesus & Mendonça, 2018; Gumley, 2014; Mont et al., 2017; Preston, 2012) Difficulty of measuring long term benefits of CE (Bechtel et al., 2013; Ritzén & Sandström, 2017; Rizos et al., 2016) Limited available funding and financial support (Ilić & Nikolić, 2016; Kirchherr et al., 2018; Pheifer, 2017; Rizos et al., 2016) Low prices of virgin materials (Kirchherr et al., 2018; Preston, 2012)
Social	<ul style="list-style-type: none"> Increased market internationalization (Zhu et al., 2011) Increased worldwide awareness on CE (Mathews & Tan, 2011; Pheifer, 2017) Increased employment opportunities and quality of life (European Commission, 2014) Moral and ethical drivers (Gregson et al., 2015; Lozano, 2012) 	<ul style="list-style-type: none"> Lack of social awareness on CE (Kirchherr et al., 2018; Pheifer, 2017)
Institutional	<ul style="list-style-type: none"> Regulations directing towards CE (Dong et al., 2016; Geng et al., 2012; Q. Liu et al., 2009) Subsidies and supportive taxation (Dong et al., 2016; Liu & Bai, 2014) Quality standards and goals (Dong et al., 2016; Liu & Bai, 2014) 	<ul style="list-style-type: none"> Obstructing or absence of regulations (Kirchherr et al., 2018; Mont et al., 2017; Pheifer, 2017; Rizos et al., 2016) Limited circular procurement (Bechtel et al., 2013; Eijk, 2016; Kirchherr, Hekkert, et al., 2017; Witjes & Lozano, 2016) Absence of incentives for CE (Gumley, 2014; Pheifer, 2017)
Technology and information	<ul style="list-style-type: none"> New technologies (Lacy & Rutqvist, 2016; Mathews & Tan, 2011) Information sharing platforms (Ellen MacArthur Foundation, 2012) Higher level of education (Q. Liu et al., 2009) Knowledge (de Jesus & Mendonça, 2018; Pheifer, 2017; Rizos et al., 2016) 	<ul style="list-style-type: none"> Lack of technologies (Adams et al., 2017; Ballard, 2005; Bechtel et al., 2013; de Jesus & Mendonça, 2018; Kirchherr et al., 2018) Lack of knowledge and information (Adams et al., 2017; Ballard, 2005; Bechtel et al., 2013; de Jesus & Mendonça, 2018; Kirchherr et al., 2018) Strong focus on linear models (Rizos et al., 2016)
Supply chain	<ul style="list-style-type: none"> More efficient resource usage (Andrews, 2015; de Jesus & Mendonça, 2018; Esposito et al., 2017; Ghisellini et al., 2016) Less price velocity (Mont et al., 2017; Moreno et al., 2014; Schulte, 2013) 	<ul style="list-style-type: none"> Operating in a linear business model (Kirchherr et al., 2018; Pheifer, 2017) Lack of cooperation in supply chain (Kirchherr et al., 2018; Rizos et al., 2016; Witjes & Lozano, 2016)
Organisational	<ul style="list-style-type: none"> Increase in goodwill and green image amongst stakeholders (Geng et al., 2012; Mont et al., 2017) The integration of CE oriented strategies, goals and KPIs (Pheifer, 2017; Tura et al., 2019) CE business model more cost effective (Linder & Williander, 2017) Top management commitment (Araujo Galvão et al., 2018; Bechtel et al., 2013; Mont et al., 2017) Effective communication (de Jesus & Mendonça, 2018; Ilić & Nikolić, 2016) Mindset and commitment of staff (Rizos et al., 2016) 	<ul style="list-style-type: none"> CE not integrated with strategy, mission, vision, goals and KPIs (Pheifer, 2017) Silo thinking (Liu & Bai, 2014) Internal reluctance to change (Bechtel et al., 2013; Kirchherr et al., 2018) Organisational systems and a lack of managerial support (Bechtel et al., 2013)

Table 1: Framework of circular economy drivers and barriers

3. Research method

This chapter provides insight into the methodological choices made. The section consists out of the research design, description of the case study, data collection, data analysis procedure and research ethics.

3.1 Research design

Societies, organisations and businesses face more and more challenges that are not limited to a single field of knowledge and more intertwined, where multiple fields of knowledge meet each other (Carew & Wickson, 2010). These challenges require academia to overstep the traditional disciplinary and academic boundaries and apply a transdisciplinary approach in which multiple fields of knowledge are connected and make a practical contribution to the solution for the presented challenge (Carew & Wickson, 2010). The question with which we are faced with within this case is: how to overcome barriers and use drivers for a more CE oriented public organisation?

The goal of this research was to gain knowledge on the drivers and barriers that are associated with the integration of circular economy within a public organisation, in this case a Dutch university. Until now limited research is conducted on this topic. Several authors focus on drivers and barriers (de Jesus & Mendonça, 2018; Kirchherr et al., 2018; Ritzén & Sandström, 2017; Rizos et al., 2016; Tura et al., 2019) which can be linked to a (semi-)public organisation. Through interviews with key persons in the organisation it is determined whether the drivers and barriers, which are represented in the constructed framework, or new drivers and barriers are of influence for CE integration in public organisations. This makes a case study applicable to focus on a contemporary development like this (Benbasat, Goldstein, & Mead, 1987). In addition, a case study is also an appropriate approach to understand the developments that happen in practice (Flyvbjerg, 2006; Hartley, 2004; Yin, 2014).

3.2 Case study

In order to answer the research question of this thesis “*What are the drivers and barriers for integrating the concept of circular economy in a public organisation?*” it is important to understand the elements that are involved in the integration of CE. To do so, a qualitative approach was used in this research, which fits within a case study (Hartley, 2004). A qualitative approach is the most fitting approach due to the nature of the research question since this approach aims to achieve an in-depth understanding of the construction and perception of drivers and barriers of individuals within an organisation (Duberley, Johnson, & Cassell, 2012).

3.2.1 Case selection

In this study, the case was selected on the basis of a practical challenge the Radboud University (RU) is facing. Namely, further integrating sustainability and CE in the organisation. More specifically, the further integration of circular procurement. Access to this case was provided by dr. ir. S. Witjes who

was in contact with the Purchasing manager of the Radboud University. To get a sense of the case at hand, exploratory meetings with the manager purchasing and the program director sustainability were organized.

3.2.2 Case description

The RU is a general university with 22.976 registered students in October 2019 (Radboud Universiteit, 2019). The RU is organized in such a way that each faculty can operate highly autonomously both in terms of finances as well as organisation. Consequently, the RU can be seen as an organisation which operates in a decentralized organisational structure. The RU has seven faculties and one large overarching department where the secondary and supporting services are located. It is noteworthy that the faculties and departments are accommodated in different buildings across campus. The organogram of the RU is displayed in figure 2.

Currently, the RU is in a transition in becoming a more sustainable oriented organisation. The process of becoming a more sustainable organisation dates back to 2009 when a covenant for sustainable purchasing was signed (Franken, 2009). In 2016 this was followed by the ambition to purchase 100% sustainably in 2020 (Deneer & Laurijsen, 2016) and the appointment of a ‘Program Director Sustainability’ in November 2018. This illustrates that the RU is not unfamiliar with the topic of sustainability and has already made progress in this field in the past years. Resulting from these ambitions on sustainability, the RUPD is looking to further integrate circular purchasing in the organisation but is encountering problems in achieving this. According to Pim Zeldenrijk, purchasing manager, the tools to do so are in place. However, it seems that employees are not making use of these tools or are just not purchasing circular or sustainable products.

