

Real estate developers as service providers

P2 Report

Imardo de Blok
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“The host, planet earth, sets the table; not the guests.

The guest has to comply with the given rules.

Our being on earth is temporarily, and therefore we are guests.

Moreover, everything on earth is temporarily: People, animals, trees, cars, chairs, buildings.

Nothing is permanent, except for the consequences of temporary things.”

After: Thomas Rau, CEO of Turntoo

Foreword

Motivation & Vision

In the spring semester of 2014, I graduated from my HBO studies into architectural engineering with a thesis about the Circular Economy. The relating research project was about the implementation of a circular business model into an adaptive re-use project towards a residential function (Hereijgers & De Blok, 2014). Because I graduated from a studies into architectural engineering, the focus of this graduation thesis was on adaptivity, flexibility and the disconnection of the different 'construction layers' of Brand (1995). During this graduation my enthusiasm and interest in the Circular Economy grew.

However, in this thesis the organizational, managerial and financial aspects that are involved in the Circular Economy were barely discussed. It turned out that these organizational aspects formed the biggest obstruction for organizations in the real estate sector to shift towards a Circular Economy. Which is the root cause of the slow implementation of circular business principles in the real estate sector.

Therefore I decided to start a research project with the general motivation of making the circular economy applicable to the real world while bringing it to a 'next level'. This created an opportunity for a graduation research in the MBE-mastertrack.

In the meanwhile I came into contact with OVG Real Estate (OVG) and got familiarized with their new business strategies. An user-cantered approach is a key element in this strategy, hereby OVG starts to acts a service provider.

The role of the service provider is also very important in circular real estate development projects. Therefore, conducting a graduation internship at OVG provided me with the opportunity to (1) conduct a research into Circular Economy, (2) help to build on the new strategy of OVG and (3) conducting an internship at the leading real estate development company in The Netherlands.

About the future

As mentioned before, I think that the Circular Economy has a high future potential for the real estate industry. Next to this, the potential of servitization of real estate and other new business models is big. Therefore I see it as a 'competitive advantage' for my career to obtain knowledge and insight in these fields.

Objectives & targets

Parallel to this research project, I will conduct a graduation internship at OVG Real Estate. This real estate technology company is known of being innovative, out of the box and entrepreneurial. Conducting an internship at this company provides me with the opportunity to develop my personal skills within OVG's mind-set and present my capabilities and competencies.

At last, the underlying aim of this graduation research project is obviously to graduate from the Master MBE. My personal goal is to graduate 'Cum Laude', this implies I have to graduate in January 2018 with an end-result higher than 8,0.

I hope you enjoy reading this report!

*Imardo de Blok
Delft, June 2017*

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1. Introduction

This chapter functions as an introduction for the research proposal. In this chapter, the research topic is introduced and discussed briefly. Hereafter the problem description is discussed from different perspectives, which provides simultaneously the research relevance from these perspectives. The research aim is presented in the conclusion at the end of this chapter.

1.1. Research topic

In the past years, much attention was given by scholars, governmental bodies, practitioners and companies to the implementation of the Circular Economy in the real estate sector. One of the aims of implementing the Circular Economy is to “replace the ‘end of life’ concept of the linear economy [...] and aim for the elimination of waste through the superior design of materials, products systems, and, within this, business models” (Ellen MacArthur Foundation, 2013b, p. 7). This concept stands out from many other sustainable concepts because of the addition of an economic model.

Essential in this economic model is the idea of product services, hereby the ownership of materials stays with the suppliers of the product. This means that suppliers do not sell products but lease them to consumers in the form of user rights. This provides an incentive for suppliers to optimize the design of their products in such a way that the quality and value of the raw materials remain in their original value. This will guarantee the so-called ‘closed loops’ (Ellen MacArthur Foundation, 2013b; Prins, Mohammadi, & Slob, 2015; Rau & Oberhuber, 2016).

The manage system behinds the servitization of products are called ‘Product-Service-Systems’ (PSS), these systems are “a marketable set of products and services capable of jointly fulfilling a user’s need” (Goedkoop, Van Halen, Te Riele, & Rommens, 1999). In order to come to such a system, the current roles and responsibilities of all the involved actors in the supply chain will change. In this research, a servitised real estate sector is explored while focussing on the role of the ‘focal organization’ in a Product-Service-System, which is the service provider.

