Circularity adoption in corporate real estate

The consumers' perspective

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Delft University of Technology
Management in the Built Environment

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Colophon

Circularity adoption corporate real estate. The consumers' perspective

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Abstract

The pressure for businesses to respond and contribute to sustainability is increasing and organizations are expected to actively address these issues (Joyce & Paquin, 2016). However, achieving circularity in real estate development poses significant challenges and barriers. Previous studies have primarily focused on the drivers and barriers influencing frontrunner's uptake of circular solutions, particularly within the supply side. Meanwhile, the perspective of non-frontrunner clients and the demand side of circularity has gotten limited attention.

This study aims to enhance circularity in the built environment by exploring how corporate real estate clients who are not early adopters can implement circular ambitions and solutions. The thesis research focuses on the demand side of corporate real estate within the Dutch context, utilizing a mixed-approach that combines theoretical research and on-field investigation. The study identifies two groups of interest: *early adopters* and *next adopters.* Then, through qualitative field interviews with representatives from 12 organizations it sheds light on the experiences of both groups. The findings reveal that the main drivers for next adopters of circularity are the organization's core business and personal motivation, while the primary barriers include uncertainty regarding circularity benefits and a general lack of circularity awareness. Based on these findings, the study concludes by providing circularity adoption recommendations tailored to corporate real estate clients who are new to the field.

By addressing the demand side and considering the experiences of non-frontrunner clients, this research contributes to a more comprehensive understanding of circularity in real estate development and offers practical guidance for organizations seeking to embrace circular solutions in their operations.

Keywords: *Circularity, adoption, barriers, drivers, strategies*

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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EXECUTIVE SUMMARY

Introduction

In recent years, there has been a growing awareness of the scarcity of non-renewable resources and the consequences of the massive generation of waste. The construction industry is considered one of the major contributors to climate change, it is said to be responsible for 19% of global greenhouse gas emissions (MATHUR et al., 2021). This requires structural and radical changes in the current linear patterns of production and consumption, and as a response, the circular economy (CE) has emerged (Pereira & Vence, 2021). Moreover, the construction sector has been declared a 'priority area' for the CE transition, not only because of its role in the economy but also because it produces the highest amount of waste in the EU (Giorgi et al., 2022).

Problem statement and research aim

The literature on circularity in the built environment has been centred on discussing the drivers and barriers to achieving a circular economy in the building sector, especially in the application of circular strategies (Giorgi et al., 2022). So far, these studies have focussed on the drivers and barriers that influence the uptake of solutions for circularity, typically concentrating on the supply side and increasingly on the demand side from a frontrunner's perspective. However, far fewer studies investigate the drivers and barriers that influence clients who are not frontrunners in adopting circular ambitions and solutions. Therefore, this research aims to analyse the demand side perspective in the context of corporate real estate (CRE), namely the consumers or final users of the office spaces. This study will focus on what and how drivers and barriers influence their adoption of circularity, with the goal to provide insights on circularity adoption, that can be transferred through actors such as consultancy services and contribute to the overall adoption process of circularity in the built environment.

Research questions

The main question of this research is raised by the urgency to accelerate the implementation of circularity in the built environment, and the leading role of clients. The main question of this research is as follows:

How can the next adopters within corporate real estate adopt circularity ambitions and solutions?

To answer the main research question and enable the purpose of the research, the sub-questions are formulated as follows:

SQ1. What are the main concepts and characteristics of circularity adoption in the built environment?

SQ2. Who are the next adopters of circularity in CRE and what are their characteristics?

SQ3. How is circularity being adopted in CRE from the early adopters' perspective? And how do they overcome the challenges?

SQ4. What is the perception of circularity in CRE from the early adopters' perspective?

SQ5. What is the perception of circularity in CRE from the next adopter's perspective?

Methodology

The research methodology is a mixed approach that combines a literature review and qualitative interviews. The research methodology tested the theory with the perceptions of the demand side of corporate real estate. The research was sectioned into several steps, the first was the prepare and collect stage. The second was the analysis of the collected data. The third was the report of the findings of each method. The fourth was the analysis and synthesis of the findings into a conclusion. And lastly, a set of recommendations was formulated.

Literature research findings

This research provided the theoretical knowledge to define and analyse the main concepts of circularity strategies, drivers, barriers, and enablers in the built environment, as well as the existing understanding of them in the specific area of corporate real estate. The structure was guided by the sub-questions and the relationship between concepts, determining research themes.

Circularity in the built environment

The circular economy is defined as: **"A systems solution framework that tackles global challenges like climate change, biodiversity loss, waste, and pollution". (Ellen MacArthur Foundation, n.d.).** The goals of circular building design aim to **maximize** the use of currently available resources, **reduce waste** production from buildings, and **minimize** the environmental impact of buildings (Kanters, 2020). While the most typical approaches based on the circular economy often include the reuse and recycling of construction materials, adaptable buildings, material passports and design for disassembly (Kanters, 2020; Cruz Rios et al., 2021).

Drivers, barriers and enablers in the built environment

In the context of decision-making, the drivers are often referred to as a factor or a variable that significantly influences or motivates a decision. On the contrary, barriers often refer to an obstacle or constraint that hinders or obstructs the process of making a decision. However, enablers are factors

or elements that facilitate or support the decision and enhance its effectiveness. The following table summarizes the drivers, barriers and enablers that were found in the circularity literature.

Drivers	Barriers	Enablers
• Sustainable corporate image • Stakeholders pressure • Subsidies and incentives • Resource efficiency • Governmental pressure	• Conservative sector • Unclear cost benefits • Materials availability • Sectorial knowledge • Inflexible building codes • Lack of awareness	• Strong business case • Policies and incentives • Whole life costing system • Financial incentives • Leadership • Awareness-raising campaign

Innovation adoption

Diffusion Theory is commonly applied when addressing digital innovation, technology, or the creation of new products, to analyse the process of adoption and diffusion (Rogers, 1983). In this theory, four key factors are determined: Innovation, communication channel, time and the social system. In this research, circularity is studied as the innovation.

The adoption of an innovation is the result of a process of reduction of uncertainty, which is measured by attributes or success factors. In the case of circularity adoption, this research considers these factors to characterize the barriers, drivers, and enablers for circularity adoption. Moreover, the innovation-decision process is defined through five stages: 1. Knowledge, 2. Persuasion, 3. Decision, 4. Implementation and 5. Confirmation.

Rogers (1983) defines the adopter categories according to the moment of adoption of an innovation, or on the basis of "Innovativeness". Rogers categorises the adopters into five categories based on their adoption moment within the group to adopt an innovation: Innovators, early adopters, early majority, late majority and laggards.

Circularity adoption

Research by Carini et al. (2021) mapped the diffusion of circular economy good practices in the European context. This research explains the current state of circularity adoption and determines that circularity is still in the early adoption stage in the European context. This determined the groups to be studied in this research identifying the Early adopters that represent the current state of the circularity adoption and the Next adopters' category which includes the early majority, the late majority and the laggards.

Theoretical framework

The literature research findings concluded on the theoretical framework that guided the on-field research and provided the basis for discussion on the results. These findings are summarized in the following table:

1	2	3
Diffusion Theory	**Circularity adoption**	**Circularity adoption in CRE *(This thesis)***
Innovation	Circularity	Circularity
Social system	European context	The Netherlands
Adoption stages	Current stage: Early adoption	Next adopters
Unit of adoption		CRE
Success factors		Drivers, barriers & enablers

Qualitative interviews findings

1. **Concept awareness.** The research found that some of the next adopters are already implementing circularity strategies such as the refurbishment of furniture or the reuse of the coffee leftovers. However, they are not aware that these actions are considered circular. This suggests that the concept of circularity is not completely clear to all the participants in this group.

2. **Refurbishment cost.** The research found that the main driver for the next adopters to reuse elements or refurbish furniture is cost. In several cases, participants considered this option to be cheaper than buying new furniture or elements. However, for others, the refurbished furniture was considered to be more expensive.

3. **Personal motivation.** It was found that some facility managers were personally motivated to follow sustainability and decided to purchase only refurbished furniture.

4. **Core business.** The role of the core business has been found to be a major driver for circularity adoption in both adopter groups. It was found that circularity is adopted either to compensate for the core business, align with the business vision, or to respond to external demands that are related to the business.

5. **Budget is not always an issue.** The research found that the budget can be either a driver or a barrier for circularity adoption. This is related to the benchmark costs of an organisation versus the cost of circularity. For some, budget is barrier, while for others it is a driver. This finding is directly related to the core business and how organisations prioritize their budget decisions.

6. **Employee misconception of refurbished furniture**. Employees of both adopter groups doubt the quality of the refurbished furniture and often reject these products. This was found to be a recurrent topic, especially in the next adopters' group where these actions are relatively new for employees. While the early adopters are already acquainted with the idea, employees are still reluctant.

7. **Communication and employee participation** were found to be important enablers for the adoption of circularity among both adopter groups, especially to help solve the aforementioned barrier of refurbishment misconception.

8. **The role of regulations** has found to be neither a driver nor a barrier. However, some interviewees in the next adopters' group are expectant for upcoming regulations for circularity, they expressed they want to be prepared for the future.

Conclusion

The goal of this thesis was to answer the main question: How can the next adopters within CRE adopt circularity ambitions and solutions? Next circularity adoption is focused on the Next adopters of circularity. Their perspective has been studied through the on-field research and compared to the literature in this thesis. Based on the literature by Rogers (1983) and the research done, it is confirmed that the Next adopters' group is waiting on the early adopters to reduce uncertainty and show them the path into circularity adoption. Moreover, it was found that the main drivers that motivate this group are based on the organisation's core business and the personal motivation of the facility managers. Also, in terms of barriers it was found that this group is still uncertain about circularity's benefits and attributes, but most importantly, it was found that this group is still lacking overall awareness of the circularity concept. Lastly, the diffusion of circularity is related to the role of the consultancy services and the facility managers in CRE. Therefore, once again in research, Diffusion Theory (Rogers,1983) has proven to be valid for current adoption questions. Thus, it can be concluded that the Next adopters within CRE can adopt circularity ambitions and solutions, by including the following insights in Rogers (1983) adoption process:

1. Knowledge

In this stage it is necessary to increase the awareness of circularity as a built environment approach towards sustainability, which could be promoted through communication channels such as consultancy services. Also, research has proven that personal willingness is key to the diffusion and adoption of new ideas. Thus, looking to increase circularity adoption, consultants can seize on the fact that there is a personal willingness from the facility managers to adopt circularity. Moreover, this stage also entails reviewing and evaluating the strategies that were tested by the early adopters, as well as studying how the early adopters overcame the challenges that were found and formulate possible enablers.

2. Persuasion

In this stage, the benefits shown by the early adopters are studied and evaluated, these benefits can include the cost-benefit of reusing and refurbishing.

3. Decision

In this stage, the next adopters are finally convinced about the circularity innovation.

4. Implementation

In this stage, the strategies that were previously tested are implemented. when this results in new barriers the adoption process goes back to the persuasion stage where new enablers are formulated.

5. Confirmation

If the implementation stage is considered successful based on the organisation's acceptance of the innovation, then the final stage is reached.

Recommendations

The outcome of this thesis is drafted as a set of recommendations for Next circularity adoption. These recommendations can be used by the intended audience of the research which includes the CRE consultants, external advisors, academics, and students interested in the topic. However, it is important to note that in this specific case, the final user of the research findings will be Colliers. As it is the company to host the research, the findings are contextualized within their client's profile, therefore the data can not be generalized, and a distinction needs to be done when applying the results to other research or contexts. Nevertheless, the recommendations that resulted from this research are as follows:

1. **Circularity awareness.** It was found that the next adopters of circularity are not at all or not completely aware of the circularity concept, its benefits, and attributes. Therefore, it is recommended that the consultants diffuse the information and make the CRE clients aware of circularity.

2. **Facility managers.** It was determined that the role of the facility managers has a high impact on circularity due to their daily operations decisions and their influence on the elements that are more frequently changed. Therefore, it is recommended to address the knowledge awareness among the facility managers and diffuse the concept of circularity.

3. **Personal motivation.** It was found that the facility managers of the interviewed companies have a personal motivation to follow sustainable innovations. Therefore, it is recommended that the consultants seize on this intrinsic motivation to offer circularity solutions to these representatives.

4. **Core business.** It was found that one of the main cultural drivers to adopt circularity is related to the core business of the organisation. This driver seeks to compensate or align to the core business as well as to respond to external pressure either direct or indirect from the government. Therefore, it is recommended that the consultants inquire on the relation of the core business with the environment, as well as the external demands in relation to circularity goals.

5. **Cost savings.** It was found that one of the main financial drivers to choose for reuse and refurbishment was because of the cost savings it generated. Therefore, it is recommended that the consultants appeal on this concrete benefit of circularity options when advising on CRE strategies.

6. **Communication.** It was found that there is a general misconception about the quality of refurbishment within the final users of CRE. However, it was counteracted with communication strategies. Therefore, it is recommended that the consultants include these strategies in the implementation of circularity strategies.

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PART 1.

Introduction

1. INTRODUCTION

In recent years, there has been a growing awareness of the scarcity of non-renewable resources and the consequences of the massive generation of waste. The construction industry is considered one of the major contributors to climate change, it is said to be responsible for 19% of global greenhouse gas emissions (MATHUR et al., 2021). This requires structural and radical changes in the current linear patterns of production and consumption, and as a response, the circular economy (CE) has emerged (Pereira & Vence, 2021). Furthermore, in 2019, the European Commission introduced the European Green Deal, which re-launched the circular economy agenda promoted by the European Commission since 2014 (Giorgi et al., 2022). The construction sector has been declared a 'priority area' for the CE transition, not only because its role in the economy, but also because it produces the highest amount of waste in the EU, which is expected to increase and cause relevant environmental impacts (Giorgi et al., 2022). Therefore, the pressure for businesses to respond and contribute to sustainability is also increasing and organizations are expected to actively address these issues (Joyce & Paquin, 2016).

1.1 The circular economy

The circular economy has been extensively defined; however, research agrees that the most prominent definition is given by the Ellen MacArthur Foundation (2012): *"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).

Additionally, in the built environment, circularity is defined as *"a lifecycle approach that optimizes the buildings' useful lifetime, integrating the end-of-life phase in the design and uses new ownership models where materials are only temporarily stored in the building that acts as a material bank."* (Leising et al., 2018).

The CE is a new paradigm and has become a driver of change in companies and public organizations (Pereira & Vence, 2021). This transition towards a circular economy requires complex innovation processes. In literature, Circular Oriented Innovation (COI) has been defined as *"the coordinated activities that integrate CE goals, principles, and recovery strategies into technical and market-based innovations, such that the circular products and services that are brought to market purposively maintain product integrity and value capture potential across the full life cycle."* (Brown et al., 2019). This process interacts with all levels of business strategy, and it involves different types of innovations such as business models and system innovations, and many different stakeholders (Brown et al., 2020).

1.2 The role of the client

In recent literature, the role of the client is an enabler of circularity adoption. Often, projects that implement circularity, are initiated because a client demands circularity in the project. This is the case of a recent study that selected cases based on the same point of departure, a circularity ambition was demanded from the client (Gerding et al., 2021). Also, literature by Wamelink & Heintz (2015) positions the client as the driver to improve the industry. In the context of real estate development, the chain and relations of stakeholders can vary from one project to another, however, if there is a change in the demand side of the market, a positive change can occur. As research suggests, triggering a change towards circularity requires an increase in demand from the client side(Zimmann et al., 2016). In fact, the most frequently mentioned barriers in the construction industry include a lack of

demand on the part of the building owners (MacKenbach et al., 2020). While the main driver for the implementation of the CE in a project is a supportive client with a well-defined assignment (Kanters, 2020).

1.3 Corporate real estate

Office space in The Netherlands accounts for up to 19 million of built square meters and continues on the rise (Colliers, 2022). It has been projected that the new office space will be divided between high-end and sustainable offices, and a value-add segment (Hesselink & Cushman-Wakefield, 2022). Moreover, investment managers have shown a growing interest in sustainable new-built and renovated buildings to satisfy the criteria of the EU Taxonomy (Colliers, 2022). Therefore, it is relevant to analyse the current role of circularity in corporate real estate (CRE) and the overall adoption of circularity to achieve sustainability in the built environment.

1.4 The role of consultancy services

In the innovation adoption field, consultancy services often play an important role on the driver side of the process (Bessant & Rush, 1995). This means that for an idea to be transmitted in determined markets, consultancy services work as an external influence. Moreover, in the case of circularity in CRE, literature suggests that an emerging field of research has focused on the role of consultancy, in contributing to defining the CE, especially through the reports that have been published by major global consultancy firms such as McKinsey, Accenture, Deloitte, and organisations such as the Ellen MacArthur Foundation (Kircherr et al., 2017).

1.5 Problem statement

In recent years, the literature on circularity in the built environment has been centred on discussing the drivers and barriers to achieving a circular economy in the building sector, especially in the application of circular strategies (Giorgi et al., 2022). So far, these studies have focussed on the drivers and barriers that influence the uptake of solutions for circularity, typically concentrating on the supply side and increasingly on the demand side from a frontrunner's perspective. However, far fewer studies investigate the drivers and barriers that influence clients who are not frontrunners in adopting circular ambitions and solutions. Therefore, this research aims to analyse the demand side perspective in the context of CRE, namely the consumers or final users of the office spaces. This study will focus on what and how drivers and barriers influence their adoption of circularity, with the goal to provide insights on circularity adoption, that can be transferred through actors such as consultancy services and contribute to the overall adoption process of circularity in the built environment. Figure 1 illustrates the research gap.

Figure 1 Research gap (own image)

1.6 Research focus

From the problem statement and the existing literature explained in the previous section, Figure 2 shows the research focus in the context, the research gap and topics that guide this thesis.

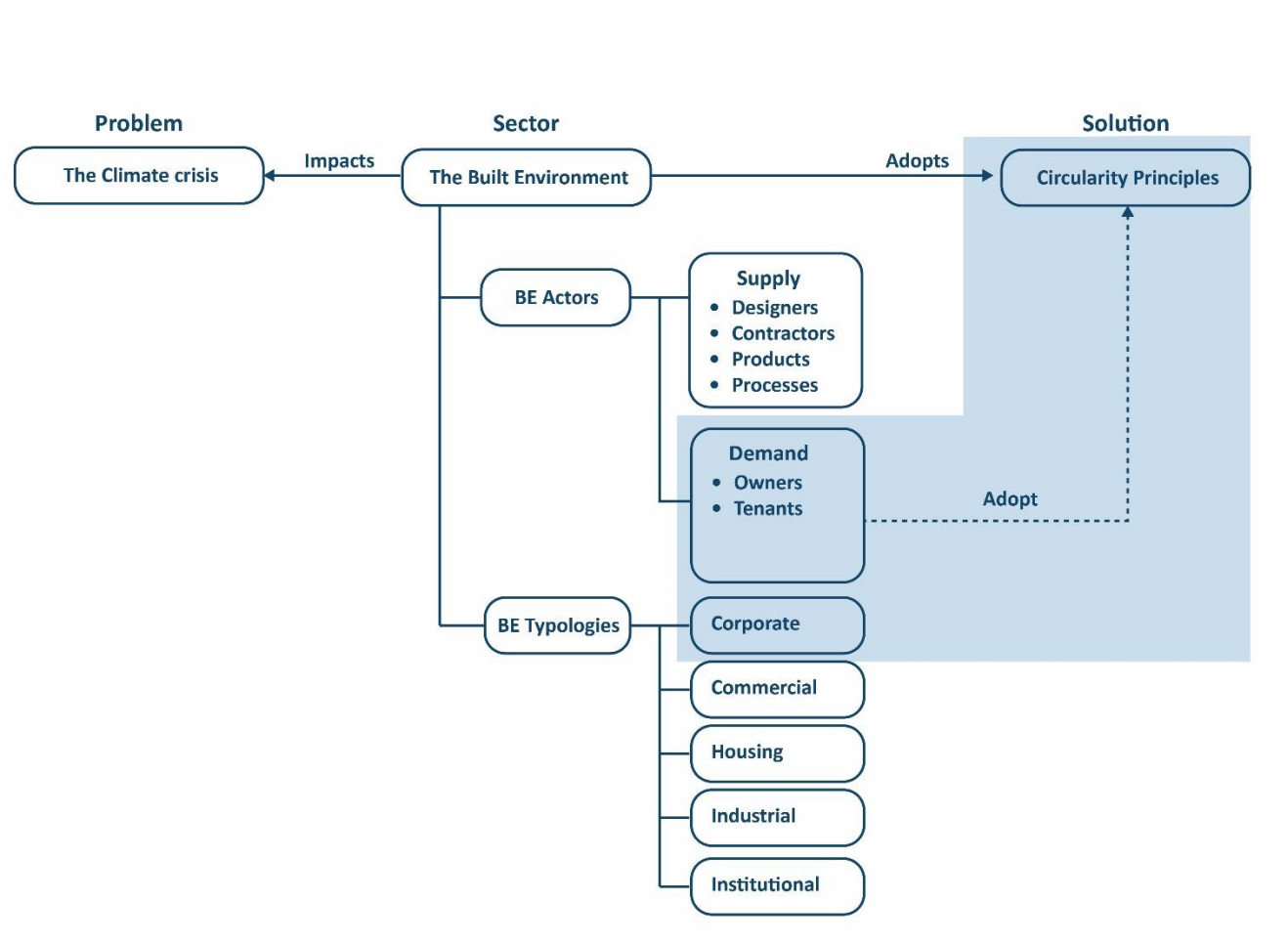

Figure 2 Research focus (own image)

1.7 Societal relevance

As states by the United Nations Environment Programme (2023), circularity contributes to achieving the United Nations Sustainable Development Goals (Figure 3). Especially focusing on goal number 12. Responsible consumption and production, by addressing resource efficiency, environmental impact, and human well-being. In consequence, circularity contributes to goals number 3, 5, 6, 7, 8, 11 & 12.