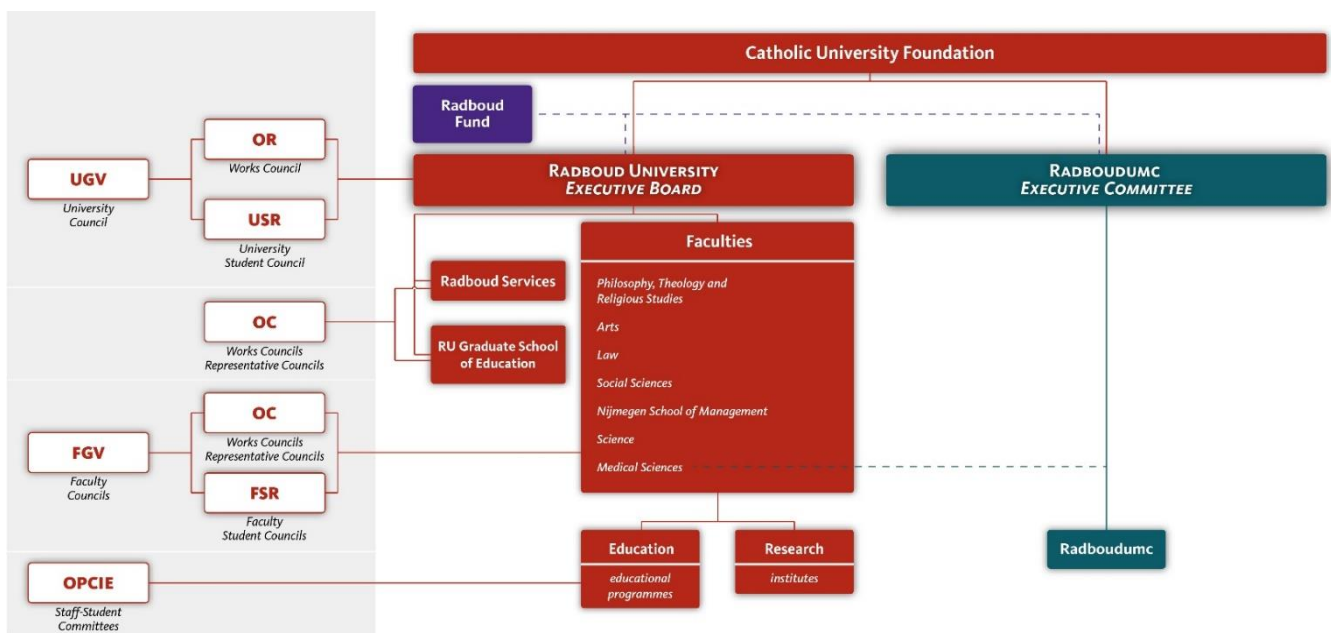


Figure 2: Organogram Radboud University. By: Radboud Universiteit., 2019

The concepts of sustainability and circularity were taken into consideration during previous procurement processes. For the categories of office furniture and office supplies, appropriate suppliers that have sustainable or circular products in their catalogue were contracted. Despite the possibility to purchase these products, employees apparently perceive barriers to do so. The number of employees that are concerned with purchasing office furniture is limited. Approximately one employee per faculty is involved, which comes to a total of approximately ten employees. With regard to buying office supplies, this is more decentrally organised. Every employee with an authorization for the purchasing portal (iProcurement) can purchase office supplies. As a result, the RUPD is searching for an approach to realize a culture change amongst these employees to direct them into purchasing more sustainable products.

3.3 Data collection

For this research, there are two data sources which can be divided in document analysis and field research. With regard to field research, interviews were conducted amongst pre-selected employees.

3.3.1 Document analysis

Documents are an important aspect of organisational life, they provide an insight in policies, procedures and strategies and thus in the organisational culture (Lee, 2012). These documents can be both publicly available but can also be restricted to internal use only. In this research only publicly available documents and webpages have been used.

Public documents of the RU, which could have a relation with circularity and sustainability are included in the list below. The contents of these documents were first analysed to find topics on the subject of sustainability and circularity. After conducting the interviews, the findings were compared with the found documents. In table 2 five publicly available documents are mentioned that have been used in this research.

Nr.	Name	Year of publication	Purpose of document
1	Verklaring duurzaam inkopen	2009	Declaration of intent for sustainable buying
2	Jaarverslag 2018	2019	Information on organisational performance in 2018
3	Wij gaan voor duurzaam!: gezamenlijke duurzaamheidsagenda van de Radboud Universiteit en het Radboudumc	2016	A shared agenda of the Radboud University and the Radboudumc on sustainability and circular economy

4	Duurzaamheidagenda 2016 - 2020	2015	The agenda of Radboud University on sustainability and circular economy
5	De Radboud Universiteit op weg naar 2020: An invitation to change perspective	2015	Outlining the strategic plan for the time span of five years

Table 2: *Documents used in analysis process*

3.3.2 Field research

Information that was gathered ‘in the field’ took place within the RU. The university consists of seven faculties and a department called ‘Radboud Services’ in which supporting services are combined, as can be seen in figure 2. With regard to the data collection, the interviews were conducted in cooperation with another researcher. This researcher is focussing on the same field but with a different theoretical focus.

By the use of semi-structured interviews, employees of the RU were interviewed to uncover relevant experiences, thoughts and cultural aspects that will or will not substantiate on the theoretical factors that have been formulated beforehand. In this case, the interviews were focussed on validating or finding drivers and barriers for CE. Interviews are an adequate way when conducting deductive research (Bleijenbergh, 2015) and provide the potential to uncover new information, which has not yet been covered in the scientific literature (Campbell, Moy, Feibelman, Weissman, & Blumenthal, 2004). In this case, semi-structured interviews provided the possibility to ask interviewees for theoretical factors in a structural way. Because culture is a subjective and often hard to point-out concept, a semi-structured interview is a fitting approach to go more in-depth. By doing so, it is possible to take a side step on the pre-formulated interview scheme and ask for thoughts, ideas and motivations which can then provide detailed information (Bleijenbergh, 2015). In this research two of the three sources as mentioned in King (2004) are used to draw the interview guide; research literature as mentioned in theoretical background and informal preliminary work. During the process, the information gained from interviews were used as input for the following interviews (King, 2004). As previously mentioned, interviews were prepared and conducted in cooperation with another researcher. Both researchers used their own theoretical input and co-created an interview guide that was applicable for both researchers. The transcriptions of the interviews were done in cooperation due to the fact that there was no room for applying an own interpretation of these results. The coding and analysis of these interviews was done individually.

For this research, the manager of the RUPD was the internal contact person. He provided a contact list for employees throughout the Radboud University, who have a managerial or coordinating function and were involved in the procurement process for new furniture back in 2015. Eleven persons were

approached and asked to conduct an interview with, ultimately, interviews were held with ten of the eleven employees as can be seen in the overview in Appendix [C](#)

Employees were contacted through email to make an appointment. In this email, it was stated that the interview would be anonymous. Some interviewees made clear that mentioning their name or function would not pose a problem. Depending on the language proficiency of the interviewee, the interview was conducted in either English or Dutch and subsequently transcribed in the corresponding language to preserve authenticity. Nine of the ten interviews were recorded and were processed into an edited transcription in which speech tics, repetitions and incorrect sentence building were removed or corrected. The interviews were transcribed using transcription software *Express Scribe Transcription Software*, *Amberscripts*, *Speechmatics* and *Trint*. After the interviews were transcribed, member checking was applied. The transcripts were sent to the interviewees to check the content on accuracy and incorrect, missing or additional information (Symon & Cassel, 2012). Two of the ten interviewees provided minor additions to their interviews.

3.4 Data analysis procedure

The research strategy of this report is constructed as presented in figure 3. A literature review is conducted, followed by drawing the theoretical framework out of which the data gathering is structured. The results of the data collection were matched with the theory from the literature review, out of which the contribution to science can be determined. This is an iterative process in which changes to the literature and theoretical framework can be made. Ultimately the findings will implicate some scientific and managerial recommendations.