1.2. Relevance & problem description

1.2.1. Societal relevance

The Dutch government launched in September 2016 a new government-wide program which focusses on the development of a Circular Economy (CE). Main goal of this program is the transformation of the current Dutch economy into a circular one before the year of 2050 (Ministerie I&M en EZ, 2016). The real estate sector is responsible for one third of the total global energy use, uses 40% to 50% of all the raw materials every year and produces 40% of solid waste streams (Antink, Carrigan, Bonneti, & Westaway, 2014). Since currently the real estate developer has a big influence on the organization of real estate projects, this organization has a big influence on the sustainable performance of the real estate sector. A shift in the way the real estate developer manages, coordinates and organizes their projects could therefore have a big positive impact on the total global energy use, raw materials detraction and waste streams.

In the meanwhile, several public parties (e.g. the Municipality of Amsterdam) try to push the implement of the Circular Economy and other sustainable developments by introducing so called ‘urban living

labs' (Heurkens, 2017; Steen & Van Bueren, 2016). These living labs are “user-centered, open innovation ecosystems based on a systematic user co-creation approach in public-private-people-partnerships (4Ps)” (Steen & Van Bueren, 2016, p. 12). Hereby local planning authorities use a facilitating role to support private initiatives (Heurkens, 2016; Steen & Van Bueren, 2016). Until now these urban living labs did not gain much momentum because the private parties have difficulties to cope with the implementation of circular business models in their organizations.

1.2.2. Scientific relevance

Although the willingness to implement circular business models is present under many private parties in the real estate sector, not many building projects could be typified as ‘circular’. The biggest obstacles for the real estate industry to shift towards a Circular Economy can be found at the organizational level, around issues concerning responsibilities, liabilities and ownership. This because there is an ongoing discussion between the market parties about the occurring shift in responsibilities (Kazemi, 2016; Kok, Wurpel, & Ten Wolde, 2013).

In order to overcome these organizational barriers, a paradigm shift has to take place. This in the form of system optimization, new production processes, new ownership relations, networks and chains. Moreover, the complexity of the development processes will increase while the need of different parties working together rises (Prins et al., 2015; Van den Brink, 2016). Therefore a building that truly fits within the Circular Economy requires “[...] a systematic approach and will need new forms of cooperation among multiple actors operating in different parts of the supply chain [...]” (Kazemi, 2016; Prins et al., 2015, p. 455). The shift towards a Circular Economy therefore implies an inter-organizational collaboration challenge (Van Staveren, 2016), whereby existing parties get new roles and new organisations will participate in the real estate development process. But since there is discussion and ambiguity among market parties, these parties do not succeed in delivering circular real estate development projects.

1.2.3. Sectoral relevance

The service provider plays an important role in the shift towards a circular real estate sector because this organization is the central ‘spider in the web’ that should align demands of the clients with services provided by the service suppliers (De Grauw, 2015). In the interviews held by Van den Brink (2016) it was said that developers and contractors see themselves as the new service provider since they are already the coordinating and assembling party within the industry. In current real estate development processes the real estate developer is therefore already the ‘spider in the web’. Because they have already obtained the needed competences it can be hypothesized that real estate developers can change their role into service provider (Nozeman et al., 2008; Van den Brink, 2016). However, a research gap exist how to successfully implement PSS business models, this because the PSS literature has not discussed business models extensively (Reim, Parida, & Örtqvist, 2015).

Real estate developers themselves are willing to innovate and change towards service providers. Example of this is OVG Real Estate, which by introducing a new strategy opts for a more user-centred approach¹. However, since other actors are not willing or capable to change their role, the real estate developer is hindered by changing its business model towards a PSS-business model.

When shifting towards a PSS, suppliers remain ownership of their products and keep their responsibility to maintain, operate and re-cycle them. However, currently these suppliers are not

¹ OVG Real Estate (2017) “The guide” – A look into our new way of working [under embargo]

willing to take their responsibility over their products and are therefore not willing to shift towards a servitised real estate sector.