Figure 3 United Nations Sustainable Development Goals

This research aims to promote circularity adoption and increase the demand in the corporate real estate sector. The goal is to impulse this sector to change from the linear economy to the circular economy. Moreover, this research believes that the main driver for change lies in the initiative of the demand-side, namely the owners and tenants of the built environment. Therefore, contributing to sustainable development and help overcome the climate crisis.

1.8 Scientific relevance

In the field of circularity, research has focused mainly on the demand side, especially on the drivers and barriers. However, the role of clients in the demand for circularity has been less studied as research focuses on projects that started because of circularity ambition from a client. Therefore, the relevance of this study lies in contributing to filling the knowledge gap on the clients' perspective towards circularity.

This research will analyse not only the next adopters' perspective but also will test the circularity drivers and barriers in case studies from the early adopters' perspective. Furthermore, this research will be complemented by the base strategies developed in recent years by Acharya et al. (2020) because of its timely relevance and in accordance with the global trends of circularity adoption in real estate.

1.9 Sector relevance

This research aims to investigate the barriers and drivers from a client's perspective, with the goal to improve the advice given by consultancy services and promote circularity adoption. As a result, this could increase the demand and, eventually, impulse the change in the real estate development sector.

1.10 Research question

To conclude this section, the main question of this research is raised. As a result of the urgency to accelerate the implementation of circularity in the built environment, the leading role of clients in demanding circularity from the real estate development sector and the role of external advisors as enablers, the main question is:

How can the next adopters within corporate real estate adopt circularity ambitions and solutions?

Part 2.

Literature Review

2. THEORETICAL BACKGROUND AND FRAMEWORK

This chapter will discuss the formulation of the theoretical framework through which the main concepts of this research will be analysed. The proposed theoretical approach will investigate the overall circularity adoption in the context of the built environment from the perspective of the demand side, especially the CRE consumers. This theoretical research will provide the basis to formulate and structure the on-field research. Figure 4 shows the conceptual relationships that will guide the structure of the literature study.

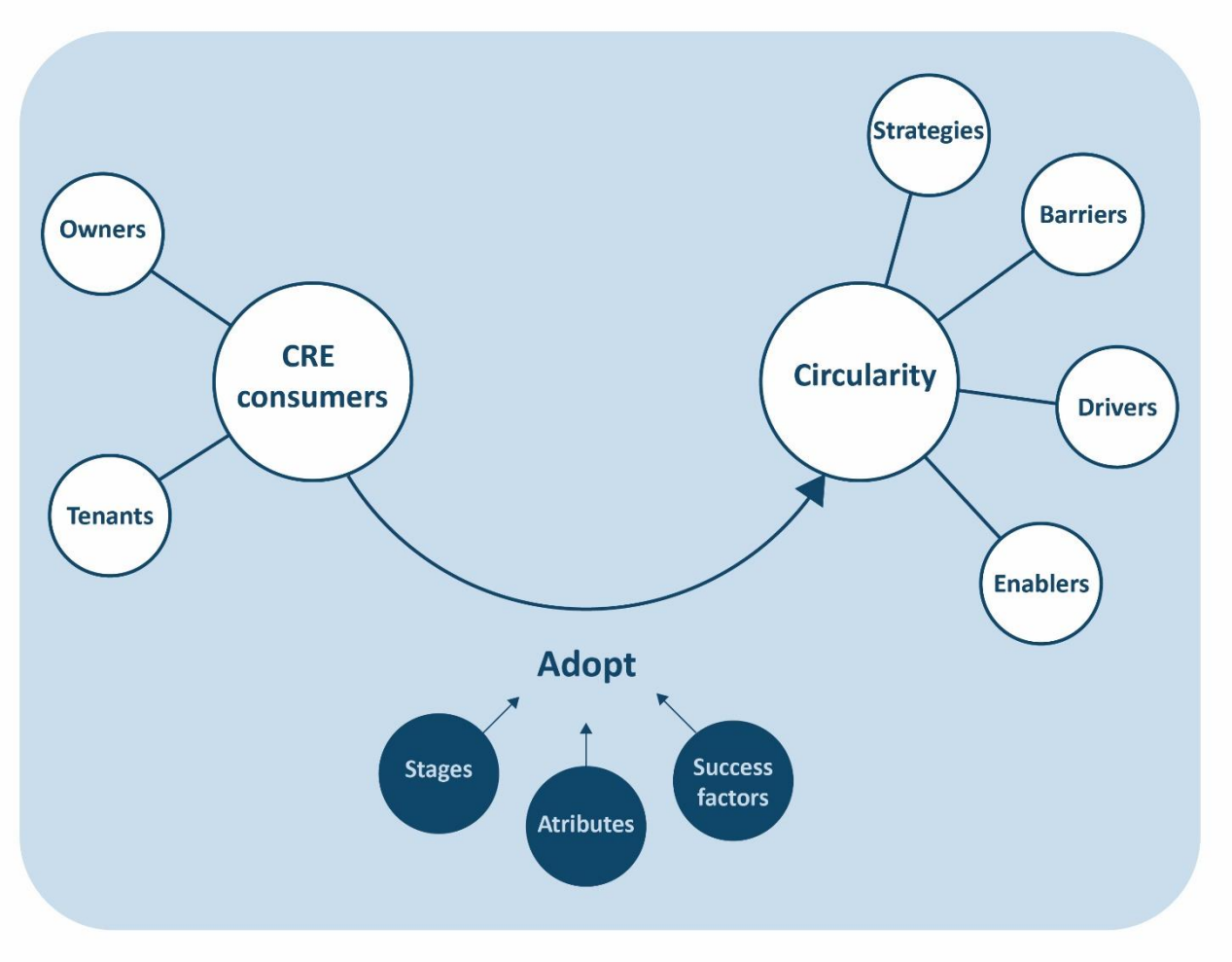

Figure 4 Conceptual model (own image)

2.1 Circularity in the built environment

The circular economy has been widely defined, however, since there is no specific definition that applies to the building sector, architects and designers majorly rely on the circularity principles as defined by the Ellen Mac Arthur Foundation (Kanters, 2020) The circular economy is defined as:

> *"A systems solution framework that tackles global challenges like climate change, biodiversity loss, waste, and pollution".*
>
> *And it's based on the three main principles of:*
>
> - *Eliminating waste and pollution*
> - *Circulating products and materials at their highest value*
> - *Regenerate nature*
>
> (Ellen MacArthur Foundation, n.d.)

To illustrate the principles of the circular economy, the Ellen MacArthur Foundation created the "butterfly diagram" (Figure 5), which shows the flow of materials, nutrients, components and products in the biological cycle and the technical cycle. This diagram is based on Cradle to Cradle.

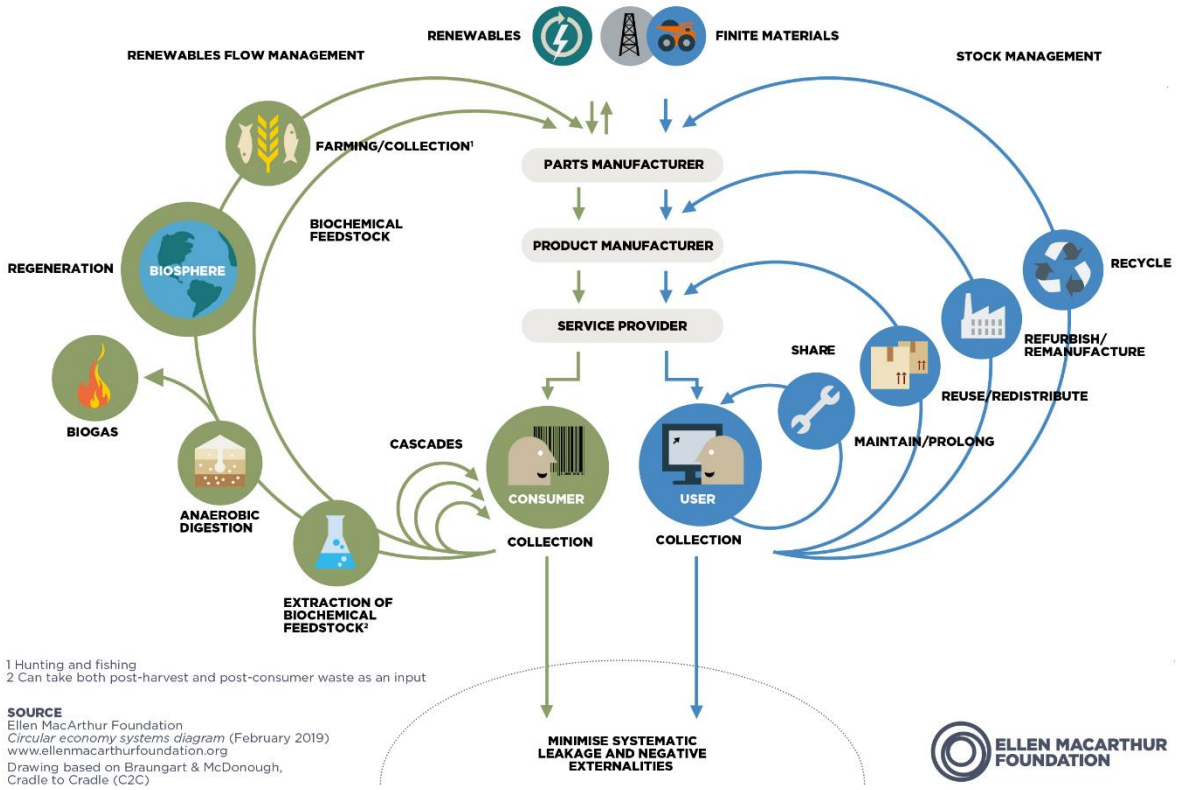

Figure 5 Butterfly diagram from the Ellen MacArthur Foundation

Moreover, the actions to implement circularity in the built environment are also explained by the Ellen Mac Arthur Foundation through the RESOLVE framework: Regenerate, Share, Optimise, Loop, Virtualise and Exchange (Luebkeman & Fellow, 2016). Table 1 shows the details of this framework.

Principle	Strategies
Regenerate	• **Regenerating and restoring natural capital** • Enabling the resilience of ecosystems • Returning biological nutrients safely to the biosphere
Share	• **Maximising asset utilisation** • Pooling the usage of assets • Reusing assets
Optimise	• **Optimising system performance** • Prolonging an asset's life • Decreasing resource usage • Implementing reverse logistics
Loop	• **Keeping products and materials in cycles, prioritising inner loops** • Remanufacturing and refurbishing products and components • Recycling materials
Virtualise	• **Displacing resource use with virtual use** • Replacing physical products and services with virtual services • Replacing physical with virtual locations • Delivering services remotely
Exchange	• **Selecting resources and technology wisely** • Replacing with renewable energy and material resources • Using alternative material inputs • Replacing traditional solutions with advanced technology • Replacing product-centric delivery models with new service-centric ones

Table 1 RESOLVE framework adapted from Ellen MacArthur Foundation (Luebkeman & Fellow, 2016)

In line with the statements by the Ellen Mac Arthur Foundation, the goals of circular building design aims to maximize the use of currently available resources, reduce waste production from buildings, and minimize the environmental impact of buildings (Kanters, 2020). While some of the most typical approaches based on the circular economy often include the reuse and recycling of construction materials, adaptable buildings, material passports and design for disassembly (Kanters, 2020; Cruz Rios et al., 2021). Furthermore, research has determined the key aspects in applying circularity across a building's life cycle (See table 2). However, researchers also notice that they are often applied in isolation and within a particular sector or project (Adams et al., 2017).

Life cycle stage	Circularity strategies
Design	• Design for disassembly. • Design for adaptability and flexibility. • Design for standardisation. • Design out waste. • Design in modularity (reduce waste). • Specify reclaimed materials. • Specify recycled materials.
Manufacture and supply	• Eco-design principles. • Use less materials/optimise use. • Use less hazardous materials. • Increase the lifespan. • Design for product disassembly. • Design for product standardisation. • Use secondary materials. • Take-back schemes. • Reverse logistics.
Construction	• Minimise waste. • Procure reused materials. • Off-site construction.
In use and refurbishment	• Minimise waste. • Minimal maintenance. • Easy repair and upgrade. • Adaptability. • Flexibility.
End of life	• Deconstruction. • Selective demolition. • Reuse of products and components. • Closed-loop recycling. • Open-loop recycling.

Table 2 Circular economy aspects across a building's life cycle stage, adapted from Adams et al. (2017)

2.2 Circularity in corporate real estate

ARUP and the Ellen Mac Arthur Foundation have concluded recent research on the foundations of circularity applications in real estate. Their newest report was written by Acharya et al. (2020). Where five business models are proposed based on capturing lost value in real estate and responding to market trends through circularity principles. Each model is presented together with a case study in which the model has been applied and its financial performance (see table 3). And the authors state that a project could adopt more than one model or even all at the same time, and they can also be applied to different types of real estate. Lastly, in the report it is stated that to achieve the adoption of these circularity approaches, they should be viewed by investors and construction clients as a business strategy and not just as waste management or a design approach (Acharya et al.,2020).

Model	Create value	Strategy	Circularity aspect	Result
Flexible spaces	In underutilised space and increase value from additional tenants.	List online the existing underutilised building spaces for short-term use.	The efficient use of existing space, thus reducing the need to build new spaces.	Positive financial performance of 18% reduction in net present cost over 12 years.
Adaptable assets	By preventing premature demolition.	Buildings that can accommodate more than one use during their lifetime by retrofit instead of demolition.	Keeping buildings in use for as long as possible at their highest value.	3% increase in internal rate of return over 50 years.
Relocatable buildings	Vacant land and target the profit opportunity of revenue generation from short-term space use.	Modular buildings, designed for deconstruction, made of durable, high-quality materials. Located in vacant land through temporary rental agreements.	Prefabricated and modular construction, and ensure materials are kept in use for as long as possible through design for disassembly.	This model resulted in 26% increase in the internal rate of return over 11 years.
Residual value	Depreciated materials and seek the profit opportunity of selling the reclaimed building materials.	New contract, with the recoverable materials of the building, which is placed on the market and whoever owns the contract at the time of deconstruction becomes the owner of the materials.	Reducing future waste by planning the future reuse of construction materials.	This model resulted in a 5% reduction in net present cost over 10 years.
Performance procurement	Underperforming components and target the profit opportunity of subscription costs, to access building systems.	Product-as-a-service for individual construction products. In this model, the supplier turns into a service provider, and is responsible for the product's maintenance, repair, and upgrade.	Reducing waste by incentivising suppliers to create high-performance systems that last.	This model resulted in a 3% increase in the internal rate of return over 30 years.

Table 3 Circular real estate business models, adapted from Acharya et al. (2020)

2.3 Circularity drivers, barriers, and enablers in the built environment

In the following sections, the drivers, barriers, and enablers of circularity will be discussed from the built environment perspective. These will be explained through the studies by Kanters (2020), where the analysis considers the three main stakeholders in the built environment: the client, the architect and the contractor, and the study by Cruz Rios et al. (2021) where the barriers and drivers are categorized into cultural, regulatory, financial, and sectorial.

Drivers

Research agrees that one of the major drivers for circularity adoption is a supportive and well-defined intention stated by the client, which allows for the architects and the design team to explore new products, materials, and new ways of working (Kanters, 2020). However, these clients are also driven by internal or external factors to adopt circularity, this thesis aims to study the perspective of the demand side, thus the drivers that will be mentioned in this section correspond to studies focused on the demand side of CRE.

In general, research agrees on the client's awareness of the fact that their CRE could contribute to their 'sustainable corporate image' (Kanters, 2020), as one of the major cultural drivers for circularity adoption. At the same time, it has been concluded that this awareness drives the stakeholders' pressure inside organisations to adopt circularity (Ranta et al., 2018). Furthermore, research also agrees that the corporate responsibility and the sustainable practices, can help businesses to improve their reputation (Camilleri, 2019).

Financial drivers are often mentioned in literature as financial subsidies or incentives (Ranta et al., 2018). Also, the resource efficiency of circular practices helps organisations reduce their consumption, resulting in cost savings (Acharya et al., 2020). While the governmental pressure by the introduction of policies and measures to reduce carbon emissions is a regulatory driver for circularity adoption (Govindan & Hasanagic, 2018).

Barriers

Literature understands circularity barriers as the challenges concerning the adoption of the CE in a specific sector (Hart et al., 2019). In the financial category, research concluded that the building industry is very conservative, and the considered financial risk of the CE represents a major barrier (Kanters, 2020). Furthermore, research also concluded that the unclear cost benefits of the CE, the cost constraints, the limited funding, and the low virgin material prices are the main barriers to achieving the CE in the built environment (Cruz Rios et al., 2021).

In the sectorial category, the building sector, it is determined that new materials availability, the supply and demand of reused materials and the lack of specific knowledge about reused materials and to harvest them represent the main barriers (Kanters, 2020). Moreover, the complexity of the buildings (Zimmann et al., 2016), the lack of a coherent vision for the industry, the long product lifecycles, the challenges in material recovery, the lacking standardization and the insufficient development of circularity-focused design are considered the most relevant barriers in recent studies (Hart et al., 2019).

The regulatory barriers are often determined by the lack of flexibility in the building codes and regulations (Kanters, 2020), the lack of a regulatory framework and the existence of obstructing laws and regulations, also understood as the lack of incentives in adopting circularity (Hart et al., 2019) In some cases, it was found that the existing regulations and codes even hinder reuse and repair of materials or structures (Cruz Rios et al., 2021).

Cultural barriers are related to awareness and education in the building sector; therefore, it has been concluded that a lack of interest, knowledge and engagement throughout the value chain, and a lack of collaboration between businesses and between business functions represent major challenges to achieving circularity (Hart et al., 2019). Also, in relation to knowledge, there is an overall lack of clarity on the meaning of circularity and what it entails, as well as a lack of awareness on the long-term costs and benefits of implementing circularity (Cruz Rios et al., 2021). Furthermore, research has found an industrywide lack of information about circularity concept among clients, designers, and subcontractors (Adams et al., 2017).

Enablers

In literature, enablers are formulated as an answer to the circularity adoption barriers in the built environment (Hart et al., 2019). In general, research agrees that major drivers for circularity adoption are a strong business case (Adams et al., 2017) and enabling policies and incentives (Guerra & Leite, 2021). Research by Adams et al. (2017) also proposed a clear economic case, metrics, and tools for circular design as enablers for circularity in the building industry. Moreover, research has concluded that enabling strategies should prioritize solving economic, regulatory, and educational barriers (Rakhshan et al., 2020).