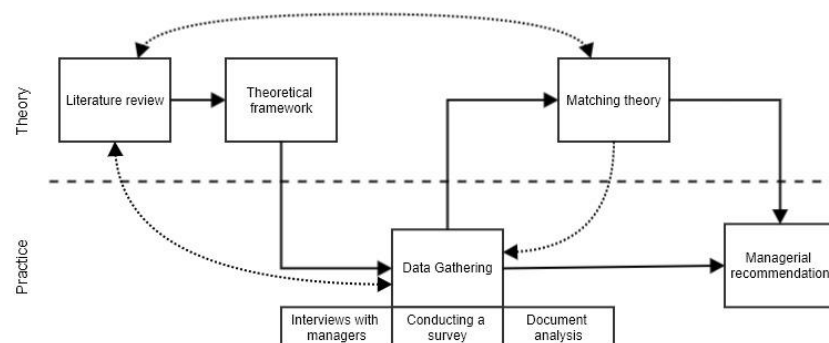


Figure 3: Research strategy

With regard to the data analysis, this relied on theoretical propositions (Yin, 2014) which shaped the data collection plan. The theoretical propositions will serve as the foundation for the analysis in the form of pattern matching (Yin, 2014). By using different sources to gather empirical data from the organisation and thus conducting data triangulation, the validity of the findings is increased (Hartley, 2004). This was achieved by interviewing a specific group of employees who were involved in the

procurement process for office furniture and represented the different faculties and departments of the RU. Both purchasing and procurement are related to the phenomenon of circular economy. Procurement in the sense of finding a supplier that can supply products, which fit within the CE concept, purchasing in the sense that employees who are concerned with purchasing have the choice to either buy circular or sustainable products.

As was mentioned in the previous section, the interviews that were held were transcribed. Consequently, the transcriptions were analysed and coded using coding software, in this case, *Atlas.ti*. The codes that were used during this process were determined on basis of the discussed literature and the corresponding framework. The operationalisation and theoretical foundation, based on the literature review, that was used is shown in the table below. An extended version which included the definition and stipulated definition can be found in Appendix [B](#). Interesting sections in the interviews and documents that could not be assigned to a specific code were marked as an open quotation for further reviewing after the initial codes were assigned. The second coding round was used to identify new possible drivers and barriers.

Concept	Dimension	Indicator
Drivers	Environmental	<ul style="list-style-type: none"> • Reduction of negative impact • Waste reduction • Maximising resource usage
	Economic	<ul style="list-style-type: none"> • Cost reduction • Lifetime increase/prolong • Reduction waste and energy costs • Finding synergies • Development of new business models • Increase growth for existing business models
	Social	<ul style="list-style-type: none"> • Market internationalisation • Employment opportunities • Quality of life • Moral • Ethical • Awareness
	Institutional	<ul style="list-style-type: none"> • Regulations directing CE • Subsidies • Supportive taxation • Quality standards • Goals
	Technology and information	<ul style="list-style-type: none"> • New technologies • Information sharing • Higher level of education • Knowledge • Awareness • Understanding concept of CE
	Supply chain	<ul style="list-style-type: none"> • More efficient resource usage • Less price velocity

	Organisational	<ul style="list-style-type: none"> • Goodwill • Green image • Business model more cost effective • Top management commitment • Effective communication • Mindset • Commitment
Barriers	Economic	<ul style="list-style-type: none"> • High upfront costs • Measuring long term effect • Limited funding • Limited financial support • Prices of virgin resources
	Social	<ul style="list-style-type: none"> • Social awareness on CE
	Institutional	<ul style="list-style-type: none"> • Obstruction of regulations • Absence of regulations • Limited circular procurement • Absence of incentives for CE
	Technology and information	<ul style="list-style-type: none"> • Lack of technologies • Lack of knowledge • Lack of information • Focus on linear models
	Supply chain	<ul style="list-style-type: none"> • Operating in linear business model • Lack of cooperation in supply chain
	Organisational	<ul style="list-style-type: none"> • CE not integrated in strategy • CE not integrated in mission • CE not integrated in vision • CE not integrated in goals • CE not integrated in KPIs • Silo thinking • Hierarchical systems • Lack of managerial support

3.5 Research ethics

To ensure the integrity of the research report and the author, the guidelines written down in the Netherlands Code of Conduct on Scientific Practice (*Nederlandse Gedragscode Wetenschapsbeoefening*) were followed closely. In general, the researcher is transparent about the steps that have been taken in order to conduct the research. At the start of the conducted interviews, participants were thoroughly informed to develop an understanding of the research and were asked permission to record and transcribe the interview (American Psychological Association, 2017). Participants of the interviews had the undisputed freedom of withdrawing themselves from participating in the research. In addition, participants in the research remain anonymous and will only be mentioned by function when needed in its context. In this research, no work, information, figures or data is used without a proper citation to the original author or organisation (American Psychological Association, 2017).

By conducting this research, the change process to a more circular oriented organisation might already be affected. In other words, by discussing the topic in interviews the research possibly already made a contribution in the change process to circular economy integration amongst the employees.

A further elaboration on these practices can be found in the ‘*Master thesis Business Administration Handbook 2018-2019*’ of the Radboud University. The author is aware of these elaborations and will follow the guideline as strict as possible, ensuring the integrity of himself and the research project. When handing in the final version of the master thesis an additional document will be included which will include a detailed version of the above mentioned unacceptable research practices.

4. Results

In the following section the findings of the data collection are presented. The section is divided in two main sub-sections which consecutively consist out of a section for drivers and barriers to CE that were encountered during the data collection. The findings are categorised on basis of the framework presented in section 2. At the end of this section the synthesis between the findings and the theoretical framework is discussed. Quotations were added to provide extra context. Whenever a quotation is provided the specific quote number is mentioned. Depending on the language proficiency of the interviewee the interviews were conducted in either Dutch or English. All quotations can be studies in appendix

4.1 Drivers for implementing CE

This subsection corresponds with sub-question 1; “*What are the drivers that enable the integration of the circular economy concept in a public organisation?*” The findings are presented in line with the categorisation as presented in the framework in the literature review. One driver that was identified during the data analysis was not represented in the framework, and is therefore placed at the end of this section.

4.1.1 Environmental

During the data collection, most of the interviewees did not mention the ‘reduction of negative impact on the environment through waste reduction and maximising resource usage’ as a driver. Despite the fact that every interviewee was quite aware on the topic of CE, the interviewees connected this driver to a financial (8:26, 8:6, 9:30, 17:17) or moral driver (9:17, 10:31, 17:61) to pursue CE. This was illustrated by the Head projects: “*Hoe we nu nog met circulariteit omgaan is kosten nog vaak wel een driver. Als je kijkt naar de inrichting van het Berchmanianum is dit echt een kostenaspect geweest.*” (8:26). Five employees spoke about the reduction of negative impact while using financial and moral drivers as a proxy. More information regarding the knowledge and moral and ethical drivers will be provided in the upcoming sections.

4.1.2 Economical

As described in the previous section, interviewees often mentioned that financial aspects are a driver for integrating CE (2:11, 8:26, 10:31, 11:54, 17:17). Interviewees mentioned ‘cost reduction through prolonging lifetime of products’ as a simple driver in order to reduce costs (8:63, 10:31, 11:54). The program director sustainability mentioned furniture and foods as attractive topics in becoming more circular oriented: *“I think especially in the long term if you don't have to buy everything new but you can reuse things, for example this furniture, but also in foods, [...] in which it's financially attractive to become more circular.”* (11:17) Most of the interviewees attributed the prolonging of product lifetime to furniture and the corresponding need for furniture to accommodate everyone. This is already put into practice by using a product for its actual lifetime instead of just its economic lifetime (11:54).

The economic driver ‘reduction in waste and energy costs’ was mentioned simultaneously with ‘cost reduction through lifetime prolonging’ and was mentioned by five interviewees (8:26, 8:6, 10:31, 11:54, 17:17). During the interviews, it was pointed out that during the demolishing of one of the campus building a lot of money has been saved (9:30) due to that 90% of the materials have been re-used (11:55).

‘CE synergies between organisational processes’ within the university was found in the connection between business operations and the actual science and education. It was stated that there was no link between knowledge development and CE for a long time (11:12). However, in the past years both operations and education have found common ground which resulted in the development of knowledge consecutively a quick application in operations to experiment (11:12) and learn from each other (8:39). Finding synergies was mentioned by four interviewees (8:39, 11:12, 16:14, 17:62).