The lack of innovation at the side of the suppliers is also caused by the fact that financial institutions such as investors or banks do not want to accept the concept of real estate as a service. In A CE, the responsibility and ownership of products remain at the side of the supplier. Therefore suppliers need more equity to keep supplying products, this equity should be provided by investors but they do not accept real estate as a service.

1.2.4. Relevance for the graduation company

In the different business models developed by Van den Brink (2016) it is assumed that the roles of the main-contractor and developer will disappear when a consortium is formed to realize circular real estate development projects. Currently, these parties play a central role within the real estate development process and it is highly probable that these parties do not want to forfeit their positions in the real estate industry. In order to keep up with increasing market demands developers should change their business models and corporate culture. This also makes them more stronger in (keeping) their leading role developments (Buskens & Heurkens, 2016). Therefore real estate developers should find a way to provide incentives for other actors to enable and incentivize change.

In their new strategy, OVG Real Estate sets this trends and transforms their business model “From a time-consuming client-driven process to a scalable user-cantered product”². Hereby, products and processes will be standardized as much as possible and collaborations with key players will be established to standardize products. This relates closely to the implications of offering service products in PSSs. The supply chain management literature suggests that when the real estate sector will implement integrated service models, supply chain integration will take place and integrated product concepts will be developed (De Ridder & Vrijhoef, 2005; Vrijhoef, 2011).

1.3. Conclusion

There is a broad consensus among scientists, governmental bodies and private institutions that the current linear economy cannot sustain anymore and a circular approach should be adopted. Therefore the urge for the real estate sector to transform towards a Circular Economy is huge.

Real estate developers are, from an organizational perspective, the spiders in the web in the real estate development process. Since the current role of the real estate developers is quite similar to the role of the service provider in the real estate sector it is likely that real estate developers will become service providers in the Circular Economy. Several real estate developers are willing to change their role and become service providers, but are currently hampered because other actors are not willing or capable to change their role.

Therefore the aim of this research project is to: Explore possible instruments and means that could be used by real estate developers (1) to incentive suppliers to accept their new role and responsibilities and (2) to convince financiers to invest in servitised real estate projects.

² OVG Real Estate (2017) “The guide” – A look into our new way of working [under embargo]

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2. Background

The aim of this chapter is to introduce the main concepts and root causes that serve as a starting point for this research project. This is done by presenting briefly the main problems of the current linear economy in the next section and making a bridge to 'products as services' in the second section. Hereafter the problem statement, research objective and related research questions are presented. These form the input for the Methodologies, which are presented in Chapter 0.

2.1. Problems of the linear economy

Currently, our industrialized world – of which the real estate sector is part of - follows a so-called 'linear model' of consumption, hereby a 'take-make-waste' pattern can be recognized. In this model, companies harvest and extract materials, use them to manufacture a product and sell those products to consumers. When these consumers no longer need these products, they discard them and put them into waste. (Ellen MacArthur Foundation, 2013b).

In the meanwhile, manufacturing companies use these consumption patterns to make profit. In general, this leads to high consumption patterns, this is in essence not a problem. However, the manufacturers of products design their products according to a linear model. The general problem with the linear economy is that it leads to a scarcity of resources in the longer term (Ellen MacArthur Foundation, 2013a; Rau & Oberhuber, 2016). According to Ellen MacArthur Foundation (2013b) these resource losses are created in four ways:

- Waste production in the supply chain
- End-of-life waste
- Energy use
- Erosion of ecosystem services

2.1.1. Sustainability is not enough

In the last decades, there was a huge focus on sustainability in general. However, sustainability is traditionally based on concepts like eco-effectiveness and eco-efficiency. Hereby things are doing less worse, this concept aims at the reduction in resource while increasing economic and social well-being (Ghisellini, Cialani, & Ulgiati, 2016). This means diminishing the impact and reducing toxic emissions. This strategy still harms the environment and only postpones the total depletion of resources. So, it does not eliminate the root causes for unsustainable practices. Therefore sustainability is sometimes referred to as: doing things less bad, instead of doing things good.

According to Rau and Oberhuber (2016) the root cause of the existence of unsustainable practices in the linear economy is a so-called 'split incentive'. This split incentive is that manufacturers take full advantage of the linear economy and the way the current supply chain is designed, while the consequences – being creating waste and related costs - are being 'outsourced' towards the client and towards society in the form of resource depletion, toxic waste and climate change.