In the financial category, it is recommended to enable circularity is to factor circularity savings in the Whole Life Costing System (Hart et al., 2019). Additionally, it is proposed that financial incentives to use secondary materials can also be an important enabler in the building sector (Adams et al., 2017).

In the sectorial category, research suggests that the building sector should provide a better evidence base to policymakers to enable regulatory changes (Hart et al., 2019). Moreover, it is proposed that the sector needs to translate the vision of the circular economy from principles into practice (Zimmann et al., 2016). Additionally, it is also suggested that collaboration in the sector combined with design tools and strategies can enable and drive the adoption of circularity (Hart et al., 2019).

The regulatory enablers often focus on policy support, regulatory reform to obstructive regulations and fiscal incentives for projects with circularity adoption (Hart et al., 2019). These enablers are aligned with the ones proposed by Cruz Rios et al. (2021) to policymakers which entail raising public awareness on circularity, promoting a regulatory reform to eliminate barriers to circular building design strategies such as reuse and repair, emphasize the benefits of reuse and lower embodied energy in buildings, and create economical and fiscal incentives.

As cultural enablers, Hart et al. (2019) suggest leadership, value chain engagement and systems thinking. Also, it is proposed that an awareness-raising campaign is necessary to drive the adoption of circularity (Adams et al., 2017). Additionally, the study by Kanters (2020) emphasizes the role of architects and consultors on the distribution of circularity knowledge and awareness.

Table 4 summarizes the main drivers, barriers and enablers that were mentioned in this section.

Drivers	Barriers	Enablers
• Sustainable corporate image • Stakeholders pressure • Subsidies and incentives • Resource efficiency • Governmental pressure	• Conservative sector • Unclear cost benefits • Materials availability • Sectorial knowledge • Inflexible building codes • Lack of awareness	• Strong business case • Policies and incentives • Whole life costing system • Financial incentives • Leadership • Awareness-raising campaign

Table 4 Main drivers, barriers and enablers mentioned in literature.

2.4 Client's Role and perspective

In this thesis, the client is considered as the consumer of corporate real estate. As mentioned in the first part of this report, recent research found that the main driver for circularity in the building sector is 'a supportive client with a well-defined assignment and idea' (Kanters, 2020). Moreover, it is also considered that investors and construction clients must embrace the circular economy to achieve the final goal of reducing the environmental impact of the built environment (Acharya et al.,2020). Nevertheless, as stated in the problem definition, these clients' perception and adoption of circularity has not been extensively studied yet. Therefore, this section discusses the existing literature about corporate clients' views and perceptions of circularity in their real estate.

Research has found that one of the main drivers for clients to uptake a circularity ambition is to contribute to their 'sustainable corporate image' through their buildings (Kanters, 2020). This means that these decisions are not directly decided upon the financial value but could also be driven by a social value. Moreover, research agrees that ambitions are a key aspect into the adoption of a new idea (Chebo & Kute, 2018). Therefore, when researching the client's perspective it is paramount to dive deep into understanding the motivations that drive the uptake of circular ambitions.

On the other had, research on the challenges to circularity adoption has shown that clients' awareness of circularity is very low compared to other stakeholders involved in the construction sector (Adams et al., 2017). Moreover, research on the perspective of the client, places it's role on the decision-making side of construction projects, and concludes that the construction clients should be made aware and persuaded about circularity adoption (Dokter et al., 2021).

Lastly, research has also found that for clients to be persuaded into circularity adoption, the most important driver is a clear business case (Adams et al., 2017). Therefore, the models explained in the previous section can be used as success cases when diffusing circularity within the corporate clients.

2.5 Innovation adoption

Diffusion Theory is commonly applied when addressing digital innovation, technology, or the creation of new products, to analyse the process of adoption and diffusion (Rogers, 1983). In this theory, Rogers (1983) determines four key factors:

- **Innovation:** is defined as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption". This means that an innovation could have been invented for a long time, yet it is only perceived as new later in time.

- **Communication channels:** are the means by which messages are transmitted from one individual to another, with the goal to create awareness-knowledge.

- **Time:** is a key element in diffusion theory is relevant when contextualizing the adoption of a determined innovation.

- **The social system:** is defined as the units or individuals that are engaged in solving a problem to achieve a common goal. These members can be individuals, organizations, and subsystems. As explained by Rogers (1983), "the social system constitutes de boundary within which an innovation diffuses".

In Diffusion Theory (Rogers, 1983), the adoption of an innovation is the result of a process of reduction of uncertainty, which is measured in the following attributes or success factors:

- **Relative advantage** is the degree to which an innovation is perceived as being better than its predecessor, it can be expressed in economic, social or the like terms depending on the nature of the innovation.

- **Compatibility** is the degree to which an innovation is perceived as consistent with the potential adopters' values, experiences, and needs.

- **Complexity** is the degree to which an innovation is perceived as challenging to understand and use.

- **Trialability** is the degree to which an innovation can be experimented on a trial basis.

- **Observability** is the degree to which the results of an innovation can be observed and communicated to others.

In the case of circularity adoption, this thesis considers these factors to characterize the barriers, drivers, and enablers for circularity adoption. This provides the basis for a clearer understanding of the innovation and the reasons for a driver or barrier to being perceived and determined. Additionally, the success factors also help to distinguish which aspect of circularity as an innovation needs to be improved so it can succeed in the social system.

According to Rogers (1983), the innovation-decision process is the process through which an individual or unit confirms the adoption of an innovation. Rogers defines five stages:

1. **Knowledge:** is when the unit of adoption becomes acquainted with the existence of an innovation.

2. **Persuasion:** is when another unit of adoption forms a positive or negative attitude towards the innovation.

3. **Decision:** is when the unit of adoption determines a choice between accepting or rejecting an innovation.

4. **Implementation:** is when the unit of adoption puts the innovation in motion.

5. **Confirmation:** is when the unit of adoption assesses the implementation of the innovation to either reinforce the decision or refuse it.

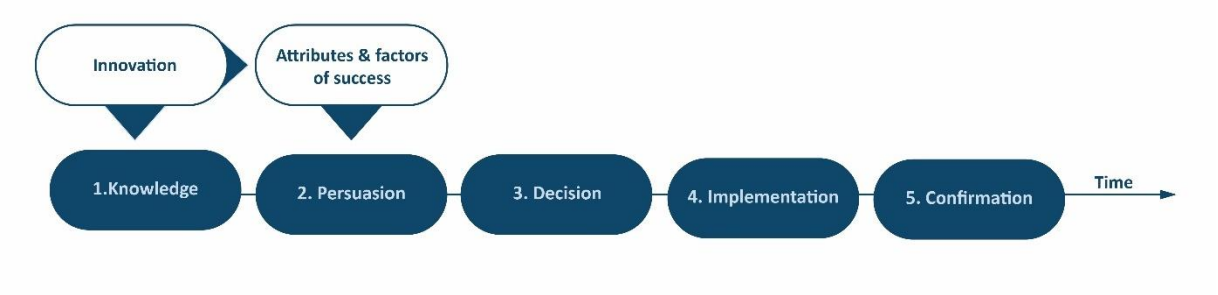

Figure 6 Diffusion process diagram adapted from Rogers (1983)

Rogers (1983) defines the adopter categories according to the moment of adoption of an innovation, or on the basis of "Innovativeness". Which refers to the degree to which an individual or unit of adoption is relatively earlier in adopting new ideas than other members of a social system. This means that the earlier the adoption of an innovation the most innovative the individual is.

Rogers makes this classification through the S-curve of adoption and normality (see Figure 7) where it shows the comparison between the diffusion of innovation in the cumulative s-shaped curve and the bell-shaped frequency curve that illustrates the adopter categorization on the basis of innovativeness.

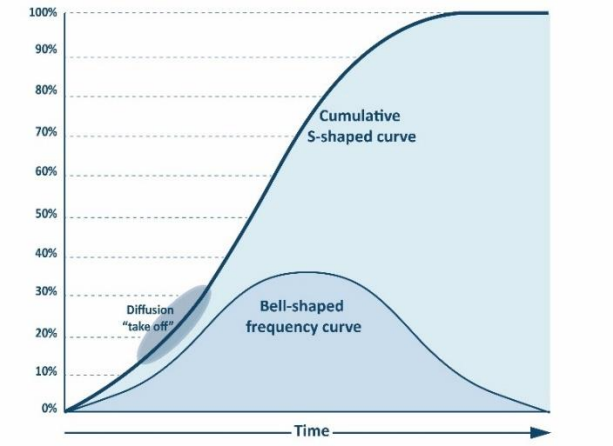

Figure 7 Adapted from Rogers (1983): The bell-shaped frequency curve and the s-shaped cumulative curve for an adopter distribution.

Rogers categorises the adopters into five categories based on their adoption moment within the group to adopt an innovation: Innovators (2.5%), early adopters (13.5%), early majority (34%), late majority (34%) and laggards (16%).

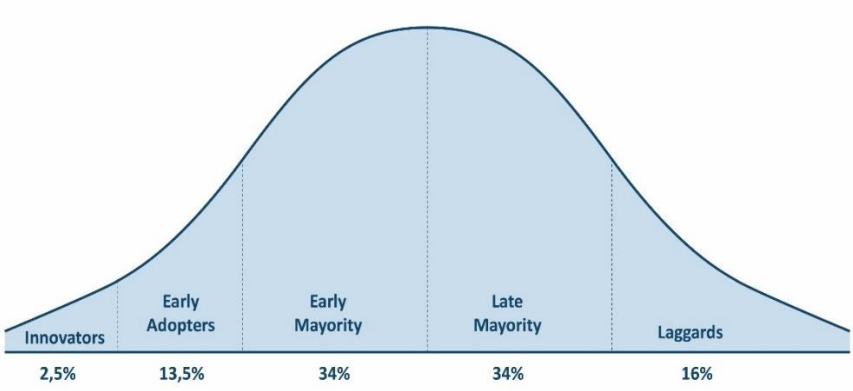

Figure 8 Adapted from Rogers (1983) The adopter categorization on the basis of innovativeness.

The adopter categories as described by Rogers (1983) will be explained as follows:

Innovators

These are the first individuals to adopt an innovation, this group is described as to be willing to take risks and eager to try new ideas. They have access to substantial financial resources to absorb possible

losses and can understand and apply complex technical knowledge. Also, they must be able to cope with the high degree of uncertainty about an innovation at the time of adoption. They are considered the gatekeepers in the flow of new ideas into a social system.

Early Adopters

This group is described as the respectable group in the social system. This group has the greatest degree of opinion leadership in most social systems. Potential adopters look to early adopters for advice and information about the innovation. The early adopters' group serves as a role model for many other members of a social system. Therefore, the role of the early adopters is to reduce the uncertainty about the new idea by adopting it.

Early majority

This group adopts an innovation after a significant portion of the population has already adopted it, but just before the average member of a social system. Their innovation-decision period is often longer than that of the innovator and the early adopter, since they need to see evidence that the innovation is effective before adopting it. And they are also leaders in their social system.

Late majority

This group adopts an innovation after the average member of the population. They are described as to be skeptical about change and often need to see evidence that the innovation is effective before adopting it. This group adopts an innovation because of a necessity and the network pressure. Also, this group has relatively scarce resources, so almost all uncertainty about a new idea should be removed before they feel safe to adopt it.

Laggards

This group is described as to be traditional and suspicious of innovations, therefore they are the last to adopt an innovation. They base their decisions on the past experiences of the previous generations. Their adoption process is so slow that it shows a resistance to innovations. Their limited resources force them to be extremely cautious in adopting innovations, therefore they must be relatively certain that the new idea will not fail.

To summarize Rogers (1983) Diffusion Theory, Figure 9 shows the main concepts of this theory.

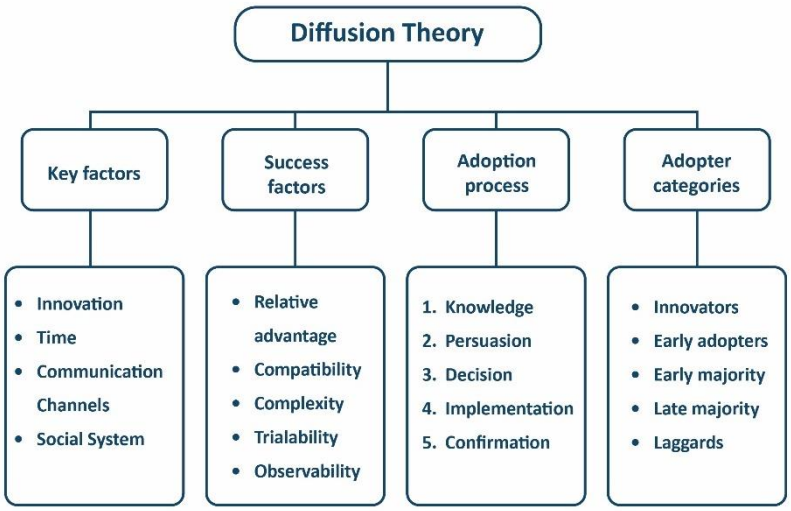

Figure 9 Diffusion Theory adapted from Rogers (1983)

2.6 Circularity adoption

Circularity has been adopted in different economic sectors. Recent research by Carini et al. (2021) mapped the diffusion of circular economy good practices in the European context. This research involves the study of empirical cases to determine the success factors, the challenges, and the way forward to achieve the goal of circularity. The framework used to analyse how circularity is widespread is done through the Diffusion Theory by Rogers (1983), which was explained in the previous section. Because of this, the timely publication date and the direct relation with the circularity practices mentioned in this thesis, it is relevant to consider this research in the explanation of the current state of circularity adoption. Furthermore, it helps to determine the types of adopters and supports the group of adopters chosen to be studied in this thesis.

To place the study of circularity adoption, it is necessary to explain how each concept of diffusion theory is defined in the study by Carini et al. (2021). In this case, circularity is understood as the innovation to be studied, it is placed in a timeframe from 2015 until 2021, the social system is determined in the Italian system, but with European connections and the communication channel is a shared platform at European level.

The research shows that the most implemented circularity strategies are “closing the loop”, especially in the approach of end-of-waste treatment strategy, and “circular design”, focused on lifecycle approach. Lastly, the strategy of “slowing the loop”, that aims to lengthen the life of products, was found in the minority of cases (Carini et al., 2021). These results are intrinsically related and determined by the success factors of circularity that were studied.

In Rogers terms, the relative advantage of circularity was found in the reduction of production costs, the reduction of pollution and energy efficiency, the savings of raw materials and even price comparisons between circular substitute product and product from natural raw material (Carini et al., 2021). Compatibility and complexity often lead organizations to a tendency to apply circularity to the entire business activity, while in the case of trialability is not always present or still in progress (Carini et al., 2021). Lastly, observability is found to be lacking especially in the external communication of projects (Carini et al., 2021).

Because of the factors previously mentioned, the research by Carini et al. (2021) concludes that the diffusion of circularity as a business model innovation is still in the early stage of the adoption curve at a practical level (see Figure 10).

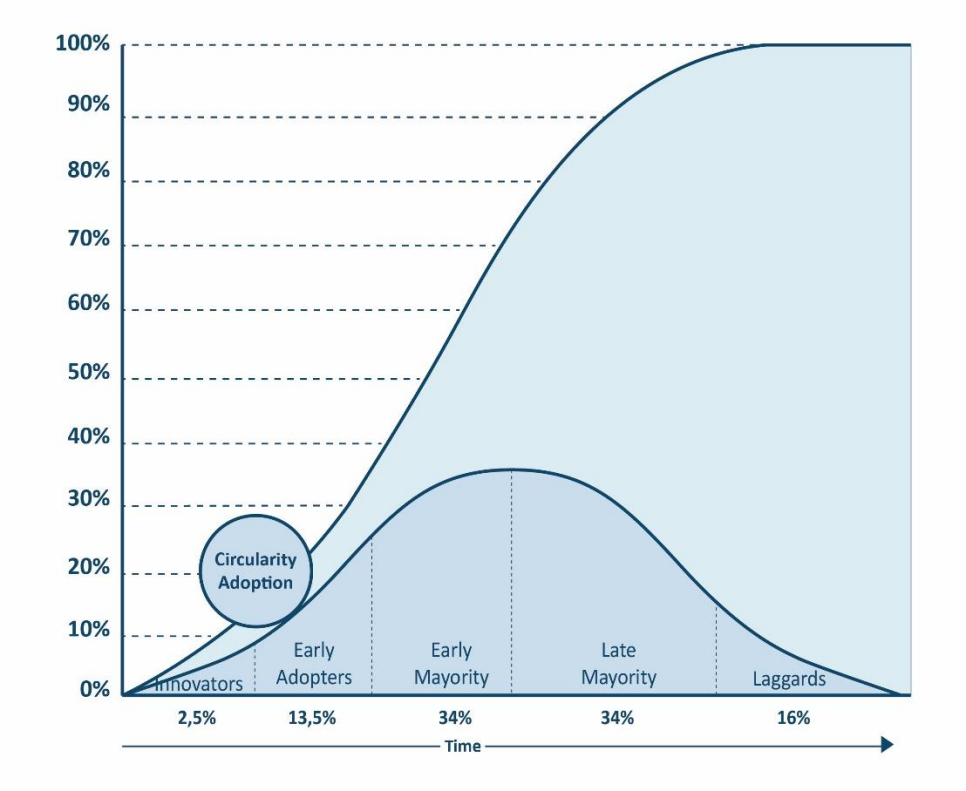

Figure 10 Circularity adoption current state, adapted from Carini et al. (2021)

The research found that the main drivers or motivations to circularity adoption are the benefit in terms of cost reductions and pollutant emissions leading to an overall benefit in terms of improved economic, environmental and social performance, while the barriers or challenges are characterised by a high level of complexity, especially in the involvement of other businesses in the circular transition and a still low level of communication of applied case studies (Carini et al., 2021).

Lastly, it is recommended that the good practices undertaken by the early adopters should be looked at by the early majority to achieve the next stage of circularity diffusion (Carini et al., 2021).

2.7 Next circularity adoption in corporate real estate

The concepts defined by Rogers (1983) on the Diffusion of innovations theory and the research by Carini et al (2021) help define the context and the actors to be researched in this thesis.

Innovation	Circularity
Social system	CRE in The Netherlands
Time	Dutch government goal to be fully circular by 2050
Communication channels	Consultancy services firm in The Netherlands

Moreover, the theory also helps to define the two groups to be analysed, the 'Early adopters' and the 'Next adopters' of circularity in CRE. These groups can be defined first by their location in the adoption categories. As Carini et al. (2021) concluded, the overall adoption of circularity in the European context is still in the early stages. Therefore, for the purpose of this research, two groups are defined:

Early adopters

These are the CRE clients that are already asking for circularity, and some might already have adopted circularity in their CRE projects since at least five years ago until today.

Next adopters

This group can contain adopters from several adopter categories, namely the early majority, late majority, and the laggards. The determining factors will be the willingness to adopt circularity, their perspective on the innovation's barriers and drivers. Furthermore, as their adopter category is unknown, through analysis of the data from Rogers (1983) concepts, the study by Carini et al. (2021), and the on-field research, their adopter category can be distinguished.