‘Development of new business models’ was mentioned by two interviewees as a driver (9:2, 17:62). Nonetheless, this was placed more in the context of making use of new business models than rather developing themselves. In this regard, the use of servitization of office furniture was mentioned: *“We betalen een bepaald bedrag per jaar voor de inrichting van de werkkamer en indien de eisen worden gewijzigd dan worden de producten vervangen. Als je dat niet hebt en producten moeten vervangen worden vanwege andere eisen zit je met ontzettend veel items die je niet kan gebruiken en nog wel in goede staat zijn. [...] Maar als je het leaset van een leverancier heb je dat probleem niet. Als het om circulariteit is het volgens mij een veel efficiëntere oplossing.”* (9:2). Using new circular oriented business models can be used to lower certain costs, in this case for office furniture. The last economic driver, ‘increase of business growth for existing businesses’ was not identified during the data analysis.

4.1.3 Social

The driver ‘market internalisation’ was not mentioned during the data collection. In contrast however, the driver ‘increased worldwide awareness on CE’, which was mentioned by eight interviewees (8:9, 9:28, 10:16, 11:58, 15:9, 16:34, 17:40, 18:15). Two of the interviewees perceived this

driver as one of the most apparent drivers for CE (15:57, 16:34). They mentioned that especially the young generation of people are interested in sustainability challenges due to the changing world around them and they want to contribute to a positive change (16:49, 17:69, 17:40). Interestingly, the interviewees mentioned that the left political orientation of both the city of Nijmegen and the university and their increased awareness on the topic was of importance when speaking about CE (9:16). According to one of the interviewees this could be appointed to that people who work and study at a university are in general more than average concerned with societal and ecological problems (17:48). One of the interviewees also pointed out that it could also work the other way; people are aware of the urgency of the problems and want to contribute to the process from within their sphere of influence and consecutively improve the world (11:63). People are often confronted with circularity in their private atmosphere by either societal influences or by activities such as waste separation (9:7). It is consecutively the task of the organisation to make employees aware of how to incorporate awareness within their function and how to contribute within their sphere of influence to CE within the organisation. This is illustrated by one of the interviewees: *“Ik denk niet dat we ons moeten beperken tot de werksfeer, maar ook naar de privésfeer. Iedereen moet na gaan denken hoe grondstoffen worden gebruikt en hoe men met afval omgaat. Het moet dus veel verder gaan. Het speelt zich ook af in kantoorartikelen, of energie en noem maar op. Dus ik denk dat dit langzaamaan door moet dringen in de organisatie.”* (9:7) The facility manager of the faculty of Social Sciences mentioned that awareness can be created by nudging people in the direction you want them to move. In this case, by gently directing them to think and acting in a circular way: *So if you're looking at circularity at my point of view, we try to recycle all our materials like furniture but also trash. We're looking at how to use the cups, if you want to use plastic cups or just a mug. Everything is pure about nudging. Give people the feeling like you have a choice but know what the consequences are.”* (16:5) Another way to achieve awareness was mentioned by a facility manager. She stated that by experiencing the consequences of the pollution of the environment people are becoming aware of the impact that they have on the environment: *“For me there was a point [...] I went on holiday to Bonaire and it is a really beautiful country with a beautiful nature. Except at this side of the Venezuela side of Bonaire all the trash from the ocean [...] and it's so awful to see that, how many plastic, how many stuff is put into the sea and what happens with the nature. And gave me a switch, like I really want to do something about it.”* (16:31) These illustrations shows two ways of creating awareness on the topic, either by experience the effects of the linear economy and on the other hand by nudging people into becoming aware of the topic of CE.

‘Increased employment opportunities and quality of life’ is not mentioned by the interviewees as a driver for the integration of CE. However, as mentioned before, the interviewees see the transition to CE more as a moral and ethical obligation. This driver was mentioned by six of the ten interviewees (2:12, 9:17, 14:19, 16:19, 17:18). The program director sustainability mentioned being sustainable and circular the ‘new normal’ (14:19). It is also said that people can discuss about the costs of CE

integration, or that some of the measures taken are too rigorous. Nevertheless, there are very few criticisms on the stance that being sustainable minded to improve the quality of life on the planet is ‘just a smart thing to do’ (9:17, 11:7). One interviewee even stated that being sustainable and circular is a prerequisite to ensure a long term outlook on a livable planet (15:14).

4.1.4 Institutional

‘Regulations directing towards CE’ and ‘quality standards and goals’ were not mentioned during the interviews. However, one of the interviewees noted that the Radboud university does have an accreditation for ISO14001 (11:13). With regard to ‘subsidies and supportive taxation’, five interviewees mentioned this as a driver (8:49, 9:27, 11:42, 16:45, 18:4). However, interviewees did not mention the availability of national or supranational subsidies but rather on internal subsidies for stimulation of the CE integration into the organisation. This was explained by the fact that the Radboud University has a decentralised management system where each faculty manages its own budget and that a subsidy could be provided to compensate for possible extra costs for CE integration (8:27, 8:49, 16:45, 18:4).

4.1.5 Technology and information

When talking about technological drivers, none of the interviewees mentioned that new technologies could drive the integration of CE in the organisation. But with regard to information sharing platforms, three of the ten interviewees mentioned this as a driver (8:5, 11:60, 16:48). Interviewees pointed out that both internal information sharing platforms such as project groups, discussion groups and brainstorm sessions (11:18) and external platforms (11:60) could pose as a driver for CE. Especially for internal sharing platforms a translation from science to practice could be of use (8:5, 8:41). An operations manager motivated the use of information sharing platforms as a trigger to others: “[...] *het in gesprek blijven, niet denken dat het allemaal vanzelf gaat. En door het in gesprek gaan elkaar triggeren en uitdagen om verder naar de volgende stap. Dit onderwerp moet continu besproken blijven.*” (11:66). A facility manager illustrated how an internal information sharing platform can take shape in a university. She proposes a platform in which every faculty of the university is represented and by doing so the different aspects on CE and sustainability can be shared and discussed (16:14, 17:19).

Only one interviewee noted that the people working and studying at the university is a very intelligent community who are informed in societal developments (9:33). However, while being higher educated could mean that one is better informed about the topic, this does not mean that people are aware on the topic and apply it in their personal or professional life (9:33).

Six of the ten interviewees mentioned knowledge as a driver (2:30, 8:29, 11:28, 15:20, 17:22, 18:5). Two interviewees pointed out that they see knowledge more as a condition for CE instead of a driver (8:29, 15:20). They stated that one should have knowledge about CE before you can be aware of the issue and are able to contribute to the transition (8:29, 15:20).

4.1.6 Supply chain

During the data collecting interviewees did not mention that ‘more efficient resource usage’ within the supply chain was a driver. This was also the case for ‘less price volatility.

4.1.7 Organisational

In order to be an attractive employer, or university to study, interviewees see a green image as a driver for CE (15:53, 17:70). Three of the interviewees see it as a unique selling point for the organisation (2:33, 14:42, 17:10). This was substantiated by one of the interviewees, saying that the RU could use a green campus from a marketing perspective (2:33). Another interviewee pointed out that having a green image was not meant as a unique selling point but that it could appeal to specific groups (15:48) who find it an important aspect when orienting on a study or employer (15:53).

Seven of the ten interviewees noted that policies with a focus to further integrating CE are a driver (2:17, 8:3, 11:4, 14:12, 15:51, 16:23, 17:6). This was illustrated with the introduction of the Sustainability Agenda 2016 -2020, through this agenda the pace of the development of CE within the organisation is increased (Deneer & Gemert, 2016). One of the operations managers underlined this as well: *“Maar met de duurzaamheidsagenda is dat ook wel een beetje in een stroomversnelling gekomen omdat we het gesprek over duurzaamheid veel uitgebreider zijn gaan voeren, en dan kom je van het ene idee in het andere idee.”* (11:57). They describe that by the use of organisational policies, and indirectly through top management commitment, that CE integration is supported: *“De afgelopen jaren is er door de Duurzaamheidsagenda het bewustzijn wat we met elkaar vergroot hebben binnen de universitaire organisatie veel meer op dit soort zaken gelet en dat maakt dat we daar nu dus veel alerter op zijn.”* (11:4). One of the interviewees motivated this by enforcing organisational wide rules for the purchasing of circular or sustainable products and declining products that do not meet this requirement: *“Imposing RU-wide rules to enforce the purchasing of circular/sustainable products, for example not accepting the cost declaration when items are purchased from a supplier that is not on the list provided by the Purchase Department.”* (2:17).