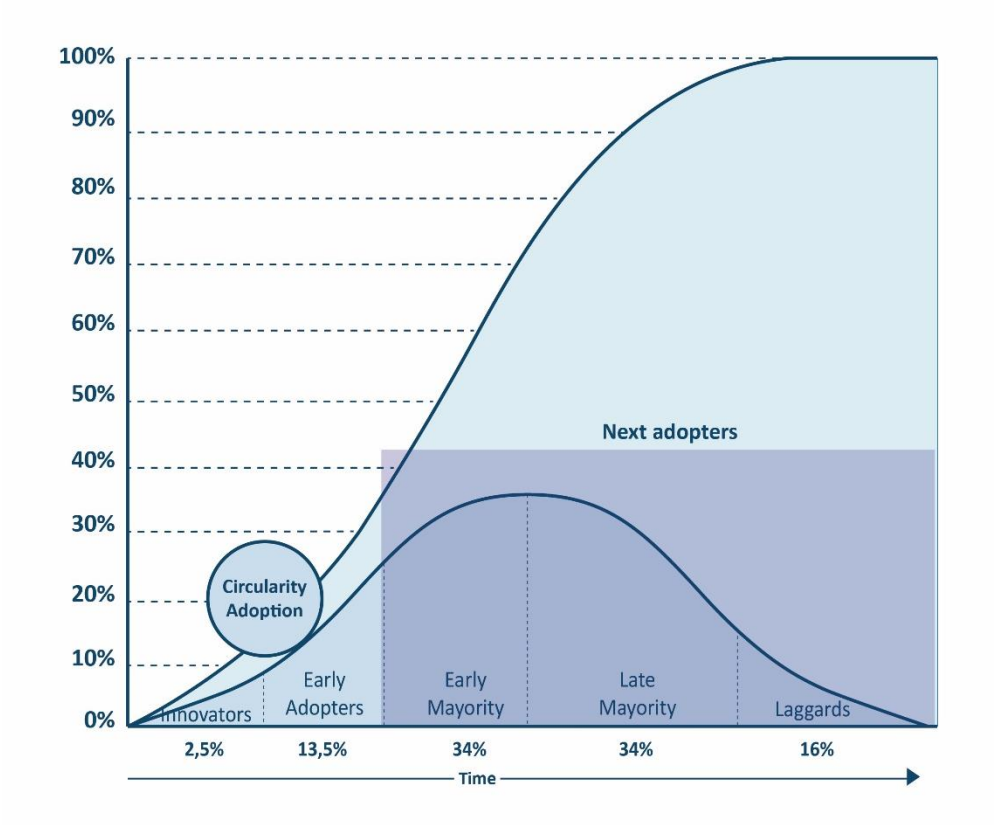

Figure 11 Circularity adoption groups adapted from Carini et al. (2021)

2.8 Theoretical framework summary

To summarize, the theoretical perspective takes Rogers (1983) Diffusion Theory but adapted to circularity as an innovation in the study by Carini et al. (2021), which also determines the overall adoption stage of circularity in the European context.

The perspective of the corporate real estate clients will be researched through the innovation success factors that determine the innovation adoption. These factors are understood as the barriers and drivers to achieve circularity adoption as well as the enabling strategies to overcome the challenges.

Table 5 shows the main relations that resulted from the theoretical study.

1	**2**	**3**
Diffusion Theory	**Circularity adoption**	**Circularity adoption in CRE *(This thesis)***
Innovation	Circularity	Circularity
Social system	European context	The Netherlands
Adoption stages	Current stage: Early adoption	Next adopters
Unit of adoption		CRE
Success factors		Drivers, barriers & enablers

Table 5 Theoretical framework summary

PART 3.

Research Methods

3. RESEARCH METHODS

3.1 Research question

The main question of this research is raised by the urgency to accelerate the implementation of circularity in the built environment, and the leading role of clients in demanding circularity from the real estate development sector. The main question of this research is as follow:

How can the next adopters within corporate real estate adopt circularity ambitions and solutions?

This research aims to analyse the influential factors on the corporate clients who are the next adopters of circularity in real estate projects. The answer the main research question and enable the purpose of the research, the sub-questions are formulated as follows:

- **SQ1.** What are the main concepts and characteristics of circularity adoption in the built environment?
- **SQ2.** Who are the next adopters of circularity in CRE and what are their characteristics?
- **SQ3.** How is circularity being adopted in CRE from the early adopters' perspective? And how do they overcome the challenges?
- **SQ4.** What is the perception of circularity in CRE from the early adopters' perspective?
- **SQ5.** What is the perception of circularity in CRE from the next adopter's perspective?

3.2 Research methods

This section will explain the necessary steps that should be followed to successfully answer the research questions and result in a meaningful conclusion. Figure 12 illustrates the research method, phases, and steps.

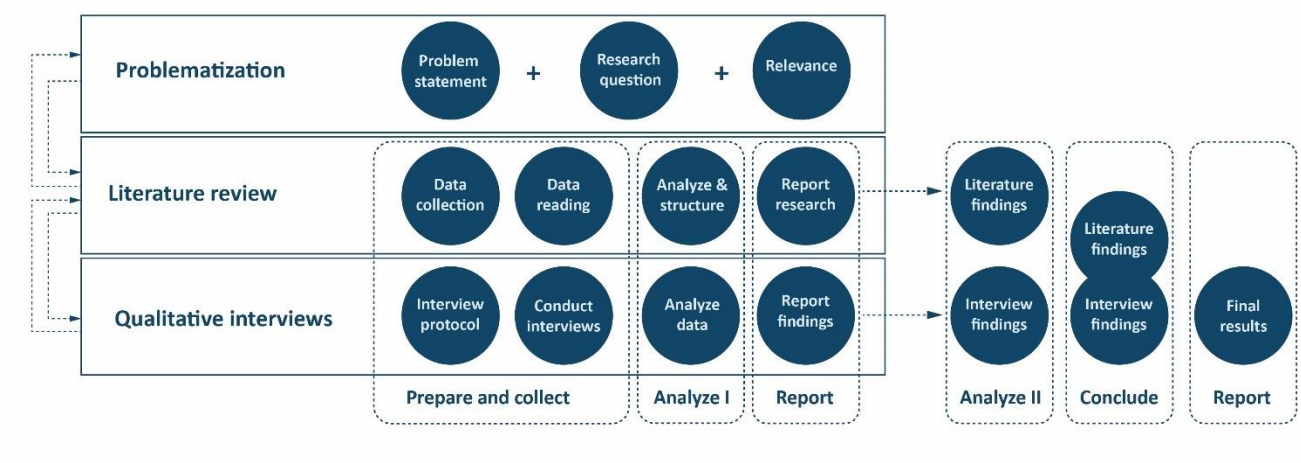

Figure 12 Research framework (own image)

The problematization phase determined the problem statement, the main research question, and the relevance of the research. The main goal of the research is also defined in this section, it is determined that the goal will address the perspective of corporate real estate clients on circularity adoption and contribute to increasing the demand for circularity ambitions on corporate projects.

The proposed research methods will be a mixed approach by combining a literature review and qualitative interviews. The research method will test theory with the perceptions of the demand side of corporate real estate. The research is sectioned in three main steps, the first is prepare and collect stage, second the analysis and third the report of each method. In the following set of steps, the findings resulting from the methods will be analysed, synthesized in a conclusion, and lastly reported. During the process the data that is collected will be analysed and compared simultaneously to achieve a complete understanding of the data. Table 6 shows the determined methods that will be used to answer each sub-question and consequently answer the main question.

Main research question: How can the next adopters within corporate real estate adopt circularity ambitions and solutions?

Sub- questions	Literature review	Qualitative interviews
SQ1. What are the main concepts and characteristics of circularity adoption in the built environment?	**X**	
SQ2. Who are the next adopters of circularity in CRE and what are their characteristics?	**X**	**X**
SQ3. How is circularity being adopted in CRE from the early adopters' perspective? And how do they overcome the challenges?	**X**	**X**
SQ4. What is the perception of circularity in CRE from the early adopters' perspective?	**X**	**X**
SQ5. What is the perception of circularity in CRE from the next adopter's perspective?	**X**	**X**

Table 6 Sub-questions methods

3.2.1 Literature review

This research will provide the theoretical knowledge to define and analyse the main concepts of circularity strategies, drivers, barriers, and enablers in the built environment, as well as the existing understanding of them in the specific area of corporate real estate. Data will be collected from academic publications via academic search engines such as Google Scholar, Scopus, and the TU Delft digital library. The expected output of this part of the research will be the background information that supports the problem statement, contextualizes the previous research done on the subject and will guide the theoretical basis for the elaboration of interview questions as well as defining the structure of the analysis. Furthermore, this study serves as the basis to help answer the research question. The structure of this review is guided by the sub-questions and the relationship between concepts, determining research themes. Figure 13 shows the topics that were reviewed in section 2 of this thesis.

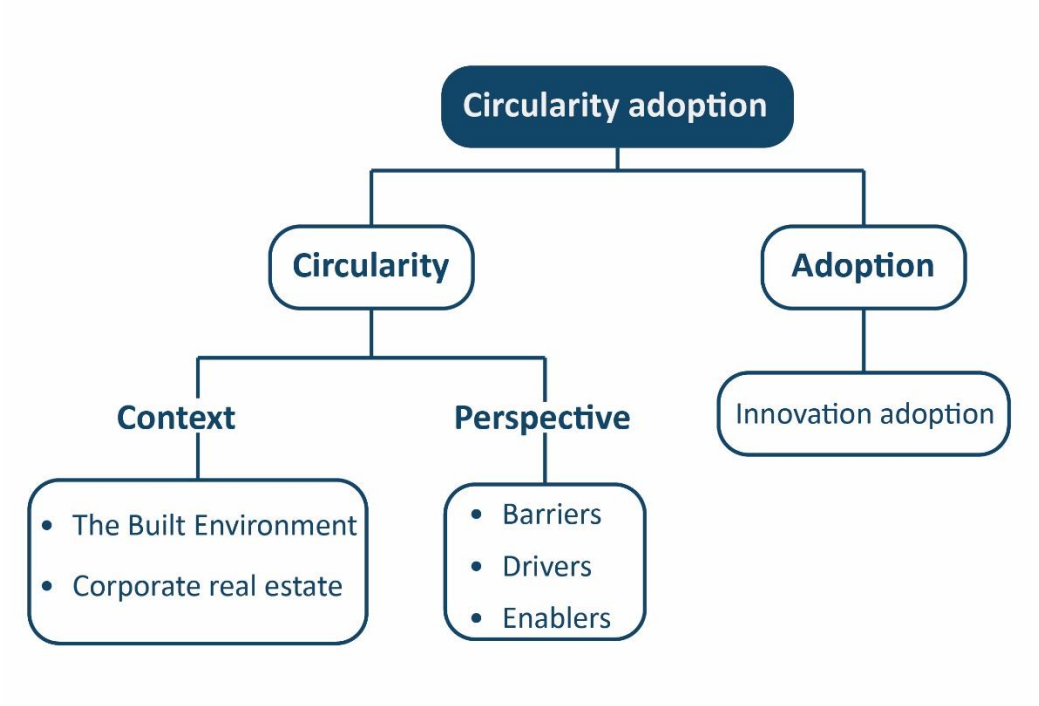

Figure 13 Literature review topics (own image)

3.2.2 Qualitative interviews

Following the literature review and the analysis, the interview questions are formulated to collect suitable data for this research. These interviews address what, how and why corporate clients decide to demand circularity in their real estate portfolios. The interview participants are accessed through Colliers, a consultancy services firm in The Netherlands. The selection of this company is guided by the background literature done for the problematization. Section 1 of this report addresses the role of consultancy services on the clients demand for circularity in corporate real estate.

Based on the research presented in the previous section, and the details of section 2.7, this thesis defined two groups to investigate, therefore, the selection of interviewees focuses on two types of corporate clients. The first group addresses the 'Early adopters', these are the CRE clients who are already adopting circularity and have a long-term circularity plan for the following years. The second group addresses the 'Next adopters', the CRE clients who are not yet adopting circularity but could potentially demand for circularity in their corporate real estate. The goal of this selection is to retrieve

the client's perceptions and positions towards circularity adoption, as well as understanding the circularity strategies that have been proposed to these clients in such cases.

The qualitative interviews will engage with twelve interviewees and will be formulated as semi-structured interviews, with a time duration of 45 to 60 minutes and consist of approximately ten questions. The final interview protocol is formulated to guide the interview. The questions are open ended to allow participants to elaborate on their answers and avoid steering the conversation with definitive answers (Jacob & Furgerson, 2012). The questions will concern the circularity strategies, how corporate clients perceive drivers and barriers in circularity and how they overcome them. This method aims to answer the following research sub-questions:

- **SQ2.** Who are the next adopters of circularity in CRE and what are their characteristics?
- **SQ3.** How is circularity being adopted in CRE from the early adopters' perspective? And how do they overcome the challenges?
- **SQ4.** What is the perception of circularity in CRE from the early adopters' perspective?
- **SQ5.** What is the perception of circularity in CRE from the next adopters' perspective?

The interviews will be recorded and transcribed. The transcripts will be coded using inductive and deductive coding to find similarities in the interviewees responses and relate them to the research themes. The qualitative data collected will be analysed and used as input together with the literature review findings to formulate the recommendations for CRE clients.

3.3 Data plan

This thesis commits to the FAIR Guiding principles guaranteeing the used data is findable, accessible, interpretable, and re-usable (Wilkinson et al., 2016). The data is collected from literature review and qualitative interviews. Existing data will be collected and analysed through the literature review, while new data will be created through the results of the qualitative interviews. The identity of the interview participants as well as their company will be kept confidential. To commit to confidentiality, information will be limited to not reveal an individual's identity. The writing on the report is cited and correctly identified. Moreover, all the data collected during this research is stored on a personal laptop and simultaneously a backup is made in online storage account. Access to both the device and the online storage account is secured through password protection. The final thesis report will be uploaded to the TU Delft repository. Additionally, Colliers will receive a report of the findings derived from the interviews and the final report. Although the thesis will be published, the interview recordings, transcripts and raw data from the study case will remain confidential, as well as the names of the companies that the interviewees represent. The responsibility for the data management is the sole responsibility of the researcher.

3.4 Ethical considerations

The research ethical considerations will follow the four principles of Internet/Web mediated research such as respect for the dignity of persons, scientific value, social responsibility, and beneficence (Blaikie & Priest, 2019). These principles ensure the respectful and ethical handling of all the research participants including interviewees and the companies they represent. Moreover, their identities will be kept confidential, and no research will be defamatory to any party. This thesis aim will safeguard the scientific value is achieved and that the benefit is maximized while the harm is minimized.

Of special interest of this research is the ethical extent to which Colliers' clients will disclose the internal reasons for choosing an alternative over another, some of this data can be delicate in terms of future negotiations, therefore it is paramount that the answers and the interviewees are kept confidential and rephrased to hide the participant's identity. This consideration will be included in the final report and the presentation of findings as well as the report that will be given to Colliers.

3.5 Research output

The goal of this analysis is to contribute on formulating customized advice to corporate clients who are not yet demanding circularity for their real estate. The research output will be qualitative data of the Early and Next adopter clients' perspectives on barriers and drivers to achieving circularity and possible strategies to adopt circularity in corporate real estate projects. The output will be translated into written recommendations in the final report.

The intended audience of this research includes corporate real estate clients' external advisors, academics and students interested in this topic. However, it is important to note that in this specific case, the final user of the research findings will be Colliers. As it is the company to host the research, the findings will be contextualized within their client's profile, therefore the data can not be generalized, and a distinction needs to be done when applying the results to other research or contexts.

3.6 Research plan

To achieve the research goals and study the intended audience, shows the workflow used for this thesis. This timeline determines the steps, milestones, and interdependencies between tasks to be done. At the time of completion, the personal study targets and the research goal will be reached.

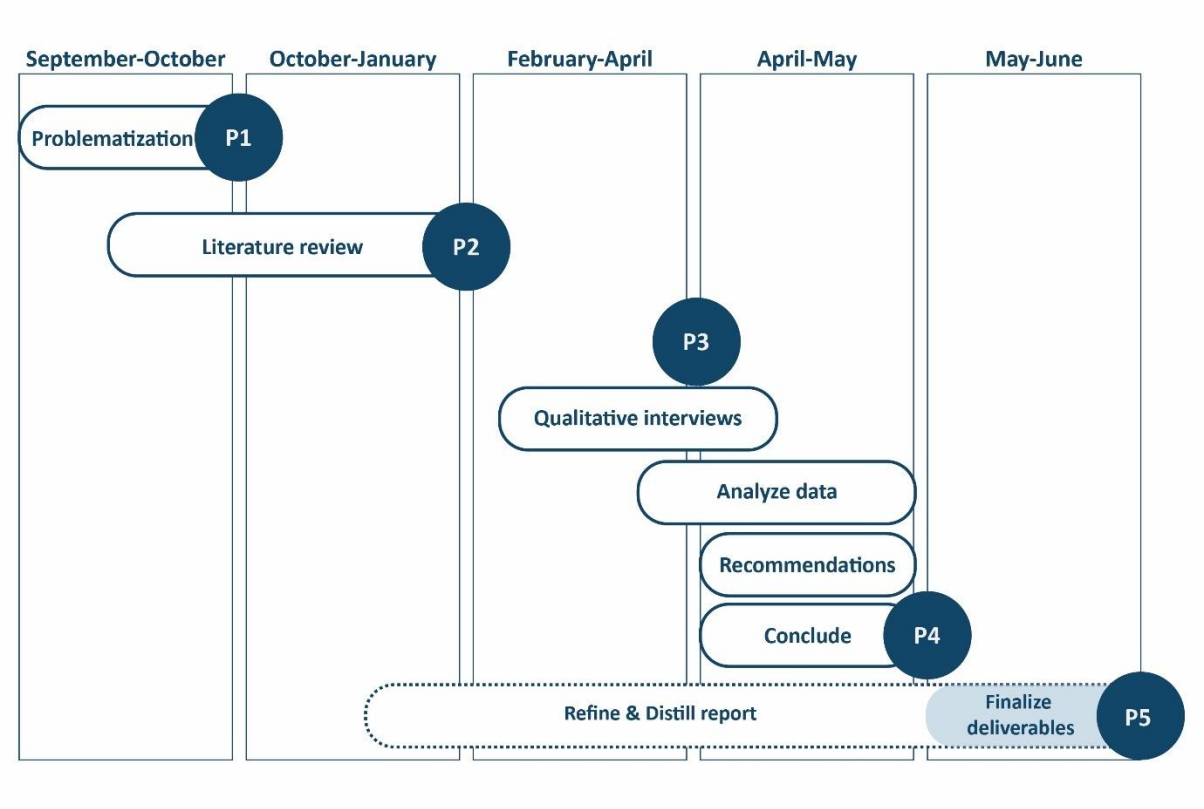

Figure 14 Research plan (own image)

3.7 Personal study targets

The main goal of the author is to learn how and why are theoretical concepts applied in the field of corporate real estate in the Dutch context. The objective is to expand and enrich the knowledge acquired through the master track and make it tangible in factual applications through a different lens, in this case, the clients, who from an outsider's perspective, can have great influence in changes in the development of the built environment.

Furthermore, the focus on the study of circularity will also complete and expand the current knowledge gained through the master studies on the topic. Additionally, circularity is considered of high importance in the current state of the built environment, especially in the European context, therefore, the in-depth study of circularity is a major driver of the personal study targets.

PART 4.

Empirical research

4. EMPIRICAL RESEARCH ANALYSIS

This section presents the empirical data that was collected. It provides an in-depth examination of the current state of circularity adoption in CRE, based on the findings of interviews with representatives of organizations that are part of the social system to be analysed. This empirical research addresses the sub-questions 2, 3, 4 and 5.

4.1 Interviewee profiles

Organisations

The participants of the interviews represent 12 organisations. Out of these organisations, 5 are governmental (03, 04, 06, 10, 12), 5 are private (01, 02, 07, 08, 11) and 2 are non-profit organisations (05, 09). And their size ranges from 500 to 50.000 employees. In the findings section, it will be referred at the interviewees by their identification number. The numbers correspond to the order in which the interviews were held. Table 7 shows the identification number and the general characteristics of the organisations that participated in the research.

Int. Number	Group	Type	Category	Employees	Size	Core business
01	Early adopters	Private, traded	International	80.000	XL	Energy
02	Early Majority	Private, traded	International	11.000	XL	Food
03	Late Majority	Government	National	550	Medium	Public institution
04	Early adopters	Government	National	1.747	Large	Crisis management
05	Early adopters	Not for profit	National	1.500	Large	Pension funds
06	Early adopters	Government	National	1.890	Large	Care and welfare
07	Late Majority	Private, traded	International	52.000	XL	Construction chemicals
08	Early adopters	Private, traded	International	16.000	XL	Financial services
09	Late Majority	Not for profit	National	958	Large	Healthcare
10	Early adopters	Government	National	1.500	Large	Governmental
11	Early Majority	Private, traded	National	35.500	XL	Transportation
12	Laggards	Government	National	1.620	Large	Intermediaries

Table 7 Interviewees' general characteristics

Interviewee roles

The companies were represented mostly by corporate facility managers, 12 of the interviewees perform this role, while only 2 are project managers who were involved in specific projects. In the case of interview 11, the facility manager asked to be joined by the project manager, while in interview 01 the project manager represented the organisation.