Two of the ten interviewees mentioned that applying a CE business model would be more cost efficient (8:69, 9:19). This was mentioned with regard to the products as a service principle. By outsourcing certain processes, you don’t have the additional costs in order to organize these processes (9:19) However, one interviewee pointed out that it was RU policy to not finance processes externally in the previous years (8:69).

Having the commitment of top management was mentioned by six of the ten interviewees. A lot of initiatives have been taken bottom-up, but to gain organisation-wide traction and acceptance, commitment from top management is needed (8:25, 9:13, 11:67).

With regard to communication, this driver was mentioned by eight of the ten interviewees (2:30, 8:48, 9:36, 10:19, 11:25, 15:35, 16:26, 17:44). The head of projects pointed out that circular operating is important but circular communication is needed just as much: *“Je hebt de green walk en de green talk. Je hebt beiden nodig maar voor ons zal iets meer green talk zeker helpen, we zijn misschien wat te bescheiden, als heel RU denk ik ook.”* (8:72). This was also mentioned in the ‘Duurzaamheidsagenda’: *“De Radboud Universiteit neemt veel goede initiatieven op het gebied van duurzaamheid, maar communiceert hierover nog relatief weinig. De Dienst Marketing en Communicatie (DMC) kan hierin ondersteunen.”* (6:7). In order to improve communication regarding the topic the ‘Green office’ is developing an internal communication strategy: *“Also green office is really taking care of this communication part of sustainability. So they are developing an internal communications strategy right now.”* (17:44) However, interviewees were often nuanced regarding using communication towards employees. It was mentioned that communication should be targeted at the specific target groups for which the content of the communication is relevant (10:17). This was illustrated by the purchasing of furniture; the relevance of knowing that a particular product or piece of furniture is circular is not high particularly high for most employees. For employees that are concerned with buying new products or furniture this can be important information in steering towards more circular oriented purchasing (10:17, 10:19).

The last driver of the organisational category is ‘mindset and commitment of staff’. This driver was mentioned by four of the ten employees (9:13, 9:40, 11:5, 15:6, 17:66). However, interviewees recognized the importance of employee commitment and saw the interconnectedness with the drivers communication and top management commitment (11:40).

4.1.8 Exemplary role

A driver that was not mentioned in the discussed literature but came forward during the data collection is the exemplary role the university has. This driver was mentioned by eight of the ten interviewees. An exemplary role was explained in two ways. Either from an organisational perspective (2:34, 8:64, 10:3, 15:13, 16:18) or a person within the organisation (6:6, 11:8, 16:17, 17:16) (Radboud University, 2020), both of them need to show responsible behaviour to others.

According to the interviews, the university has an exemplary role (2:34, 15:13). While receiving public funding the organisation has the responsibility to spend these funds in a responsible way (10:3). In addition, one of the interviewees mentioned that it is also the responsibility of the university to act in accordance with what is being taught: *“I think the Radboud university has the example function, like a policeman has an example function on the road. So yeah he doesn't speed, stops for a red light. I think a university is a place where there is knowledge they want to give, to the people to the students, so they have an exemplary role.”* (16:18). Having the unique position to create both knowledge and operating an organisation provides the opportunity to take a pioneering role (8:64).

When focussing on employees within the organisation, interviewees mentioned that especially employees that are hierarchically high placed or enjoy high esteem within the organisation have a responsibility in showing correct behaviour (6:6). This stimulates other employees in doing the same (16:17) and will guide the organisation in the process of CE integration (11:8). In the Sustainability Agenda 2016 – 2020 this is also explicitly mentioned in the regard of sustainability: *“De komende jaren zullen we daartoe binnen onze organisatie, en ook met samenwerkingspartners en (externe) stakeholders, een continue dialoog voeren over de vraag waar kansen tot verbetering liggen en hoe we deze kunnen waar maken. In dit proces spelen leidinggevendenden een belangrijke rol; zij vervullen met hun gedrag een voorbeeldfunctie.”* (6:6).

4.2 Barriers for implementing CE

This subsection corresponds with sub-question 2; *“Which barriers are hampering the integration of the circular economy concept in a public organisation?”* The findings are presented in line with the categorisation as presented in the framework in the literature review. The results per individual driver are presented in the corresponding category. The synthesis of the of the findings with the literature are discussed at the end of this section.

4.2.1 Economical

The first economical barrier that was mentioned were the high upfront costs for CE. Four of the ten interviewees mentioned this as a barrier for CE integration by the simple reason that the financial costs are too high (15:54, 16:20, 17:41, 18:3). One of the interviewees pointed out that circular initiatives are taken but when money becomes an issue these initiatives will be cancelled first (9:24). In addition, when buying products employees are being judged on how much money is spend on products and will be less eager to choose a circular alternative, which is most of the time more expensive (17:36).

With regard to the difficulty of measuring the long term benefits of CE, two of the ten interviewees mentioned this as a barrier (8:28, 9:26). One of the interviewees underlined that when working with a linear economy measuring benefits and costs is uncomplicated. In contrast, measuring benefits of a circular economy poses an organisational challenge due to all the involved aspects (8:55). It was also mentioned that by investing in CE the resulting benefits are not always for the specific department that spend the financial means (9:26, 9:34).

Limited available funding was mentioned by seven interviewees (2:32, 9:55, 10:12, 11:7, 15:15, 16:20, 17:36). One of the interviewees pointed out that when investing money becomes an issue, people will spend the available financial means on the core business, which is education (2:32). This applied to the construction of one of the new building on campus in which circularity initiatives were cancelled first when the costs became too high (9:24). On a higher organisational level, the program director

sustainability mentioned that it is necessary to determine which projects can be carried out quickly and which projects are identified as long term projects due to the lack of financial capabilities (17:31).

One of the interviewees did mention the lower prices of virgin materials (16:13). However, it was mentioned with regard to virgin linear products instead of virgin resources that are cheaper to acquire than reuse or buy circular or already existing products (16:13).

4.2.2 Social

Seven of the eight interviewees mentioned the lack of social awareness as a barrier for CE (2:13, 9:22, 10:20, 11:34, 14:5, 15:18, 17:65). Two of the interviewees pointed out that the university consists out of a very intelligent community who are aware of all the societal developments (9:33). Most of them are not confronted with making decisions on this topic on a daily basis (9:33). This results in a lack of awareness: *“We hebben hier een hartstikke intelligente gemeenschap en die zijn allemaal op de hoogte van de maatschappelijke ontwikkelingen, die is dat niet ontgaan. Dus als je mensen met dit soort vragen aanspreekt weten ze het wel. In hun dagelijkse leven hebben ze er niet zoveel mee te maken, omdat ze de beslissingen niet nemen, er niet over gaan of bezig zijn met onderwijs. Dus als ik zeg dat er te weinig bewustzijn op dat vlak is, dan is dat vooral op dat element. Ze komen dat niet tegen in de dagelijkse praktijk.”* (9:33). Besides, the program director sustainability noted that some people are already occupied by their daily activities to also focus on the development of CE (17:65) or are just not aware on how to applicate CE in their daily routines (11:34).

4.2.3 Institutional

With regard to the barrier ‘obstructing or absence of regulations’ none of the interviewees mentioned this barrier. However, one of the interviewees mentioned the ‘absence of incentives for CE’ (9:52). He did this with regard to the costs for energy: *“Grote energieverbruikers binnen Nederland krijgen hun energie tegen hele lage kosten. Privé betaal je iets van €0,23. De universiteit betaal €0,09 volgens mij. Voor jou thuis is het dus interessant om zonnepanelen te plaatsen, op de universiteit verdient je ze dus nooit terug.”* (9:52). The interviewees did mention the absence of internal incentives to support circular economy. They mentioned specific funds to compensate for extra cost of circular products in order to remove the financial barrier (9:27, 9:34).

‘Limited circular procurement’ was mentioned by five interviewees as a barrier (11:50, 15:47, 16:42, 17:57). Nevertheless, the interviewees did point out that there was limited circular purchasing. This was despite the possibility to buy circular and sustainable products from the supplier, employees perceived a financial barrier to do so (16:42). Employees are evaluated on the amount of money spend on products and non-sustainable are the cheapest alternative (16:42). In addition, due that employees are also allowed to buy products from stores and not only from the contracted suppliers less circular products are bought (14:37). Interviewees note that due to the absence of formal policy on the

purchasing of products only few circular products are bought by employees (11:50, 15:47, 17:57, 17:58).

4.2.4 Technology and information

Both the barriers ‘lack of technologies’ and a ‘strong focus on linear models’ were not discussed during the interviews. In contrary was the barrier ‘lack of knowledge and information’, which was mentioned by five interviewees (8:30, 10:7, 14:46, 15:41, 17:38). Two interviewees explained this by stating that the concept of CE is very abstract (15:22, 17:38). The program director illustrated this as follows: *“a barrier is also lack of knowledge in general, on circularity, because circularity is a very abstract term, it's very broad. Everyone talks about it, but a lot of people don't dare to ask what exactly is it.”* (17:38). The program director nuanced this by illustrating that concept of CE was not translated well enough into the operations of the university: *“[...] we didn't translate it for our own university enough, so I think right now this is a barrier, that we're just saying "oh it's important", but we don't really have our own definition of it.”* (17:38)

4.2.5 Supply chain

Four interviewees mentioned that ‘operating in a linear business model’ posed a barrier for CE (2:15, 8:69, 9:54, 17:67). One of the interviewees pointed this out with regard to waste management: *“it is more expensive to collect was when separated instead of collecting it on one pile.”* (2:16). Another interviewee noted that the current system is not designed for business models such as product as a service: *“Wat ook meespeelt is dat het bezit en het gebruik worden gescheiden, dus het product as a service principe. Ook daar is de hele systematiek niet op ingericht. Tot nu toe hebben we altijd als uitgangspunt op de RU gehad dat we niet extern financieren, we financieren alles zelf.”* (8:69). With regard to the barrier ‘lack of cooperation in supply chain’, this barrier was not mentioned during the data collection.

4.2.6 Organisational

The barrier ‘CE not integrated with strategy, mission, vision, goals and KPIs’ was mentioned by four interviewees (2:35, 8:59, 16:7, 17:10). The interviewees note that despite the initiatives that can be taken on operational level the organisation needs strategy and goals to work towards (2:35). The head of project illustrated that, through the absence of clear vision and guidance, it is difficult to empower the correct mindset (8:13).

The barrier ‘silo thinking’ was mentioned by one interviewee (18:2). He stated that due to the decentralised organisational systems the different faculties only focus on their own budgets, instead of having a focus on the best interests for the Radboud University (18:2). This was illustrated by one of the interviewees who stated: *“We manage our own activities instead of cooperating and dealing with the other faculties and or central RU. We only work with them if we must comply with the central rules of the RU of if it is in our advantage.”* (2:14)

Six of the ten interviewees mentioned ‘reluctance to change’ as a barrier (8:35, 9:23, 11:64, 14:38, 16:21, 17:35). It was pointed out that people develop certain habits over time and are used to working in specific ways and find it hard to change the way of working after a long time (8:35, 11:64, 16:21, 17:35). One of the interviewees also indicated that scientists are generally stubborn in their working processes which makes it a challenge to change their habits (8:46).

With regard to the barrier ‘organisational systems and a lack of managerial support’, six of the ten interviewees mentioned this as barrier (8:17, 9:34, 10:2, 14:2, 17:32, 18:2). In special, the interviewees mentioned the decentralised way in which the university is organised as the organisational barrier (14:21, 17:32). Two of the interviewees noted that as an organisation you want to pursue that circularity is organised in a central way instead of the current decentralised way (8:52, 10:6).

4.3 Conclusion

During data collection, several findings were made. Firstly, a large part of the drivers and barriers from private businesses and within society are the same as the drivers and barriers that were found during data analysis in the public organisation. However, after analysing the gathered data, it became clear that several drivers and barriers that were mentioned in the framework were not present in the subject of research. ‘Increased of business growth for existing business models’, ‘increased market internationalisation’, ‘increased employment opportunities’, ‘regulations directing towards CE’, ‘new technologies’, ‘more efficient resource usage’ and ‘less price velocity’ were drivers that did not come forward in data analysis. The following barriers were not found during the data analysis: ‘obstructing or absence of regulations’, ‘lack of technologies’, ‘strong focus on linear models’ and ‘lack of cooperation in supply chain’.

Secondly, there are differences in how drivers and barriers are perceived in the public organisation. The interviewees spoke of utilising new business models instead of developing new business models. In the research framework the ‘low price of virgin materials’ was mentioned as a barrier whereas the results show that ‘low price of virgin products’ is perceived as a barrier. This is also the case for the barrier ‘limited circular procurement’. The results show that not a limited circular procurement is a barrier but rather ‘limited circular purchasing’.

Thirdly, during the data collection and analysis it became clear that interviewees identified the exemplary role of the university as a public organisation and key persons within the organisation as a driver for integrating CE. In their view it is the responsibility of the organisation to be a responsible organisation. Having integrated CE in the operations of the organisation is one of these aspects. In order to compare results of the data analysis with the research framework, the drivers and barriers that were identified are displayed in table 4. In this table the references to the articles that mention the specific drivers and barriers are included as well.

Category	Drivers	Barriers
Environmental	<ul style="list-style-type: none"> Reduction of negative impact on environment through waste reduction and maximizing resource usage (Andersen, 2006; Andrews, 2015; Esposito et al., 2017; Ghisellini et al., 2016; Lacy & Rutqvist, 2016; Linder & Williander, 2017; Mont et al., 2017; Moreno et al., 2014; Reike et al., 2018) 	N/A
Economic	<ul style="list-style-type: none"> Cost reduction by efficiency and prolonging product lifetime (Andersen, 2006; Esposito et al., 2017; Ghisellini et al., 2016; Mont et al., 2017; Murray et al., 2017; Rizos et al., 2016) Finding synergies between processes (Dong et al., 2016) Utilisation of new business models 	<ul style="list-style-type: none"> High upfront costs (Bechtel et al., 2013; de Jesus & Mendonça, 2018; Gumley, 2014; Kirchherr et al., 2018; Mont et al., 2017; Preston, 2012) Difficulty of measuring long term benefits of CE (Bechtel et al., 2013; Ritzén & Sandström, 2017; Rizos et al., 2016) Limited available funding and financial support (Ilić & Nikolić, 2016; Kirchherr et al., 2018; Pheifer, 2017; Rizos et al., 2016) Low prices of virgin products (Kirchherr et al., 2018; Preston, 2012)
Social	<ul style="list-style-type: none"> Increased worldwide awareness on CE (Mathews & Tan, 2011; Pheifer, 2017) Moral and ethical drivers (Lozano, 2012) Exemplary role 	<ul style="list-style-type: none"> Lack of social awareness on CE (Kirchherr et al., 2018; Pheifer, 2017)
Institutional	<ul style="list-style-type: none"> Subsidies and supportive taxation (Dong et al., 2016; Liu & Bai, 2014) Quality standards and goals (Dong et al., 2016; Liu & Bai, 2014) 	<ul style="list-style-type: none"> Limited circular purchasing (Bechtel et al., 2013; Eijk, 2016; Kirchherr, Hekkert, et al., 2017; Witjes & Lozano, 2016) Absence of incentives for CE (Gumley, 2014; Pheifer, 2017)
Technology and information	<ul style="list-style-type: none"> Information sharing platforms (Ellen MacArthur Foundation, 2012) Higher level of education (Q. Liu et al., 2009) Knowledge (de Jesus & Mendonça, 2018; Pheifer, 2017; Rizos et al., 2016) 	<ul style="list-style-type: none"> Lack of knowledge and information (Adams et al., 2017; Ballard, 2005; Bechtel et al., 2013; de Jesus & Mendonça, 2018; Kirchherr et al., 2018)
Supply chain		<ul style="list-style-type: none"> Operating in a linear business model (Kirchherr et al., 2018; Pheifer, 2017)
Organisational	<ul style="list-style-type: none"> Increase in goodwill and green image amongst stakeholders (Geng et al., 2012; Mont et al., 2017) The integration of CE oriented strategies, goals and KPIs (Pheifer, 2017; Tura et al., 2019) CE business model more cost effective (Linder & Williander, 2017) Top management commitment (Araujo Galvão et al., 2018; Bechtel et al., 2013; Mont et al., 2017) Effective communication (de Jesus & Mendonça, 2018; Ilić & Nikolić, 2016) Mindset and commitment of staff (Rizos et al., 2016) 	<ul style="list-style-type: none"> CE not integrated with strategy, mission, vision, goals and KPIs (Pheifer, 2017) Silo thinking (Liu & Bai, 2014) Internal reluctance to change (Bechtel et al., 2013; Kirchherr et al., 2018) Organisational systems and a lack of managerial support (Bechtel et al., 2013)