4.2 Interviewer concepts explanations

To accomplish the interviews, some concepts had to be introduced and explained by the interviewer. These terms are 'circularity' and the 'adopter categories'. While these concepts were explained thoroughly in sections 1 and 2 of this report, for the purpose and time duration of the interviews, they had to be paraphrased and summarized.

Circularity was explained by first setting it into the context of sustainability, so the basic principles of "reduce, reuse and recycle" were mentioned. Then, it was explained that circularity is a way to achieve sustainability in the built environment and is based on the first two principles of reduce and reuse, while recycling is considered a last resource. These principles were exemplified by mentioning some circularity strategies like the reuse of construction materials and elements, the reuse of furniture, the design for future reuse, the efficient design to reduce the number of square meters used and so on. In every conversation the examples were similar, however, each time the explanation varied depending on what was previously mentioned by the interviewee. If the interviewee already had mentioned a circularity strategy, it was used to exemplify the explanation of the concept.

The adopter categories explanation was paraphrased from section 2.5 in this report, where Rogers (1983) Innovation Adoption theory was outlined. This concept was introduced as part of the last question of the interview. First, it is explained that when a new product or technology is introduced in the market, for instance the cell phone, there is an innovation curve that involves the population that will adopt it and the moments in time where each individual will adopt the innovation. Then the image of Rogers (1983) adoption curve and adopter categories, is shown and it is asked to which category they think they belong to. In some cases, the interviewees are already familiar with the concept and answer right away, while others need a further explanation. For the later, the categories are explained. First, the innovators as the pioneers of the innovation, then the early adopters are described as the group that wants to set the example, then the early majority as the group that follows the example of the early adopters and that wants to adopt the innovation just before the average, the late majority as the group that adopts the innovation because they feel obliged to do it and the laggards as the last group to adopt the innovation.

4.3 Method of analysis

The data set was collected from the interviews as transcripts. These documents were then analysed together through the coding method. This method was organised with the aim to distinguish the set of statements that correspond to each sub-question. Table 8 shows the codes that were related to the sub-questions.

Sub-questions	Codes
SQ2. Who are the next adopters of circularity in CRE and what are their characteristics?	• Company information
SQ3. How is circularity being adopted in CRE from the early adopters' perspective? And how do they overcome the challenges?	• Circularity strategies • Enablers
SQ4. What is the perception of circularity in CRE from the early adopters' perspective? **SQ5.** What is the perception of circularity in CRE from the next adopter's perspective?	• Drivers: Regulatory, cultural, financial, sectorial • Barriers: Regulatory, cultural, financial, sectorial

Table 8 Sub-question related codes

The codes are organised in 3 code groups: drivers, barriers, and adopter categories. The barriers and drivers' groups contain the codes: financial, sectorial, regulatory, and cultural to classify the nature of each statement as mentioned in literature (section2.3). And the adopter categories group contains the codes: early adopters, early majority, and late majority. Lastly, to facilitate the interpretation of the coding, the transcripts are divided into two groups: the early adopters and the next adopters.

4.4 Findings

This section presents the findings, the analysis and processing of the data that was collected from 12 interviews. This information is divided into 6 key themes. First, the two studied groups are presented, the early adopters and the next adopters, addressing their characteristics and position towards circularity. Then the strategies, drivers, barriers, and enablers are presented as key themes from the perspective of each group, indicating the similarities and differences between them. This provides a clear understanding of the information that was collected and is aimed to address the sub-questions of this research.

The Early adopters

From the 12 organisations, 6 were mapped as early adopters (01, 04, 05, 06, 08, 10) out of which 3 are governmental (04, 06, 10), 2 are private (01, 08) and 1 is a non-profit organization (05). Table 9 shows an overview of the early adopter participants general characteristics.

Int. Number	Group	Type	Category	Employees	Size	Core business
01	Early adopters	Private, traded	International	80.000	XL	Energy
04	Early adopters	Government	National	1.747	Large	Crisis management
05	Early adopters	Not for profit	National	1.500	Large	Pension funds
06	Early adopters	Government	National	1.890	Large	Care and welfare
08	Early adopters	Private, traded	International	16.000	XL	Financial services
10	Early adopters	Government	National	1.500	Large	Governmental

Table 9 Early adopters list

These organisations were categorised as early adopters based on the fact that they have a long-term plan to commit to circularity and sustainability. It was found that most of them have established goals to either become CO2 Neutral (04, 05, 06, 08, 10) or at least reduce their CO2 emissions (01) and reduce waste. Moreover, this group said that they have already started circularity adoption by including the concept in their projects, tenders, and maintenance plans (01, 04, 05, 06, 08, 10). Lastly, the categorisation was also mapped by a specific question to verify with which adopter categories the interviewees identify their organisations.

The Next adopters

From the 12 organisations, 6 were mapped as next adopters (02, 03, 07, 09, 11, 12), out of which 3 are private (02, 07, 11), 2 are governmental (03, 12) and 1 is a non-profit (09) organisation. As part of the research, it was asked to the participants to which adopter category they identify with, 3 of the participants identify with the late majority, 2 with the early majority and 1 with the laggards group. Table 10 shows an overview of the next adopters' participants general characteristics.

Int. Number	Group	Type	Category	Employees	Size	Core business
03	Late Majority	Government	National	550	Medium	Public institution
07	Late Majority	Private, traded	International	52.000	XL	Construction chemicals
09	Late Majority	Not for profit	National	958	Large	Healthcare
12	Laggards	Government	National	1.620	Large	Intermediaries
02	Early Majority	Private, traded	International	11.000	XL	Food
11	Early Majority	Private, traded	National	35.500	XL	Transportation

Table 10 Next adopters

These organisations were classified as next adopters because they lack a long-term plan to commit to sustainability. It was found that almost all these companies (except 07) focus on sustainability in their buildings, particularly on energy levels and certifications, and they view circularity as a next step. This group is also characterized by the avoidance of risk-taking and often wait for an innovation to be adopted by the early adopter's group, especially the organisations identified as late majority and laggards (03, 07, 09, 12).

4.4.1 Strategies

Strategies	Early adopters	Next adopters
Repair and refurbish	x	x
Reuse waste(coffee residue)	x	x
Reuse of products and components	x	x
Design for disassembly	x	
Design for adaptability	x	
Material passport	x	
Procure reused materials	x	
Disassembly	x	

Table 11 Strategies mentioned in interviews.

Table 11 shows an overview of the strategies that were mentioned by the interviewees of both groups. It indicates with an "X'' if the group has implemented the strategies, and it is left blank when a strategy was not applied. This allows a visualization of the similarities and differences between the groups.

Both groups took the first steps towards circularity by focusing on furniture refurbishment. Interviewees mentioned that they either have a general rule of only purchasing refurbished furniture or that they have recently refurbished furniture for a CRE building (02, 05, 06, 07, 10, 11, 12). In some cases, both groups purchased refurbished partition walls (01, 02, 06, 08). Additionally, some interviewees mentioned circularity in their daily operation. Several referred to the reuse of coffee residue to grow mushrooms and later offer mushroom croquettes in the company's catering (06, 08, 11, 12).

The Early adopters group

The primary focus of this group is on producing no waste or at least reducing waste. Interviewees mentioned the reuse of materials from a previous building, especially with internal elements. In some cases, windowpanes and partition walls were also reused. One interviewee explained how they approached it in a project*: "What we have done is that we said the current interior is like a mining pit. You have to reuse everything that you see. In cooperation with our suppliers make a differentiation or about all the walls or the glass. Yeah, carpets interior. And we can reuse it where we can. At the end, we reused 90% of all our materials, but we created a total new environment."* (08). The same participant also mentioned how they prioritize the strategies: *"We have two or three strategies first, if we use our own materials second, use materials from other buildings, mining materials in the Netherlands and the last option was new. If it is new it has to be 100 percent sustainable, circular, biobased, etc."* (08).

One participant discussed their sustainable approach in a newly constructed project, which included implementing the design for disassembly strategy and the creation of a material passport, as well as incorporating a green roof and solar panels into the building (04). Another interviewee mentioned the importance of conducting a lifecycle analysis on the products they purchase *"So we ended up in a tender and we asked as a big part of the decision for a lifecycle analysis of the products that were offered to us. So that's also an important part, not only to reduce emissions "* (05).

Furthermore, one of the interviewees explained that they have adjusted their maintenance plan to circularity, by focusing on reducing and first fixing, while replacing or buying new is the last option: *"That's the old way of doing maintenance. Nowadays, we first try to repair stuff. And before we make a decision to invest in something new, we always ask ourselves the question, do we need one? Yeah,*

that's like on the level of circularity, that's the refuse step. Do we really need this product? So that's the cycle we introduced, it doesn't always work that way, to be honest, but that's the mindset we have with our maintenance partners." (05).

The Next adopters group

The interviewees often stated that they are still waiting for the early adopters to show them the way to circularity adoption. However, even if this group identified themselves as part of the next adopters, it was found that some of them are already implementing circular actions like furniture refurbishment (02,07,09,12). In two cases, when an office building is demolished, they make sure someone else can reuse the remaining parts to reduce the waste (07 & 10). Additionally, one participant often asks its suppliers to be sustainable but not with specific actions (11).

4.4.2 Drivers

Drivers	Early adopters	Next adopters
Personal motivation	x	x
Corporate image	x	x
Core business	x	x
Regulations		
Reusing cost	x	x
Budget	x	
New talent	x	
Future proof		x
Incentives on loans		x

Table 12 Drivers mentioned in interviews.

Table 12 provides an overview of the drivers that were discussed by interviewees of both groups. It indicates with an "X'' if the group has mentioned the drivers, and it is left blank when a driver was not mentioned. This allows a visualization of the similarities and differences between the groups.

Most of the interviewees in both groups are facility managers with the personal motivation to be environmentally responsible (except 07). This can be considered the main driver for choosing circularity options. One interviewee expressed: *"For instance, I am 80% vegetarian and my garbage is separated in all kinds of things. I drive electric, it's choices I make as a person. And a lot of people who work at the organisation are the same as I am and I want to make those changes within their own business environment…"* (12). However, in each adopter group, interviewees expressed different barriers and drivers that were either challenged or complemented by this motivation.

Among both adopter groups, it was found that the core business can be a major driver to adopt circularity, either to compensate for the core business (01, 02), to be aligned with the business vision (03, 04, 08, 09, 10) or to respond to external demands in relation to the business (05, 06, 07, 11, 12). One interviewee mentioned compensation by saying: *"So what they did is say, okay, we cannot do everything about our core business, but we can start with the things that we can do now, the real estate."* (01). One governmental interviewee discussed alignment by stating, *"We also want to show that we are responsible as a government organization, so we thought we should make a standard for other ones to look at."* (04). While a private organisation interviewee explained: *"We want to create a headquarter that is aligned with our own ambition and that is very standard. And also, what we thought was very important is to ask this sustainability, also in the built environment."* (08). Lastly, an interviewee said about responding to external demands: "Because also our clients, they are aware

about sustainability. I mean, they're not the activists because they stop use our type of transportation, but people do think at this moment more about the environment. So yes, I think that it is really important"(11).

Also, both groups considered that regulations were neither a barrier nor a driver. There is a general perception that regulations are not yet a deciding factor when discussing circularity (01, 05, 06, 08, 09, 10, 11, 12). However, some are expecting circularity regulations to emerge in the near future (02, 03, 04, 07). One interviewee even mentioned: *"No, I'm not afraid of that, okay, not about buildings. But the energy transition? Maybe yes. But, not about the building? Yeah, so maybe circularity is not going to be that big of regulations? Maybe…"* (07). Another interviewee mentioned that they will adopt circularity in the future because they want to be prepared for the future and ready before regulations oblige them to be circular (03). While another interviewee expressed that if they were pressured by the government, they could be driven to pay for circularity: *"We are always driven by money in the economy. So, circularity, when you want to do a project as we did, you have to pay for that, it's not for free. So, there should be some pressure from the government. Otherwise, it won't happen, I am afraid."* (04).

Additionally, the circularity principle of reusing is considered a cheaper option, this is considered by participants in both groups as a driver to adopt it (01, 07, 08, 09). While discussing this topic, the early adopters have said: *"Money wise? Yeah, it's a little bit cheaper."* (01). While the next adopters have stated: *"Mostly it is more cost driven if you come to reuse material like furniture."* (07).

The Early adopters group

This group was found to be driven by the sustainable corporate image and the advantages related to it. One interviewee explained this driver: *"It's also maybe a trend now is maybe not the reality, but in the future, we believe, and I also believe that only sustainable companies are attractive for investors, and with sustainable goals companies will survive. So, I think to be circular, there are two strategies. First of all, we have to change because of the environmental impact, but we also have to change to be future proof."* (08) Also, this group is mostly represented by governmental organisations (04, 06, 10), so they have stated the responsibility they have to be the example: "We are one of the first organizations who are doing this, because its an example." (10). Also, another governmental organisation expressed: *"I think the government has to do it. Yes, do it because we have to be good example"* (06).

In this group, it was found that the budget can be considered a driver as well as a barrier. In some cases, the client had a limited budget (04, 05, 10), while others had greater budgets (01, 06, 08). Interviewees stressed that a greater budget allows them flexibility to include circularity strategies. One interviewee explained this case, *"Yeah, the budget. Of course, finance is always a thing. But it was not a budget. It was like we say it was a big budget. That was a request, though it was just normal amounts, which was above other companies. So, we have some playing fields in the budget."* (01).

Also, it was found that some companies demand for circularity ambitions with the goal to attract new talent, especially younger people to work in the company (06 & 08). Participants stress that it is more likely to attract the young generations if they show they are sustainable including circularity. One interviewee stated: *"It's also very good to get younger people to your company… So if you if you can, if you do it, and you tell it on the right way, then you can attract new talent."* (06).

The Next adopters group

This group was found to be driven by regulations to be sustainable, but they stress that their focus lies in the specific case of energy efficiency and energy labels (02, 07, 09, 11). One interviewee explained:

"But the real estate is more looking like the standards like we have now in the Netherlands at this moment goals that are related to sustainability. So, we have the label, say which we need to have on certain buildings. You have a list of things you have to do if you want to get the money back within five years. So, all kinds of stuff you just asked is that a motivation? No. But it is something you have to do. And because it's all new, it now makes a lot of sense if you have all those things organized." (11).

Additionally, it was found in one interviewee a financial driver from the banks, who offer incentives for projects that include sustainability approaches. The interviewee explained: *"For our new buildings we have to take a loan at a bank. And that's also a next motivation for us, because then we not only have the government, but we also have the bank, who is very much interested in what are you going to do about the sustainability."* (09).

4.4.3 Barriers

Barriers	Early adopters	Next adopters
Supply of reused materials	x	x
Lack of knowledge in the supply side	x	
Material recovery	x	
Building codes and regulations	x	
Budget		x
Financial risk of circularity		x
Unclear cost benefits of circularity		x
Internal awareness		x
Accountability (role related)		x
Misconception look & feel		x

Table 13 Barriers mentioned in interviews.

Table 13 shows an overview of the barriers that were mentioned by the interviewees of both groups. It indicates with an "X'' if the group has mentioned the barriers, and it is left blank when a barrier was not mentioned. This allows a visualization of the similarities and differences between the groups.

Among both groups of interviewees, it was found that the supply side presents a major barrier (01, 02, 07, 08). Both groups have struggled to fulfil their requirements when demanding refurbished furniture from one supplier. And they stress the inconvenience of the situation: *"For example, if I contact a supplier who has refurbished, and I need, like 100 desks and is like, oh, I have 50 for you. I don't want to spend the time looking for another supplier who has also 50 I don't want to shop, you know, I need a supplier that can deliver."* (02).

The Early adopters group

In this group, participants found barriers from the supply side, especially in the supply of reused materials and construction elements (01, 08, 10). One interviewee discussed this situation: *"I think now we are in transition period where we have to deal with some materials that are not sustainable. So here we reused almost everything. But there are a lot of materials that at some point come to an end of life. And then you can't do anything with it except throw them away. So, where we want to go to is that we have materials with a never-ending lifecycle or that you can transform it easily in other projects. So that's about bio-based materials, but also about standard..."* (08). Moreover, one interviewee said that currently the construction sector is going through a transition and there is still a barrier to find in the market all the reused products that are required to be circular. On this topic, the interviewee mentioned: *"The transition where we are in now is that we, we use a lot of materials that*

in base are not sustainable. Well, the first thing is to reuse what you have, I think that's the most sustainable option." (08). Also, in terms of quality standards, participants found practical barriers (08, 10). One interviewee explained: *"Yeah, also end up changing mindset, like quality standards. For example, if you look to acoustics, or it's harder to reach that if you reuse material because maybe it's not fitting very good, or you have to add some extra."* (08).

Also, it was found that one interviewee perceived that designers and contractors are lacking awareness and knowledge on construction with reused elements and materials. The interviewee stated: *"I think the biggest challenge is first of all, to find contractors that are familiar with the process. We started to talk about the refurbishment of our biggest buildings. We started about five years ago. And now everyone is talking about it. But I think five years ago, it was also a topic. Working with reused materials was not very familiar with a lot of companies. First of all, to make a selection of companies that had the same ambition as we had. I think what was the first challenge."* (08).

In terms of knowledge barriers, in a specific case, it was found confusion about the utility of a material passport. The interviewee had received it from the designers, but the participant was not sure of how to use it or the purpose of it. The interviewee said: *"A material passport? I have heard the word before. So, I Yeah. I assume that the architect has made such a thing, but I can't replace where? Where we have got that? We should, I guess."* (04). Moreover, participants also found barriers with the employees of the company (07, 08, 10). One interviewee stressed: *"That's a challenge. It's also just to get commitment from my colleagues in our organization, not everybody thinks about it. It's also a thing, it's that important. So, we need the help from everybody. There's not only the technique, it's also behaviour."* (10).

Additionally, one participant found specific barriers when it comes to regulations in terms of insurances, especially in the reuse of materials. The interviewee explained*: "I think regulations are now accelerating the change in a positive way, but I know some examples in our business that sometimes it's difficult to locate good insurance product. It's harder to get an insurance for you reused product. Yeah, than for a new one. Okay, because an insurance company asks if it meets all regulations, if its working, what's the price? And how do we are going to get insurance? And if you if you buy a new one, you know what it is, you know, the supply chain."* (08).

The Next adopters group

In this group it was found a major misconception about the quality and the look and feel of the reused materials, especially within the employees who are the final users. The think it looks old, and the quality is bad (02, 03, 09, 12). To confront this situation, participants rely on communication strategies. An interviewee explained*: "Yes, there's a lot of misconception with within the company. And of course, if I only saw, like if we communicate about it, like, well, we're doing refurbished. But after that sentence, there's always a sentence. It's cleaned. It's new. It's checked. And it was not only like a little sentence, you have to you have to make a good communication, you have to explain."* (02). Another interviewee also shared: *"The biggest challenge is people. People within my organization, they think it's second hand what they get. Why in in the previous years everything was new in shiny? And why do we get the second hand? That's the first people find that almost an insult. That's a challenge.*" (12).

Most of the participants of this group (except 11) also found barriers from their role. They must show accountability and they stress they need to get budget approval for every project and therefore they would need to convince the board of the organisations to adopt circularity. It is not an easy task because they are focused on the core business. One of the interviewees shared: *"Right now, we are not doing very much with it. Every money we have, we give to better health care. So that's quite a difficulty for our board to make decisions into giving money to circularity or anything because we have the health care, and we want to be good at health care. Not especially in sustainability, so that's a little*

bit of how we think about this subject." (09). Also, another governmental interviewee shared: *"I think primarily because it's not our money, it's the taxpayer's money and we can demand 100% circular buildings, but then our prices of our rent triple and it's not…can we be accountable for that kind of spending? so that's the balance I think we're in."* (12).

One interviewee considered that they lack awareness on the concept of circularity because they have not been offered circularity from any of their suppliers, but that they don't demand it either. In the discussion about the topic, the interviewee said: *"No, we don't get the offer, and we don't ask the question."* (07). While another interviewee discussed about the awareness and the limitations of the actions of the people involved: *"Well, I think everybody's a little bit scared. They are scared to ask the market and the market is scared to make a bit for something out-of-the-box. And everybody does something about circularity and it's about carpets and you'll reuse carpets, but just that."* (12). Moreover, an international company representative discussed about the lack of circularity awareness from the headquarters of the organisation: *"I'm not sure if it isn't a topic in the United States and because our requirements will be made there. So, and if it's if it's there or not on the agenda, maybe people don't know. So, in our head obviously today they are not aware of it. If it's not on the agenda in the United States, then maybe it's also not on our list."* (07).

Furthermore, one interviewee also found barriers when prioritizing circularity from the financial side. They expressed that the suppliers prioritize the business and that they often find it cheaper to build or buy new instead of refurbishing. The interviewee explained: *"A challenge is finding people. Also, within my own real estate business. And the capability of being creative, putting yourself out there, and that's within my own organization. It's a difficulty and finding within the network of contractors, for example, that were ahead of things. They think business first, then circularity second. And it's hard to find a contractor who can contract in all the things to do in 20 buildings within the right combination within circularity and investment twice and creativity. Because for our contractor, it's easier to go in with the bulldozer, scrape everything and build everything new and demolition of the interior than to disassembly for reuse."* (12).

4.4.4 Enablers

To understand how the early adopters have overcome the barriers and challenges, it was asked what the possible enablers are to adopt circularity. At the same time, in the case of the next adopters, it was asked what could enable them to eventually adopt circularity. Table 14 shows an overview of the enablers that were mentioned by the interviewees of both groups. It indicates with an "X'' if the group has mentioned the drivers, and it is left blank when a driver was not mentioned. This allows a visualization of the similarities and differences between the groups.

Enablers	Early adopters	Next adopters
Strong business case	x	x
Way of working	x	x
Communication with employees	x	x
Open demand of circularity	x	
Regulations	x	
Improve price		x
Quality assurance		x

Table 14 Enablers mentioned in interviews.

Among both groups it was found that a strong business case, either through incentives or cost reductions, could enable circularity adoption within their organisations. About the cost of circularity an early adopter mentioned: *“I think people are willing to be part of circularity, unless it costs too much money."* (04). While a next adopter explained: *"Of course we are driven by the budget, if the circularity options were cheaper than buying new, of course we would do it."* (09). And about incentives, a next adopter explained: *"What always helps is legislation, we need governmental rules because then if you get subsidies or sponsorships it helps, I think.”* (12).

It was found that the way of working, both supply side and the demand side, needs to integrate circularity to enable its adoption. One interviewee discussed about the supply side: *"So for him, it was normal to design with used materials. And that way of thinking was very important. To change the way of thinking of the main architect of the project. And also create a good discussion about what is possible and what is not. Because what you see, within a lot of design companies, they have a design philosophy, and I think you have to add more people that can think different, to create change."* (08). While another interviewee mentioned: *"I think it is something that needs to be just part of the process, and not just a goal on itself. Because then it always feels unnatural. And then people feel like, ‘oh, no, that's something we have to do as well’. So, it just has to be part of the process and should be something useful or something that doesn’t disturb people. And I think that that will be sustainability in the future as well, that it's just part of the process and not something specific anymore. So, to be part of the process and part of our DNA just like safety.”* (11).

Lastly, the interviewees have discussed the importance of internal communication about the circularity actions that are being adopted within the organisations (02, 08, 12). One interviewee said: *"As the perception, we're trying to make communication around it. What impact it has? And I think if you do a project like this, the communication has to be right. And if people understand why we are doing it, they also get extra proud of it."* (08). While another interviewee discussed that the misconception about refurbished furniture can be overcome through communication with the final user and explaining that the quality is good: *"We communicate about the refurbished that is refurbished. But we don't we don't use the word second-hand. We assure the quality and cleanliness."* (02).

The Early adopters group

To overcome the supply side barriers, it was found in an interview that a successful enabler was to demand the market, especially architects and contractors, for an open circularity requirement (06). In this case, it was found that the market responded with circularity solutions that they knew how to build and solve. The interviewee explained: *"So we asked an architect and contractor to work together. And one of the big criteria was we want to do this on a circular and sustainable way, okay, so we leave it to the market, and they came with all these ideas."* (06). Moreover, it was revealed that participants consider that pressure from the government is necessary to enable circularity adoption (02,04,12). One of the interviewees explained: *"We are always driven by money in the economy. So, circularity, when you want to do a project as we did, you have to pay for that, it's not for free. So, there should be some pressure from the government, otherwise, it won't happen. I am afraid.”* (04). Additionally, one interviewee discussed that by acquiring experience in working with circularity, it could become more cost-effective to adopt it. The interviewee explained: *"I think it costs a lot of money, but I'm convinced that when we do it more, as we get more experience working in this way, it will be cheaper.”* (10).

The Next adopters group

It was found that quality assurance could motivate the circularity adoption of this group (07). Additionally, one interviewee discussed about how the participation of the employees can enable the adoption of circularity: *"What we're trying to do is to make it a kind of a party and that they're the front leaders of the company and let them think within the styling of the building and what they can*

do. So, participation of the group of people who's going to work there, and we're not all second handed what we're there are some new furniture and new colours on the wall and whatever and it. It's how you communicate. So, we are hoping that will help." (12).

4.5 FINDINGS KEY TAKEAWAYS

This section summarizes and highlights the main findings of the qualitative research. These takeaways, together with the findings that were previously presented, will be analysed, and reflected in the discussion section of this thesis.

1. **Concept awareness.** The research found that some of the next adopters are already implementing circularity strategies such as the refurbishment of furniture or the reuse of the coffee leftovers. However, they are not aware that these actions are considered circular. This suggests that the concept of circularity is not completely clear to all the participants in this group.

2. **Refurbishment cost.** The research found that the main driver for the next adopters to reuse elements or refurbish furniture is cost. In several cases, participants considered this option to be cheaper than buying new furniture or elements. However, for others, the refurbished furniture was considered to be more expensive.

3. **Personal motivation.** It was found that some facility managers were personally motivated to follow sustainability and decided to purchase only refurbished furniture.

4. **Core business.** The role of the core business has been found to be a major driver for circularity adoption in both adopter groups. It was found that circularity is adopted either to compensate for the core business, align with the business vision, or to respond to external demands that are related to the business.

5. **Budget is not always an issue.** The research found that the budget can be either a driver or a barrier for circularity adoption. This is related to the benchmark costs of an organisation versus the cost of circularity. For some, budget is barrier, while for others it is a driver. This finding is directly related to the core business and how organisations prioritize their budget decisions.

6. **Employee misconception of refurbished furniture**. Employees of both adopter groups doubt the quality of the refurbished furniture and often reject these products. This was found to be a recurrent topic, especially in the next adopters' group where these actions are relatively new for employees. While the early adopters are already acquainted with the idea, employees are still reluctant.

7. **Communication and employee participation** were found to be important enablers for the adoption of circularity among both adopter groups, especially to help solve the aforementioned barrier of refurbishment misconception.

8. **The role of regulations** has found to be neither a driver nor a barrier. However, some interviewees in the next adopters' group are expectant for upcoming regulations for circularity, they expressed they want to be prepared for the future.

PART 5.

Discussion

5. DISCUSSION

This research aimed to investigate the main research question: *How can the next adopters within corporate real estate adopt circularity ambitions and solutions?* The findings indicate that the next adopters are using circularity strategies without realizing it. Cost is the main reason for reusing and refurbishing furniture. The core business is a significant driver in circularity adoption, while budget can be either a barrier or driver. The misconception of refurbished furniture quality is a major issue, but employee participation and communication can help overcome it. Regulations do not impact current adoption, however, some of the next adopters anticipate future changes. This section will examine the implications of these findings on circularity adoption in CRE and highlight their significance. Specifically addressing the sub-questions of this research in the sub-sections. The aim of this analysis is to provide a critical evaluation of the results and contribute to the broader understanding of circularity in CRE.

5.1 The Next Adopters of Circularity in Corporate Real Estate

In this research, the next adopters of circularity in CRE are considered to be part of the early majority, late majority and laggards as explained by Rogers (1983) and contextualized in the study by Carini et al. (2021). The innovation adoption theory (Rogers, 1983) characterized these groups separately, however, in the qualitative research they were studied as a whole group. The main differentiation between the adopter groups was determined by the organisations' plans in relation to circularity. The next adopters were mapped by the lack of a long-term plan or vision towards circularity. However, in the qualitative research, it was found that this group has implemented circularity strategies in the refurbishment of furniture without being aware that it was circular. Cost was the main reason for such implementation. Then, if this group is already implementing circularity, it can be argued if this group is already an early adopter based on the theory.

By reflecting in the theory, the next adopters and their actions can also be determined through the adoption process explained by Rogers (1983) in the five adoption stages: 1. knowledge, 2. persuasion, 3. decision, 4. implementation and 5. confirmation. It can be argued that the next adopters' group is in the implementation stage because of the furniture; however, they missed the knowledge and persuasion stages as their decision was cost-driven and not because of circularity knowledge. Moreover, if this group is currently in the implementation stage, it is also argued that they are missing the confirmation stage. As it was shown in the findings, the employees are doubtful about the quality of the refurbished furniture; thus, it can be determined that their adoption process in terms of refurbished furniture is not yet completed either.

As shown in Figure 15, it can be discussed on Rogers (1983) adoption process depending on the perspective and on what is considered the innovation or the idea. In the case of the circularity concept from the facility managers perspective, based on the action of using refurbished furniture, they are in the implementation stage of a circularity concept without going through the first stages. However, if the refurbished furniture is the innovation to be adopted, then the facility managers are already in the implementation phase, but they went through the stages of adopting the idea based on the cost benefits. However, they found barriers with the final user of the products, in this case the employees of the organisation. Therefore, it can also be argued that the adoption process of the employees adopting the refurbished furniture is currently in the persuasion stage.

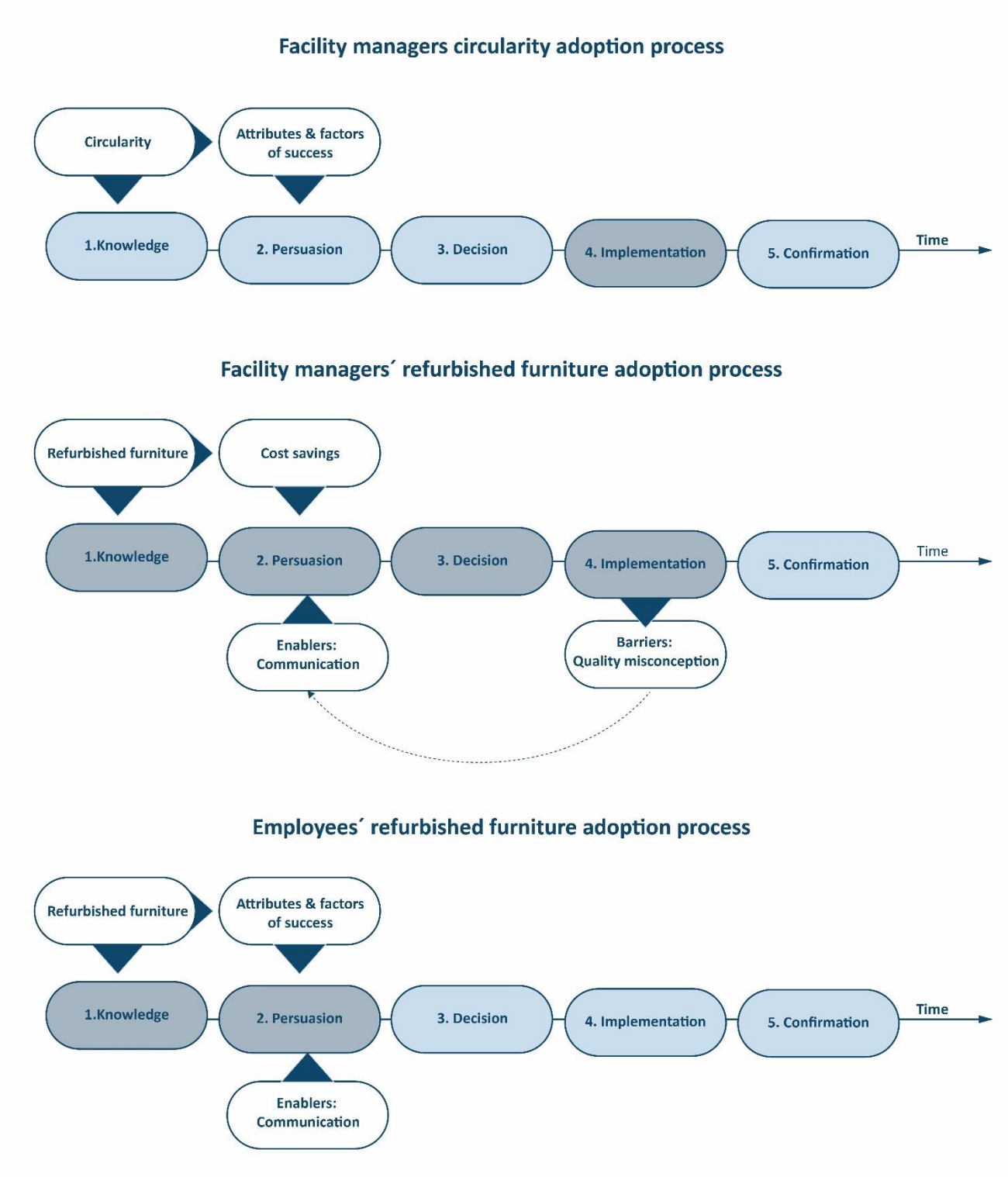

Figure 15 Adoption process based on perspectives, adapted from Rogers (1983)

Additionally, it can also be reflected on the level of 'innovativeness' (Rogers, 1983) of the members together with theory on circularity levels. Research agrees on the levels of circularity concluded by Cramer (2017) where the 10 Rs of circularity were determined and rated their level of priority from low to high (Figure 16). This study was aimed at the circularity transition in Amsterdam; therefore, since this thesis is contextualized in The Netherlands, it is highly relevant to add this filter to the research. The step of refurbish is in the middle of the ladder, neither low nor high; therefore, when reflecting on the level of innovativeness of the next adopters, it can be concluded that it is a standard approach, thus in the middle of the innovation level.

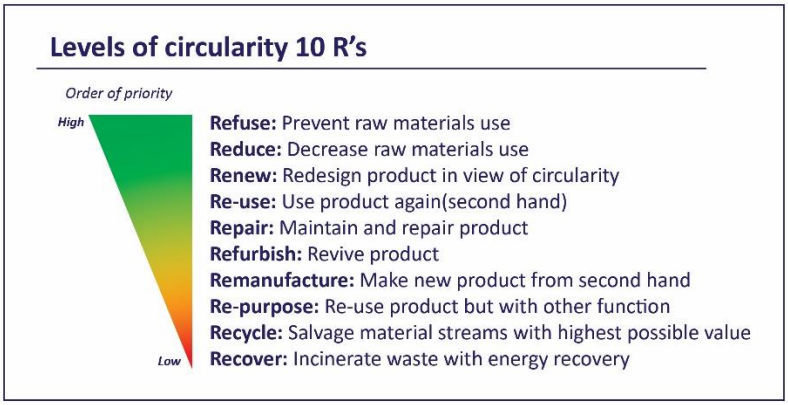

Figure 16 The levels of circularity adapted from Cramer (2017)

5.2 Circularity Adoption in Corporate Real Estate

In section 2.2 Circularity in corporate real estate, the report by Acharya et al. (2020) was introduced. It stated that to achieve the adoption of circularity strategies, they should be viewed by investors and construction clients as a business strategy and not just as waste management or a design approach. However, when reflecting on the findings of this research, it was found that the early adopters' group is focused on circularity as a design approach based on the fact that most of the mentioned strategies were realized in the design phase of the CRE, except for the maintenance plans and the reuse of coffee residue. The main motivation to choose this approach lies in the long-term plans to commit to sustainability. Nevertheless, one of the main financial motivations that were mentioned for the implementation of reusing strategies is the cost benefit of reusing. So, it can be argued that this approach could be the basis to build a business strategy in circularity adoption for this group.

Also, when discussing the research findings related to adoption in CRE, the circularity levels can be addressed. Figure 24 shows the levels of circularity in comparison with the circularity strategies that were mentioned by the interviewees (Section 4.4.1 Strategies). The highest level of circularity was found to be the re-use of elements. However, when analysing the consequences of this decision, it can be argued that the interviewees also decreased the use of raw materials, thus achieving a higher level of circularity according to Cramer (2017). Similarly, it can be discussed on the next adopter's approach. Since the findings showed that the next adopters are also focused on repair and reuse, it can be argued that they achieved a similarly high level of circularity as the early adopters. So, based on this perspective, it can be argued on the categorisation of early and next adopters. However, the foundation of this research is based on the classification by Rogers (1983), and the classification by Cramer (2017) was introduced after the data collection was completed, thus the interview questions could not be adapted to this concept.

Furthermore, when discussing on circularity adoption in CRE, it can also be argued on the enablers that were explained in literature versus the enablers that were found through the on-field research. In the case of circularity adoption, the on-field research found a strong business case, change the way of working, communication with employees, an open demand of circularity, regulations, improve price and quality assurance as the enablers mentioned by the interviewees. However, a distinction needs to be made. Some of these enablers like the communication with employees and the open demand of circularity were formulated and tested, while the strong business case, change the way of working, regulations, improve price and quality assurance were identified as enablers that could potentially facilitate circularity adoption from the perspective of the interviewees.

In section 2.3 Circularity drivers, barriers, and enablers in the built environment, the enablers for circularity adoption from literature were mentioned including a strong business case (Adams et al., 2017), enabling policies (Guerra & Leite, 2021) and an awareness-raising campaign (Adams et al., 2017), which were also mentioned by the interviewees. In this way, it can be discussed that these approaches were proposed, but not yet tested. Nevertheless, in the specific case of the strategies explained in section 2.2 Circularity in corporate real estate, these solutions target the specific enabler of a strong business case to promote circularity adoption in CRE and were tested in specific cases. Thus, these could function as examples on how to build the enabler of a strong business case.

5.3 Circularity from the Early Adopters' Perspective

The early adopters' group has been described by Rogers (1983) as having a respectable position in their social system that serve as role models for potential adopters of an innovation. In this research, this group was mapped because of their long-term plans towards circularity. However, when looking at the characteristics of the members of this group, they have a leading position in their social system. When looking at the findings, the participants of this group mentioned their desire to set the example. Plus, the next adopters mentioned that they are waiting for this group to show them the way to circularity adoption. Therefore, in this matter, the theory and the on-field research are aligned.

In the matter of drivers for circularity adoption for this group's perspective, theory and the on-field research agree on sustainable corporate image as a major driver for circularity. In theory, Kanters (2020) and Camilleri (2019) stated this driver as an approach for businesses to improve their reputation. While in the on-field research, interviewees stressed on the core business as a determining factor for circularity adoption. It was found that the reason to adopt circularity was either to compensate for the core business, to be aligned with the business vision or to respond to external demands in relation to the business. Although this relates directly to the statement on sustainable corporate image, it can be argued that while the theory did not elaborate on the topic, the on-filed research did. This results in deeper insights on how this driver can motivate and persuade CRE customers to adopt circularity.

According to the on-filed research from the early adopters' perspective, budget was considered either a driver or a barrier for circularity adoption. In some cases, the organisation had a limited budget, while others had greater budgets, which according to the interviewees allowed them the flexibility to adopt circularity. Contrary to the literature in section 2.3 Circularity drivers, barriers, and enablers in the built environment that stated that financially, cost constraints and the conservative building industry represent a major barrier for circularity adoption, budget is not always an issue from this group's perspective. However, it is important to identify how the budget is prioritized, as there was not a specific question that addressed the issue. Nevertheless, it was found (section 4.4.2 Drivers) that

there was a personal motivation within the facility managers to be sustainable that made them aware of circularity and willing to find solutions to adopt this concept.