Table 4: Results from data collection, drivers and barriers found in the public organisation

4.4 Discussion

In this section the findings of the data collection in relation to the discussed literature are compared. this is done through two subsections, for drivers and for barriers respectively. In the third and fourth subsection the limitations of the research and possible avenues for future research are discussed.

4.5 Drivers for the integration of CE in a public organisation

As mentioned in the previous section, most of the drivers with relation to CE integration in a public organisation are the same as the drivers for the integration of CE in a private organisation. The drivers ‘finding synergies between processes’ (Dong et al., 2016), ‘increased worldwide awareness’ (Mathews & Tan, 2011; Pheifer, 2017), ‘moral and ethical’ (Gregson et al., 2015; Lozano, 2012), ‘subsidies and supportive taxation’ (Dong et al., 2016; Liu & Bai, 2014), ‘quality standards and goals’ (Dong et al., 2016; Liu & Bai, 2014), ‘information sharing platforms’ (Ellen MacArthur Foundation, 2012), ‘higher level of education (Q. Liu et al., 2009), ‘knowledge’ (de Jesus & Mendonça, 2018; Pheifer, 2017; Rizos et al., 2016), ‘increase in goodwill and green image amongst stakeholders’ (Geng et al., 2012; Mont et al., 2017), ‘integration of CE oriented strategies, goals and KPIs’ (Pheifer, 2017; Tura et al., 2019), ‘CE business model more cost effective’ (Linder & Williander, 2017), ‘Top management commitment’ (Araujo Galvão et al., 2018; Bechtel et al., 2013; Mont et al., 2017), ‘Effective communication’ (de Jesus & Mendonça, 2018; Ilić & Nikolić, 2016) and ‘Mindset and commitment of staff’ (Rizos et al., 2016) were found as drivers for implementing CE in a public organisation. These drivers were mentioned in the same context as discussed in the constructed framework which shows that these drivers are also applicable to an organisation in the public domain. In total, 17 of the 25 in the literature defined drivers were encountered during the data analysis.

Seven drivers for CE within non-public organisations were not encountered. The first driver that was not encountered was ‘increase of business growth for existing business models’. This growth is achieved through the increase of profit margin, value creation and business growth (Ellen MacArthur Foundation, 2012; Linder & Williander, 2017; Schulte, 2013). The absence of this driver can be attributed to the core business of the organisation, which is the development and transfer of knowledge. The implementation of CE in the organisation does not have a direct effect on the business model of the organisation but rather in the auxiliary operations that enable the core business to operate. However, the driver ‘green image and goodwill’ (Geng et al., 2012; Mont et al., 2017) was mentioned as a driver. This driver could attribute to increase of profits by attracting new students due to a ‘green image’ (Ambec & Lanoie, 2008). The framework also mentioned ‘increased market internationalisation’ (Zhu et al., 2011). This driver was formulated in the context of Chinese production organisations that need to comply with the regulations of developed western countries in order to export products (Zhu et al., 2011). This is however a different context and the results indicate that the different cultural context and business model are of influence with regard to this driver (Bechtel et al., 2013; Kirchherr et al.,

2018) as a result, this driver is not applicable for this specific context. With regard to ‘increased employments opportunities and quality of life’ (European Commission, 2014), this driver has a focus on increasing jobs and quality of life due to high quality waste management (European Commission, 2014). Since waste management is not a part of the business model of a university as it is with organisation that handle physical resources it is logical this driver was not encountered. The driver ‘regulations directing towards CE’, which falls under the category institutional (Dong et al., 2016; Geng et al., 2012; Q. Liu et al., 2009), was also not mentioned in the framework. This was related to directional laws for waste processing (Dong et al., 2016; Tura et al., 2019). Public organisations such as universities in the Netherlands usually outsource their waste processing to external businesses, the results show that this is indeed not a driver. Next, the driver ‘new technologies’ (Lacy & Rutqvist, 2016; Mathews & Tan, 2011), while universities focus on the development of new knowledge and technologies this driver was not found during research. This can be attributed to that this driver is meant in the sense that it is a driver to make the production of products ‘cleaner’ (Ghisellini et al., 2016). While a university contributes to the development of new technologies this driver is not of influence on the operations of a university. In the category ‘supply chain’ both drivers were not found during the data analysis. ‘More efficient resource usage’ (Andrews, 2015; de Jesus & Mendonça, 2018; Esposito et al., 2017; Ghisellini et al., 2016) was meant in the sense that by using resources efficiently the organisation becomes less dependent on a supply (Ghisellini et al., 2016). During the research it became clear that at a public organisation the focus is more on the cost reduction by prolonging the products lifetime than an actual reduction in the supply dependency. This seems logical since the products that are purchased are in general widely available products, with the same rationale for the driver ‘less price velocity’ (Mont et al., 2017; Moreno et al., 2014; Schulte, 2013).

In addition, in contrast with the framework, the results pointed out that the driver ‘development of new business models’ is perceived as the utilisation of new business models in the university. the focus is more on integrating new business models such as ‘product-as-a-service’ instead of developing new models (Andersen, 2006; Mont et al., 2017). Furthermore, while the driver ‘knowledge’ is being mentioned separately (Rizos et al., 2016), the results pointed out that one sees knowledge more as a condition for CE awareness than that it poses as an actual driver, these drivers are thus highly intertwined.

During the data analysis it came forward that a public organisation serves an exemplary role in society. No corresponding literature on the topic of CE could be found which reinforces this driver. However, within the sustainability literature, which is large interconnected with CE (Geissdoerfer et al., 2017), the importance of leadership is mentioned but not the exemplary role that the organisation as a whole has. Respondents acknowledge the exemplary role and function that managers and the university as a whole have. The exemplary function that top managers have can be combined with the driver top management commitment, due to the fact that when top managers have a commitment to CE

they fulfil an exemplary role. The exemplary function of the university is not mentioned in the literature, aside from literature on corporate social responsibility (Garriga & Melé, 2004), the reason the university fulfils this role can be found in the societal responsibility and the public funding they receive. The driver that is experienced is the societal pressure to act as a responsible organisation. When discussing how to categorize this driver in the framework there are two logical options, either social or organisational. Due to that this driver can be classed as an external driver on which the organisation has a limited influence it is more logical to categorise it as a social driver.