According to the findings (section 2.3 Circularity drivers, barriers, and enablers in the built environment4.4.3 Barriers), interviewees from the early adopters group found barriers in the supply side, especially the availability of reused materials, lack of knowledge and material recovery. Literature also stated these same issues as the typical sectorial and cultural barriers. Moreover, theory and the findings agree on the regulatory barriers, especially on the lack of flexibility on building codes and regulations in the reuse of materials and construction elements due to quality and safety standards.

5.4 Circularity from the Next Adopters' Perspective

The next adopters' group was mapped within the interviewed organisations that lack a long-term plan to commit to sustainability. Also, a specific question was used to determine which adopter category they identified with. Based on their answers and the study by Carini et al. (2021), it is determined that this group is formed by three adopter categories: the early majority, the late majority, and the laggards.

Rogers (1983) characterised the early majority as leaders in their social system. However, their adoption process is longer than the early adopters. They decide to adopt an innovation before the average member of a social system. In the on-filed research, it was found that 2 out of 6 organisations considered themselves part of the early majority. It can be discussed on the characteristics of these companies. In terms of size, both are XL, and their core business are food and transportation. Just because of the size, it can be noted that they have a certain degree of influence in their social system. Moreover, they stated that they want to be part of circularity before it becomes an obligation. These two organisations stated in their interviews (02, 11) that they identify with the early majority because they also want to be leaders in the adoption even if they are not adopting it yet. On this matter, theory and the on-field research agree.

In literature, the late majority is considered by Rogers (1983) to be sceptical about innovations and often adopt them because of necessity and general pressure. However, in the on-field research, 3 out of 6 organisations identified themselves as part of the late majority. The interviewees of this group (03, 07, 09) stated that they are waiting for the early adopters to show the path to circularity. However, they are part of the organisations that are already implementing the refurbished furniture without being aware that it is a circular action. Thus, it can be questioned if this group is really part of the late majority. It can be argued that it is a personal opinion of the facility managers and because of the nature of the role and their position in the organisations, it is also a conservative answer. On the other had, this group also stated in the interviews (03, 09) that they feel a pressure to align to the government's circular vision because of their direct relation. While the international company (07) stated that their company is not yet influenced by the government, however, if there was a regulation imposed, then they would adopt circularity. Therefore, in this matter, theory and research are aligned; both agree on the general pressure as the main driver to adopt an innovation for this group.

In the on-field research, this group identified personal motivation, corporate image, core business, cost of reusing, future prevention, and incentives on loans as the main drivers to adopt circularity. In comparison with literature in section 2.3 Circularity drivers, barriers, and enablers in the built environment, most of the statements are aligned; however, the cost of reusing is not specified in literature as a driver for circularity adoption. It can be argued that this is either a new insight or that other sources of literature might have mentioned it but were not found by the researcher of this thesis. Nevertheless, it is valuable to understand how in detail the cheaper cost of the refurbishing and reusing can drive circularity adoption.

In terms of barriers to circularity adoption, through on-field research, the next adopters group found challenges with the supply of reused materials, budget allocation, financial risk, unclear cost benefits, internal awareness, accountability, and the misconception of refurbished furniture. In comparison with the literature in section 2.3 Circularity drivers, barriers, and enablers in the built environment, most of the statements are aligned, especially financially in the fact that this group is very conservative and cost constraints are a major driver to adopt circularity. Moreover, in terms of knowledge and awareness, there is a clear alignment between literature and the findings. However, the accountability that is specific to the role of facility managers was not mentioned in the literature as well as the misconception of refurbished furniture. It can be argued that since both insights are specific to the interviewee's characteristics, literature has not identified these barriers. Also, it can be discussed if additional literature might have discussed such details, but for the extent of this thesis and the literature that was considered, these insights are considered a new addition in the characterisation of the next adopters of circularity.

5.5 Next Circularity Adoption in Corporate Real Estate

Circularity adoption in corporate real estate, as found in this research, requires a change in the way of working from the supply side to the demand side of real estate. It can be argued that to achieve the next circularity adoption a transition needs to be facilitated. This can be complimented with literature on transitions management (TM). This concept often refers to the process of managing and facilitating change in a system or organization (Sondeijker et al., 2006). It attempts to induce a long-term change on a system level (Rotmans, 2005). Therefore, it can be argued that to achieve circularity adoption, this theory could be an adequate tool to foster the change.

Moreover, TM presents an approach to induce change but also to introduce an innovation in a social system (Sondeijker et al., 2006). Thus, directly related to Rogers (1983) diffusion of innovations but from newer theory and a practical approach on the steps that are necessary for this transition. According to Sondeijker et al. (2006), there is a need to change the current practices or as the interviewees said, change the way of working, to achieve sustainability in the built environment, in this case circularity as an approach and especially applied to CRE.

Furthermore, TM could be applied to foster the change, but it is necessary to determine the level and the extent of the transition. From the perspective of the interviewees, the need to change the way of working must be applied to the whole supply chain as well as the demand side. However, TM theory is often related to policy development and change at an organisational level. Therefore, in the case of the next adopters, this approach could be useful when addressing the barriers described inside the organisations such as the misconception about the quality of the refurbished furniture.

Additionally, the personal motivation of the interviewees is an important factor to consider in the next circularity adoption in CRE. If the government, an organisation, or an external consultant wants to promote the adoption of circularity within this group, personal awareness is key to promote the concept and introduce circularity as part of the standard requirements for CRE.

5.6 The role of consultants in next circularity adoption in CRE

Literature on innovation adoption stated that consultancy services often play an important role on the driver side of the process (Bessant & Rush, 1995). In the case of next circularity adoption, the consultancy services role can be discussed through the Diffusion Theory (Rogers, 1983). In relation to this theory, the consultants act as the communication channel that transmits the message of circularity to the adoption unit, in this research the CRE demand side.

In the on-field research, the CRE demand side was represented by facility managers who are Colliers clients. In one interview from the next adopters group, it was found that a major barrier in circularity adoption is the lack of concept awareness. The interviewee even stressed on the fact that the consultants never offered circularity options as part of the real estate advice, but that if the option was presented the company could have considered it. Moreover, this interviewee expressed discomfort on the fact that he lacked an overall awareness of the circularity concept. Even if this was only one interviewee that discussed this situation, it is important to understand the role of the consultants in next circularity adoption, especially in the diffusion of the message.

5.7 The role and impact of facility managers in circularity adoption in CRE

Circularity adoption in CRE was studied through the perspective of the demand side, more specifically, from the perspective of the facility managers. They represented almost all of the interviewed organisations, with the exception of one project manager who also participated in the research. Therefore, it is important to discuss on the role of facility managers and their impact in circularity adoption in corporate real estate.

The facility managers (FM) role is commonly agreed to be a support function, which manages and supports the services to meet the needs of an organisation, its core business operations and the employees (Chotipanich, 2004). As mentioned by the interviewees, their tasks vary from the daily operation to full portfolio strategies. It can be discussed that this can depend on the size of the company. Moreover, the impact of FM in the adoption of circularity can also be analysed through Brand(1995) Shearing layers concept (see figure 17).

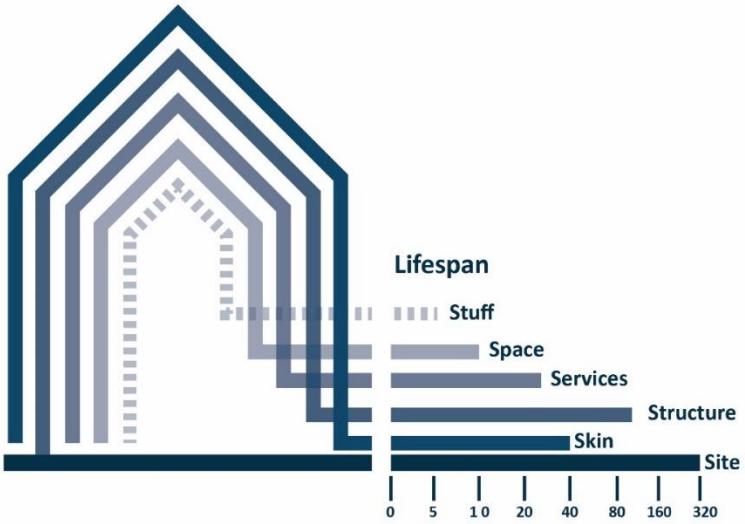

Figure 17 Shearing layers adapted from Brand (1995)

In the research, it was found that most of the circularity actions implemented by the FM, are focused on the Stuff and Space layers, specifically in the refurbishment of furniture, reuse of elements and daily operation. According to Brand (1995), the Stuff layer is supposed to be replaced up to every 5 years and the Space layer every 5 to 15 years. However, Brand explains that, in practice all layers are changed more frequently, either because of trends, outdated systems or different user's needs. It can be discussed that even if these layers are the smallest in terms of size, their impact on waste generation is high because of the frequent changes. Therefore, as the actions implemented by the FMs target the recurrent generation of waste, it can be argued that they have a high impact on circularity adoption. This is contrary to Cramer's (2017) circularity levels definition which determined that these actions have an intermediate circularity level.

PART 6.

Conclusion

6. CONCLUSION

The goal of this thesis was to answer the main question: How can the next adopters within CRE adopt circularity ambitions and solutions? To achieve this, a set of sub-questions was formulated. Consequently, a literature study and on-field research were done, followed by a discussion on the findings. In the following sections the sub-questions and the main research question will be answered based on the previously presented research.

6.1 Sub Question 1: What are the main concepts and characteristics of circularity adoption in the built environment?

The literature study in section 2. Theoretical background and framework of this thesis answered this question. It was found that the goal of circularity is to eliminate waste and pollution by considering the entire product or building life cycle (Ellen Mac Arthur Foundation, n.d.). The Ellen Mac Arthur Foundation provided the RESOLVE framework which outlines the actions to implement circularity in the built environment (Luebkeman & Fellow, 2016). The most typical circular solutions in the built environment include the reuse and recycling of construction materials, adaptable buildings, material passports and design for disassembly (Kanters, 2020; Cruz Rios et al., 2021). Moreover, the research showed a complete list of the circularity strategies that have been applied through a building's lifecycle, and section 2.2 dived deeply into specific circular approaches in CRE.

Along with the circularity concept and strategies, section 2.3 of this thesis also studied the typical barriers, drivers, and enablers of circularity in the built environment. In summary, the drivers to adopt circularity are often characterized by the desire of clients to contribute to their sustainable corporate image (Kanters, 2020; Ranta et al., 2018; Camilleri, 2019), financial incentives (Ranta et al., 2018), reduce consumption to increase cost savings (Acharya et al.,2020) and the introduction of governmental policies to reduce carbon emissions (Govindan & Hasanagic, 2018). While the typical barriers include the financial risk of circularity (Kanters, 2020), the unclear cost benefits (Cruz Rios et al.,2021), the lack of flexibility in regulations (Kanters, 2020), the material recovery (Zimman et al.,2016), the supply of reused materials (Kanters, 2020) and the general lack of awareness in the building sector (Hart et al., 2019). And the typical enablers include a clear economic case (Adams et al.,2017), new valuation techniques (Hart et al.,2019), a regulatory reform to support circularity (Cruz Rios et al.,2021) and an awareness-raising campaign (Adams et al.,2017).

Moreover, section 2.4 was dedicated to describing the role of the client, as the perspective that was the object of study in this thesis. It is defined that research on the perspective of the client places it's role on the decision-making side of construction projects and concludes that the construction clients should be made aware and persuaded about circularity adoption(Dokter et al., 2021). Additionally, to study circularity adoption from the perspective of the client as the consumer of circularity, sections 2.5 and 2.6 explain the diffusion of innovations theory by Rogers (1983), as well as the current state of circularity adoption in the European context by Carini et al. (2021). Lastly, in section 2.7 it is concluded on the adopter categories that were studied in this thesis: the early adopters and the next adopters.

6.2 Sub Question 2: Who are the next adopters of circularity and what are their characteristics?

Section 2 of this thesis concluded on the two groups that were studied in this thesis. The first group corresponds to the early adopters, while the second group is called the next adopters. The next adopters' group addresses the early majority, late majority, and the laggards. The selection criteria that determined guidelines to map the interviewed organisations, was based on the fact that the early adopters had a long-term plan to commit to sustainability, while the next adopters lacked such a plan.

In the on-field research, it was found that the next adopters of circularity are organisations that without being aware are already implementing circularity actions. Therefore, their adopter category was discussed, however, based on diffusion theory (Rogers, 1983) concepts, especially the adoption stages, it is concluded on the next adopters' category as the organisations that are either in the knowledge stage of circularity adoption, or the ones who are not yet aware of the circularity concept.

Moreover, it is concluded that the next adopters' group is characterised by Rogers (1983) adopter categories definitions of the early majority, the late majority, and the laggards. In general, this group is waiting for the early adopters to reduce uncertainty and follow their path into circularity adoption. Also, it is concluded that this group is characterised by feeling a general pressure from their context to adopt circularity in the future, they want to be ready before regulations oblige them, however, they are not taking concrete action yet.

6.3 Sub Question 3: How is circularity being adopted in CRE from the early adopters' perspective? And how do they overcome the challenges?

From the early adopters' perspective, in the on-field research, it was found that this group is adopting circularity in diverse ways, however, it was found that most of them address circularity from a design approach, especially focusing on the reuse of construction elements and materials. Also, the interviewees implemented strategies such as repair and refurbishing, design for disassembly, material passport, design for adaptability and procurement of reused materials. Consequently, the early adopters found challenges while implementing these strategies, these included for instance the lack of knowledge from the supply side, and as an answer one of the enablers that the interviewees tested was the open demand of circularity. This approach resulted in the supply side offering circular ambitions and solutions that they knew how to achieve.

On the other hand, there were other enablers or possible solutions that were found in the interviews with the early adopters' group such as a strong business case, a change in the way of working, communication, and regulations. The typical strategies that were mentioned in section 2.1, such as reuse and recycling of construction materials, adaptable buildings, material passports and design for disassembly, together with the specific approach of Acharya et al. (2020), including flexible spaces, adaptable assets, relocatable buildings, residual value, and performance procurement, set out the guidelines for circularity implementation in the built environment. However, as it was found in the on-filed research, in the analysed sample, it can be concluded that the approaches to circularity are rather limited, with the main reason being that the circularity strategies are not completely diffused and there is a possibility that the interviewees are not aware of the diverse approaches that exist.

6.4 Sub Question 4: What is the perception of circularity in CRE from the early adopters' perspective?

In this thesis, the early adopters of circularity were mapped to be a group with long-term plans to commit to sustainability. The interviewees had already implemented circularity strategies in their CRE, and to investigate on their perception, the barriers, and drivers to adopt circularity were questioned. It is concluded that as this group has a leading position in their social system, the main driver for this group is a sustainable corporate image, which is directly related to their core businesses. Moreover, this group is also driven by the personal motivation of the facility managers, who were concluded to be a key role in the implementation of circularity in CRE.

On the other hand, it is concluded that as this group is already in the implementation stage of the circularity strategies, most of the barriers were found in the supply side, especially in the availability of materials and the lack of knowledge in the designers and contractors. In consequence, as this group is in the implementation stage, it is also concluded that awareness is not a major issue since the facility managers already passed the knowledge stage, however, company-wide, there is still a knowledge barrier among the employees of the companies ergo the final users of the CRE, who are not yet aware of circularity and its benefits.

6.5 Sub Question 5: What is the perception of circularity in CRE from the Next adopters' perspective?

From the Next adopters' perspective, in the on-field research, it was found that this group is still uncertain about circularity. Most of their barriers towards circularity adoption include the financial risk of circularity, the unclear cost benefits, internal awareness, accountability, and misconception. Therefore, it is concluded that the circularity adoption of this group is still in the knowledge phase of adoption. However, since this group has already implemented some circularity actions, it is also important to look at the drivers that guided this decision. It can be concluded that the main drivers that motivate this group are the cost of the reused and refurbished products, the facility managers that have a personal motivation to commit to sustainability, the corporate image, and the prevention for the future. So, it can be concluded that from the perspective of the Next adopters, while it is still characterised by a high level of uncertainty and misconception, there are major drivers that motivate this group to adopt circularity.

6.6 Main Research Question: How can the Next adopters within CRE adopt circularity ambitions and solutions?

Next circularity adoption is focused on the Next adopters of circularity. Their perspective has been studied through the on-field research and compared to the literature in this thesis. Based on the literature by Rogers (1983) and the research done, it is confirmed that the Next adopters' group is waiting on the early adopters to reduce uncertainty and show them the path into circularity adoption. Moreover, it was found that the main drivers that motivate this group are based on the organisation's core business and the personal motivation of the facility managers. Also, in terms of barriers it was found that this group is still uncertain about circularity's benefits and attributes, but most importantly, it was found that this group is still lacking overall awareness of the circularity concept. Lastly, the diffusion of circularity is related to the role of the consultancy services and the facility managers in CRE. Therefore, once again in research, Diffusion Theory (Rogers,1983) has proven to be valid for

current adoption questions. Thus, it can be concluded that the Next adopters within CRE can adopt circularity ambitions and solutions, by including the following insights in Rogers (1983) adoption process:

1. **Knowledge:** In this stage it is necessary to increase the awareness of circularity as a built environment approach towards sustainability, which could be promoted through communication channels such as the consultancy services. Also, research has proven that personal willingness is key on de diffusion and adoption of new ideas. Thus, looking to increase circularity adoption, consultants can seize on the fact that there is a personal willingness from the facility managers to adopt circularity. Moreover, this stage also entails reviewing and evaluating the strategies that were tested by the early adopters, as well as studying how the early adopters overcame the challenges that were found and formulate possible enablers.

2. **Persuasion:** In this stage, the benefits shown by the early adopters are studied and evaluated, these benefits can include the cost-benefit of reusing and refurbishing.

3. **Decision:** In this stage, the next adopters are finally convinced about the circularity innovation.

4. **Implementation:** In this stage, the strategies that were previously tested are implemented. when this results in new barriers the adoption process goes back to the persuasion stage where new enablers are formulated.

5. **Confirmation:** If the implementation stage is considered successful based on the organisation's acceptance on the innovation, then the final stage is reached.

Figure 18 shows an overview of circularity as an innovation in the adoption process from the perspective of the next adopters.

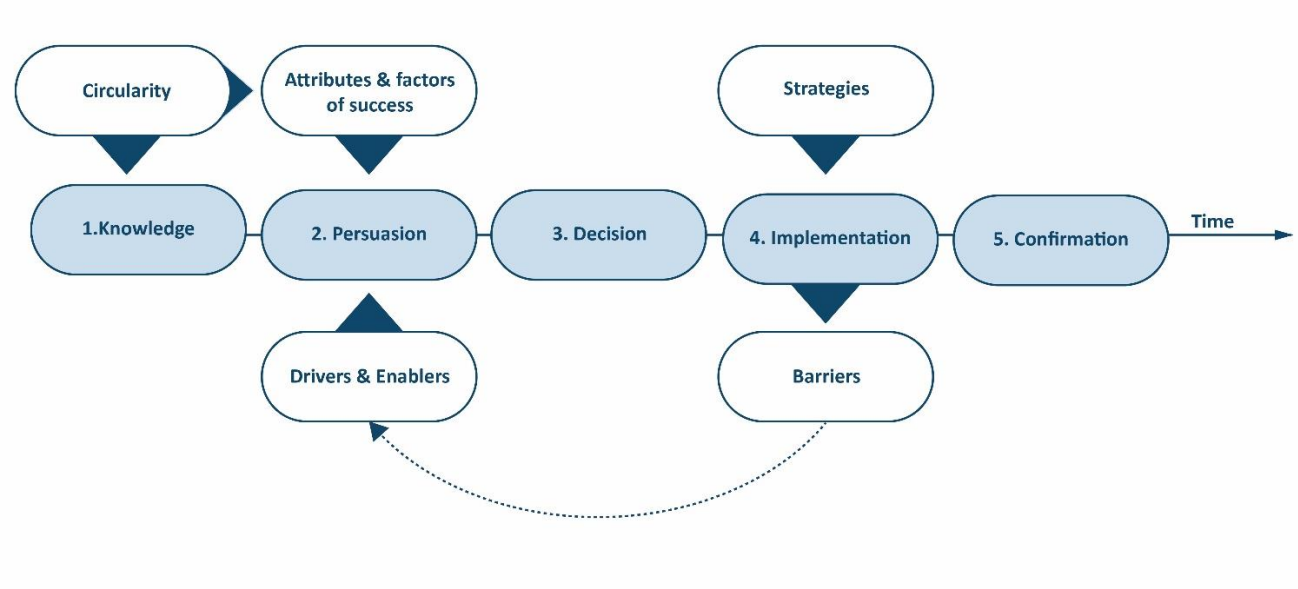

Figure 18 Circularity adoption process based on Rogers (1983)

PART 7.

Research output

7.RECOMMENDATIONS FOR NEXT CIRCURLARITY ADOPTION

The outcome of this thesis is drafted as a set of recommendations for next circularity adoption. These recommendations can be used by the intended audience of the research which includes the CRE consultants, external advisors, academics, and students interested in the topic. However, as mentioned in section 3.5, it is important to note that in this specific case, the final user of the research findings will be Colliers. As it is the company to host the research, the findings are contextualized within their client's profile, therefore the data can not be generalized, and a distinction needs to be done when applying the results to other research or contexts. Nevertheless, the recommendations that resulted from this research are as follows:

1. **Circularity awareness.** It was found that the next adopters of circularity are not at all or not completely aware of the circularity concept, its benefits, and attributes. Therefore, it is recommended that the consultants diffuse the information and make the CRE clients aware of circularity.

2. **Facility managers.** It was determined that the role of the facility managers has a high impact on circularity due to their daily operations decisions and their influence on the elements that are more frequently changed. Therefore, it is recommended to address the knowledge awareness within the facility managers and diffuse the concept of circularity.

3. **Personal motivation.** It was found that the facility managers of the interviewed companies have a personal motivation to follow sustainable innovations. Therefore, it is recommended that the consultants seize on this intrinsic motivation to offer circularity solutions to these representatives.

4. **Core business.** It was found that one of the main cultural drivers to adopt circularity is related to the core business of the organisation. This driver seeks to compensate or align to the core business as well as to respond to external pressure either direct or indirect from the government. Therefore, it is recommended that the consultants inquire on the relation of the core business with the environment, as well as the external demands in relation to circularity goals.

5. **Cost savings.** It was found that one of the main financial drivers to choose for reuse and refurbishment was because of the cost savings it generated. Therefore, it is recommended that the consultants appeal on this concrete benefit of circularity options when advising on CRE strategies.

6. **Communication.** It was found that there is a general misconception about the quality of refurbishment within the final users of CRE. However, it was counteracted with communication strategies. Therefore, it is recommended that the consultants include these strategies in the implementation of circularity strategies.

Recommendations for next circularity adoption within Colliers' clients

Application in the consulting process

Recommendations for next circularity adoption within Colliers

The graduation research was conducted with CRE clients of Colliers. Therefore, this section is dedicated to the contextualization of the research findings and recommendations within Colliers's consultancy process. Typically, the process involves six stages: 1. Vision & strategy, 2. Program of requirements, 3. Look for buildings options, 4. Design, 5. Realization and 6. Aftercare. Figure 19 Colliers's consulting process plus recommendationsFigure 19 shows this process and the moments where the recommendations can be introduced as well as the overlap with Rogers (1983) adoption stages.

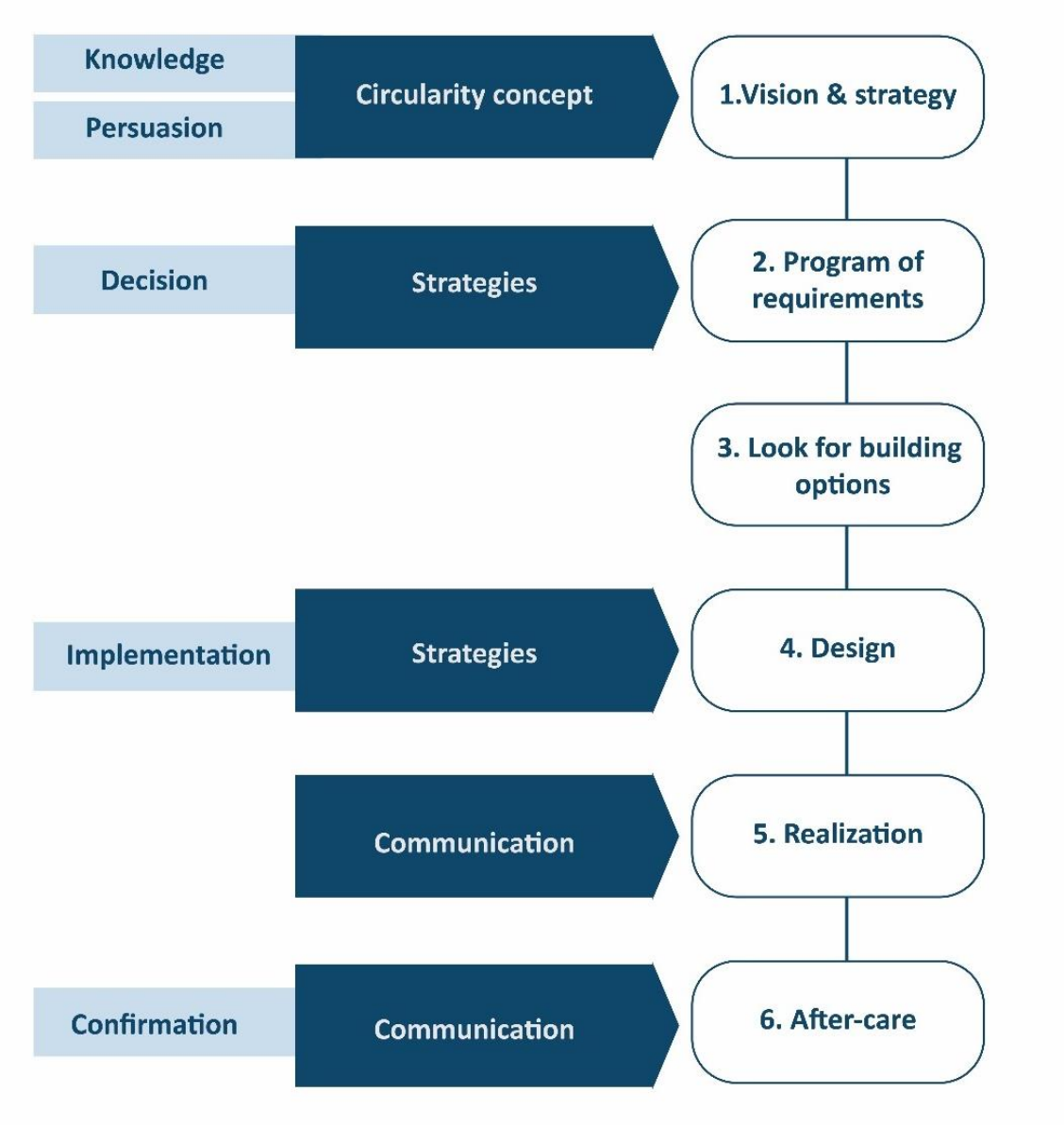

Figure 19 Colliers's consulting process plus recommendations

Vision

- This stage involves the creation of the company's vision for the CRE, which is often related to the core business. The research found that one of the main drivers to adopt circularity is related to the core business of the organisation, to either compensate or align to the core business as well as to respond to external pressure either direct or indirect from the government. Therefore, it is recommended that the consultants inquire on the relation of the core business with the environment, as well as the external demands in relation to circularity goals.

- It was found that the facility managers of the interviewed companies have a personal motivation to follow sustainable innovations. Therefore, it is recommended that the consultants seize on this intrinsic motivation to offer circularity solutions to these representatives.

- This stage is also a great opportunity to introduce new concepts and ideas. Therefore, it is recommended to introduce the concept of circularity to the clients, especially to the ones who have sustainability goals and do not have a clear idea. Also, some clients expressed a lack of knowledge on the topic, but they would like to know more. Therefore, it is recommended to introduce the concept of circularity as well as present circularity strategies, to the clients who lack sustainability goals in their vision.

- It was found that there is a general misconception about the quality of refurbishment within the final users of CRE. However, it was counteracted with communication strategies. Therefore, it is recommended that if circular actions are decided to be implemented in the CRE, the consultants could include a communication strategy addressed to the final users.

Strategy

- In this stage it is recommended to determine the circularity scope where the circularity actions will be applied. It is recommended to use Brand shearing layers as basis for the conversation with clients.

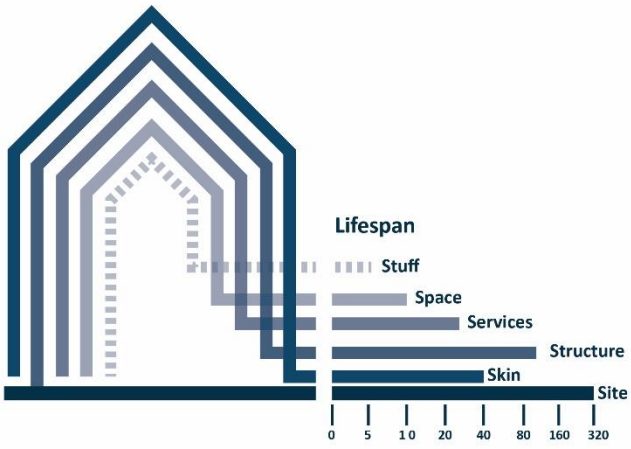

Figure 20 Brand Shearing layers

- In this stage the circularity levels that the client wants to achieve can be decided. This process can follow the circularity levels determined by Cramer (2017).

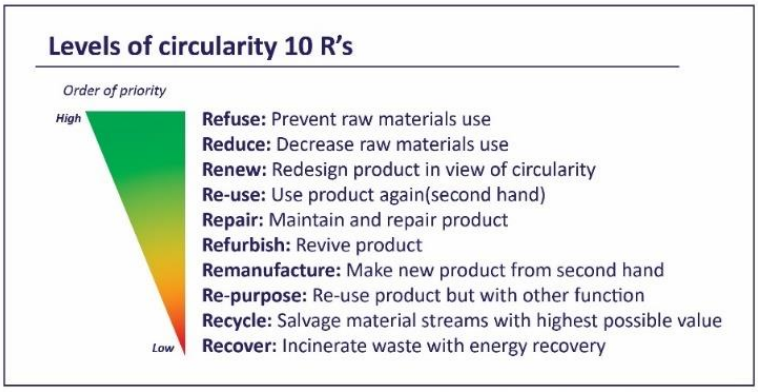

Figure 21 Adapted from Cramer (2017)

Program of requirements

- This stage involves the briefing on the CRE requirements. This is a perfect opportunity to evaluate the circularity strategies that could be implemented. Since it was found that one of the main financial drivers to choose for reuse and refurbishment was because of the cost savings it generated, it is recommended that the consultants show this benefit to the clients.

- In this stage the circularity levels that the client decided are evaluated in a feedback loop.

Design & realization

During these stages, the circularity strategies are implemented. However, since the final user will eventually use the new space, it is recommended that the communication strategies start during this phase, so that the final user is acquainted with how the CRE will look and what is the meaning of circularity in CRE. Particularly, if the furniture is going to be reused or refurbished, as mentioned before, it is recommended to pay special attention to the communication with the final user to ease the adaptation into the new CRE.

After-care

This stage typically involves the last details after the CRE is finalized, including the transition of the final users into the new space. Therefore, the communication strategies about circularity should also include this stage and help the final users to get acquainted with the new space.

PART 8.

Limitations & Further Research

8.1 Limitations

8.2 Further research

8. LIMITATIONS & FURTHER RESEARCH

8.1 Limitations

The interviews were conducted within Colliers's clients; therefore, the sample is limited to the type of organisations that hire consultancy firms for corporate real estate solutions. Also, even if the sample size of 12 organisations was considered sufficient by the researcher, this is also a limited number. These limitations affect the generalization of the findings and limit its applicability to a specific company profile.

The method of qualitative interviews limits the information that is gathered in a specific time frame, this results in a generalised conversation, leaving out details that could enrich the research results in the circularity perspective. Also, even if there was a good quorum from the participants, this research is limited by the availability of interviewees and their willingness to participate, therefore it limits the type of companies that were interviewed, only representing a specific sector of the study group.

Overall, this research is limited by its purpose, the timeframe, and the resources. Even if the research was conducted with a host company, the research is limited by the data that can be collected by one person in a specific time frame. This affects the amount of information that can be gathered in the qualitative research as well as the literature research, therefore there is a limited level of assurance that the whole literature available was considered and the findings that are considered new, can be written in literature that was not considered for this research.

8.2 Further research

This research studied the perspective of the CRE consumers from a sample that included the next adopters as one group, further research can include to study the three next adopter groups separately to provide a deeper understanding of each category and the transitions that are necessary for each group to adopt circularity in CRE. The research can also be extended through a quantitative approach where the barriers, drivers and strategies could be studied through a survey to reach a bigger sample.

Further research can focus on other perspectives as the adopters of circularity, and a series of perspectives could be merged to understand the overall adoption of circularity in the built environment. Also, this approach can be applied to research circularity adoption in other sectors. Also, further research can also be applied to other company sizes, especially medium and small. The study can also be applied to other company types and different countries and regions.

Additionally, further research could integrate the use of the levels of circularity as a basis and study perspective, guided through specific questions. Also, further research can focus on how clients prioritize their budgets, what are the KPIs for determining how to set up and use the budget, to determine the role of circularity in the budgets.

Lastly, since the perspective of the demand side has been found to be significantly less studied than the supply side and defined as the research gap for this thesis, there is an intrinsic need for further research on this perspective for several reasons. First, to improve the solutions offered by the supply side, second to improve the research given from the consultancy services to the demand side of CRE and third to achieve an overall adoption of circularity and contribute to the greater environmental well-being.

PART 9.

Reflection

9. REFLECTION

Over the course of the last year, I worked on this thesis with the aim to answer the question: How can the next adopters within CRE adopt circularity ambitions and solutions? This research question connects directly to corporate real estate management in general and especially to the REM course in the master track Management in the Built Environment. Moreover, the term of circularity was expanded and studied in detail, it complemented the master courses as the topic had been mentioned but not as closely as in the thesis research.

As the thesis investigated the perspective of a specific actor in the built environment, topics like transitions management and change management were discussed. However, even if these subjects are part of management studies, they are also studied from the social sciences perspective, thus it can be reflected that there is no direct relation with the program. Nevertheless, in my personal study journey I decided on taking an elective on leadership and strategic management where these topics were introduced, so I could connect this knowledge in the discussion phase.

Furthermore, one of my main study target was to expand and enrich the knowledge acquired through the master track, and focus on the study of circularity. Therefore, when reflecting on this topic, in my personal opinion, the personal research journey was a success, and considerable knowledge and information was acquired through this process.

The outcome of this thesis is a set of recommendations for circularity adoption in CRE. These recommendations were a direct result of the on-field research plus the literature research. However, when the qualitative interviews were coded and analysed, a second review of literature was necessary, and some terms and theories needed to be included, especially in the discussion section.

The approach of qualitative interviews was proven to be the most suitable method to understand the perspective of a specific actor. It showed several layers of detail, including the personal motivations of the facility managers. Even if it is expected that people have personal motivations, if the chosen method was quantitative such as a survey, these details would be left out. Therefore, for the purpose and extend of this thesis, the qualitative approach was appropriate. Nevertheless, when reflecting on the outcome, to be able to generalize the results, the sample could be bigger and more varied, and a quantitative method such as a questionnaire could be used as a complement to measure the most influential barriers and drivers in a bigger group.

During the data collection, sensitive opinions were released by some interviewees, therefore, I recognised possible ethical considerations that should be dealt with. In this case, the names of the interviewees and the companies are kept confidential to the research. However, as they are clients of the graduation company, they know the identities. Nevertheless, this issue was discussed with the company mentor and the concern was dismissed since they were already aware of these sensitive opinions.

Diffusion Theory (Rogers, 1983) has been used and applied and tested in plenty of research and theories. Additionally, the research approach of this thesis is explained and contextualized in the recent research by Carini et al. (2021). Therefore, by applying these two theories together with the qualitative research, the transferability of this research can be assured. Moreover, the research approach can be applied to any kind of innovation to be introduced in a social system.

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APPENDIX

I. Interview protocol

INTERVIEW PROTOCOL

Company: _____

Interviewee (Title and Name): _____

Interviewer: _____

Interview structure: In bold the topic and sub-question that will be addressed is presented. The interview questions are presented after the bullet points. And the possible answers that need to be checked by the interviewee are distinguished by a check mark. The interview includes the following sections:

A. **Background/context. SQ2**
B. **Early adopters' perspective. SQ4**
C. **Strategies. SQ3**
D. **Next adopters' perspective SQ5.**
E. **Adopter category**

Introduction

Hello, nice to meet you, first I will introduce myself so you know who is interviewing you. My name is Nicole, I am from Costa Rica, so this is the reason why we are having this interview in English and not in Dutch. I am an architect, I previously worked in real estate development for a period of five years, and almost two years ago I came to The Netherlands to do the Master track MBE in TUDelft, and now as part of my graduation thesis, I'm working with Colliers to conduct the research within the occupier services team.

To facilitate note-taking, I would like to record our conversation today. For your information, only researchers on the project will be privy to the recordings which will be eventually destroyed after they are transcribed. In addition, you must sign a consent form conceived to meet our human subject requirements. Please forward it to me if you haven't already done so. Essentially, this document states that: (1) all information will be held confidential, (2) your participation is voluntary and you may stop at any time if you feel uncomfortable, and (3) it is not intended to inflict any harm. Thank you for agreeing to participate. So, if you agree, let's start.

A. Background/context. SQ2. Who are the next adopters of circularity? And what are their characteristics?

- Can you please introduce yourself?
- Can you tell me about your role in company X? (What do you do?)
- Have you ever heard of the term circularity or the circular economy?
- If yes, did you know circularity can be applied to buildings?
- Does your company have a circularity ambition/strategy planned? If yes, since when?
- Does your company have a circularity ambition/strategy planned for the next:
  - 12 months?
  - 5 years?
  - for 2030?
- If yes, go to section B.
- If no, go to section D.

B. Early Adopters. SQ4. What is the perception of circularity in CRE from the early adopters' perspective?

- In your office buildings, what kind of circularity measures does your company ask for?
- What is your motivation to ask for circularity?
- What are the challenges?
  - ✓ Financial
  - ✓ Awareness
  - ✓ In the process
  - ✓ Regulations

C. The strategies. SQ3. How is circularity being adopted in CRE from the early adopters' perspective? And how do they overcome the challenges?

- The case of building X presented a very interesting circularity ambition, can you tell me about it? What did you do?
- What motivated this interest in circularity?
  - ✓ Financial
  - ✓ Awareness
  - ✓ Regulations
  - ✓ Sustainable corporate image
  - ✓ Other:
- In relation to the initial circularity ambition, how does the final product relates to it?
- Can you tell me about the challenges that you found to achieve the circularity goal?
  - ✓ Financial
  - ✓ Awareness
  - ✓ In the process
  - ✓ Regulations
- Did you overcome these challenges? How?
- Now that the project is completed, what would you do differently? (Possible enablers)
- What are the main takeaways from the project? What are the lessons learned for future circularity projects?

D. Next adopters. SQ5. What is the perception of circularity in CRE from the next adopters' perspective? (B&D)

- In your office buildings, does your company ask for any kind of sustainable measures? If yes, what kind of measures?
- How do you consider circularity could be incorporated into your office buildings?
- What is your opinion on the financial costs of circularity?
- How do national regulations affect the way you choose your office buildings?
- What could motivate your company to ask for circularity in their office buildings?
  - ✓ Awareness
  - ✓ Sustainable corporate image
  - ✓ Financial
  - ✓ Regulations
  - ✓ General pressure

C. Adopter categories: Can you indicate where is your company located in the adopters categories? (Show Diagram)