4.6 Barriers hampering the integration of CE in a public organisation

As was mentioned in the conclusion section of the results, most of the barriers that were presented in the framework came forward during the data analysis. The drivers ‘high upfront costs’ (Bechtel et al., 2013; de Jesus & Mendonça, 2018; Gumley, 2014; Kirchherr et al., 2018; Mont et al., 2017; Preston, 2012), ‘difficulty of measuring long term benefits of CE’ (Bechtel et al., 2013; Ritzén & Sandström, 2017; Rizos et al., 2016), ‘limited available funding and financial support (Ilić & Nikolić, 2016; Kirchherr et al., 2018; Pheifer, 2017; Rizos et al., 2016), ‘low prices of virgin products’ (Kirchherr et al., 2018; Preston, 2012), lack of social awareness on CE’ (Kirchherr et al., 2018; Pheifer, 2017), ‘absence of incentives for CE’ (Gumley, 2014; Pheifer, 2017), Limited circular purchasing (Bechtel et al., 2013; Eijk, 2016; Kirchherr, Hekkert, et al., 2017; Witjes & Lozano, 2016), ‘lack of knowledge and information’ (Adams et al., 2017; Ballard, 2005; Bechtel et al., 2013; de Jesus & Mendonça, 2018; Kirchherr et al., 2018), ‘operating in a linear business model’ (Kirchherr et al., 2018; Pheifer, 2017), ‘organisational systems and a lack of managerial support’ (Bechtel et al., 2013), ‘CE not integrated with strategy, mission, vision, goals and KPIs’ (Pheifer, 2017), ‘silo thinking’ (Liu & Bai, 2014) and ‘internal reluctance to change’ (Bechtel et al., 2013; Kirchherr et al., 2018) were represented in the public organisation. These barriers were mentioned in the same context as discussed in the constructed framework which shows that these barriers are also applicable to an organisation in the public domain. In total, 13 of the 17 barriers were identified during data analysis.

With regard to barriers that were not encountered in the organisation, the barrier ‘obstructing or absence of regulations’ (Kirchherr et al., 2018; Mont et al., 2017; Pheifer, 2017; Rizos et al., 2016) was mentioned in the sense of limiting circular business model policies. However, a public organisation is not dependent on a circular business model. These organisations make use of these models in order to support their core business rather than developing them for their core business. With regard to the university, circular thinking in the usage and purchasing of products is applied in order to facilitate the production and transfer of knowledge. Another barrier that was mentioned in the original framework which did not come forward during data analysis was the ‘lack of technologies’ (Adams et al., 2017; Ballard, 2005; Bechtel et al., 2013; de Jesus & Mendonça, 2018; Kirchherr et al., 2018). The same

argumentation for the driver ‘new technologies’ can be applied to this barrier. A public non-production organisation is not dependent on the availability of technologies, since these are mostly service organisations. It will rather apply them if possible but it does not pose a barrier when technologies are not available. The last barrier that was not found in the data is the ‘lack of cooperation in supply chain’ (Kirchherr et al., 2018; Rizos et al., 2016; Witjes & Lozano, 2016). The supply chain in the case of a non-production public organisation comprises of the suppliers for providing materials in order to execute the core business. During the research it became apparent that suppliers, in this context, could provide circular products on request. As a result, a lack of cooperation in the supply chain did not pose a barrier.

From the results there were two barriers that were perceived differently by the public organisation. First, the ‘low price of virgin materials’ (Kirchherr et al., 2018; Preston, 2012). A university in general does not buy raw unprocessed materials. However, it does purchase products to facility their core business. The barrier in the sense of public organisation is therefore the low prices of virgin products instead of materials. With regard to the barrier ‘limited circular procurement’ it was expected that this was perceived as a straightforward barrier. Nonetheless, within the public organisation limited circular purchasing is also perceived as a barrier. this can be attributed to the decentralised organisational structure of the university. In this decentralised structure, the purchasing of products is also organized decentrally in which many employees are authorized for purchasing products. As a result, it is due to management that employees are inclined to buy the cheaper non circular alternatives while there are circular alternatives available. This leads to limited circular purchasing.

4.7 Limitations

This study used a qualitative research approach in order to identify and to provide a complete description of the drivers and barriers that are of influence when integrating CE in a public organisation. As a result, these drivers and barriers have not been tested in a broad research population but was rather focussed on mapping drivers and barriers in public organisations, which has not been done so far. No generalisations to different context can yet be made. In addition, this study focussed on identifying perceived drivers and barriers in the integration of CE in a public organisation and did not focus on the relative influence of these drivers and barriers. However, during the data analysis, it was taken into account how often a certain driver and barrier was mentioned. Another limitation of the study is the small sample of ten interviewees. In order to overcome this limitation each of these interviewees represent a different faculty or department from the university. With regard to the specific context, this research focussed on a university in the Dutch cultural context. Several authors have recognised the importance of the cultural context that is of effect when with regard to CE (Kirchherr et al., 2018; Tura et al., 2019).

4.8 Suggestions for future research

By adapting and expanding the framework by Tura et al. (2019) and consecutively compare it in the context of a university, a first step to a comprehensive overview of drivers and barriers in the public sector is made. However, additional quantitative research on these drivers and barriers is needed in order to determine and generalize the influence of the individual factors in the context of universities and other public organisations. By conducting the much needed quantitative research, the corresponding categorisation can also be the subject of research in terms of completeness or even simplifying it by reducing the amount of categories and drivers and barriers. Another fruitful research could be done by conducting the research in a different cultural context of a different country or another public organisation.

5. Conclusion

The conclusion of research is provided in this section, followed by the scientific and practical relevance of the research. The first section will provide an answer to the main question of the report and a conclusion on the formulated research question is provided.

5.1 Conclusion

Due to the increasing popularity of the concept of CE, and the found gap in scientific literature on the drivers and barriers for integrating CE in a public organisation, this research was conducted. The research question of this research is: *“What are the drivers and barriers for integrating the concept of circular economy in a public organisation?”*

In order to formulate an answer to this question the main research question is divided in two sub-questions, the first sub question is: *“What are the drivers that enable the integration of the circular economy concept in a public organisation?”* The second sub-question focusses on the opposite: *“Which barriers are hampering the integration of the circular economy concept in a public organisation?”* These research questions were answered through a qualitative study at a public university. By comparing the found drivers and barriers with the constructed framework on drivers and barriers in private organisations it has become more clear that the drivers and barriers are largely overlapping for both businesses and public organisations. Drivers and barriers can be distinguished by seven categories: environmental, economic, social, institutional, technology and information, supply chain and organisational. The corresponding drivers, barriers and foundation in science can be studied in table 4. In addition, comparing the pre constructed framework to the results show that public organisations have an additional driver, which is the exemplary function of these organisations towards society. By focussing on utilizing the drivers and overcoming the barriers, public organisations can integrate the concept of

CE in their operations which can lead to an increase in circular procurement due to a rising demand for circular products, which in turn contributes to the development of more circular products.

5.2 Scientific relevance

As was mentioned in the introduction of this research, no research on drivers and barriers for the integration of CE in a public organisation such as a university has been conducted. Previous research focusses on private organisations, in particular production organisation in supply chains. Another stream of research focuses on drivers and barriers within society itself with focus on CE adoption by civilians. This provided a gap in scientific literature on drivers and barriers within public organisations. In order to map these drivers and barriers, existing literature on the topic has been analysed to form a complete framework of the drivers and barriers for integrating CE in organisations. This framework was based on the framework created by Tura et al. (2019) with adaptations on basis of further analysis of relevant literature. Ultimately an extensive framework with the current drivers and barriers for CE was composed (see table 1) which provides the scientific field with a comprehensive framework of drivers and barriers on CE integration in private organisations.

Based on the conducted research within the Radboud University a first comprehensive framework on drivers and barriers for the integration of CE in a public organisation is created (see table 4). This framework provides the scientific field with a starting point on which drivers and barriers are at play for CE in public organisations through a comprehensive framework. The next step is to quantitatively test these drivers and barriers in order to make them generalizable in a broader context.

5.3 Practical and managerial relevance

By identifying drivers and barriers that are of influence when a public organisation is striving to integrate the CE concept within its organisation a contribution to practice is made. By being aware of these drivers and barriers provides the opportunity to focus on tackling these barriers and meanwhile utilizing the appropriate drivers. However, it can differ between organisations which drivers and barriers are most effective to utilize or tackle. It is assumed that this is influenced by the different traits that characterize the organisation, ranging from organisational culture, demographics and organisational structure. When formulating a strategy in integrating CE, this framework can serve as a starting point for organisations to determine what should be included.

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