To eliminate this split incentive, the manufacturer should become responsible for its actions and ways of doing business. When a manufacturer becomes responsible for the way this actor handles, he will be forced to think in early stages of design how to design the complete lifecycle of its materials. A way to do this is by supplying products based on the service they deliver. These Product-Service-Systems are there essential in order to shift away from our current linear way of living.

Product-Service-System are an essential mean to implement the Circular Economy (CE) in the real estate sector. The concept of Circular Economy is introduced, defined and explained in Appendix A: Circular Economy.

2.2. Products as services

Essential in the CE concept is the idea of product services, whereby the ownership of materials stays with the suppliers of the product (Stahel, 2006). The theory of the CE is that the producers do not sell products but lease them to consumers in the form of user rights. The underlying sustainable aim of this leasing system is that ownership remains with the supplier of the materials. Because the ownership remains at the supplier, this organization remains responsible for the used materials. This responsibility also includes the end-of-life processing of the supplied materials. Because the suppliers remain responsible for their products, and the components out of which these products consist, it is in their interest to optimize the design in such a way that the quality and value of the raw materials remain in their original value. This will guarantee the so called 'closed loops' (Ellen MacArthur Foundation, 2013b; Rau & Oberhuber, 2016; Van den Brink, 2016).

The concept of a service society was introduced by Walter Stahel in 1989, he advocated a service society, whereby the value of utilization is at the heart of economy. This advocates a performance driven orientation where the consumer pays for utilisation of a product. The objective of this functional economy is to "create the highest possible use value for the longest possible time while consuming as few material resources and energy as possible" (Mont, 2002, p. 238).

Walter Stahel (2008) summarized the main ideas of selling of performances instead of selling of products as follows:

- The object of sale is the performance and not the product itself, the customer satisfaction is the end-result.
- Liability of the quality of the overall performance remains at the seller [the service provider or service supplier, red.]
- Payment is done when the performance is delivered and is based on the quality of the delivered service (no fun no money), and not at the moment when products are transferred.
- Service has to be provided in situ, instead of produced centrally.
- The property rights and related liability remains at the service provider and are not transferred to the buyer.
- Customer service is used as marketing strategy, instead of using publicity and sponsoring.
- Value is delivered over the long-term utilization period instead of short-term exchange value at the point of sale.

(Stahel, 2008)

2.2.1. Product-Service-Systems

In order to deliver this service, a service-agreement must be established between the consumer and the service supplier. The combination of several services together form a building, that can be seen as a Product-Service-System. According to Goedkoop et al. (1999) a Product-Service-System is "a marketable set of products and services capable of jointly fulfilling a user's need". Hereby it is necessary that the system is designed in such a way that it provide clients / users with a particular result or function. Hereby Aurich, Fuchs, and Wagenknecht (2006) mention that "the manufacturing service enterprise [i.e. the service supplier] no longer distinguishes between products and services but rather provides its customers with highly individualized solutions. This is also supported by the definition of the Product-Service-Systems by Reim et al. (2015), they define this system as:

“Products-service-systems are longitudinal relational processes, based on the principles of circular economy, during which products and performances are integrated, whereby the product is not a goal but a subordinate to the performance and service that are aimed at meeting end-user’s evolving needs over time (in De Grauw, 2015, p.58)”.

At a glance, this has some consequences for involved stakeholders. In the perspective of a consumer, this means that a shift from buying products to buying services and solution according to their needs. This requires a higher level of customer involvement for producers and service providers. Next to this, it means that producers and service providers receive a higher degree of responsibility for the product’s full life cycle, including the design of the closed-loop system (Mont, 2002; Selviaridis & Wynstra, 2015). These consequences will be explained further in Chapter 7.

2.2.2. Real estate as a service

The real estate industry should offer products that make it possible for supplying parties to offer a performance or a service towards the customer. Since the owner will pay for this product, the service provided with it should yield a certain degree of utility (i.e. a performance) for the user. Hereby De Grauw (2015) defines performances as:

“A performance is an agreed upon action of performing that results in an output, utility, goal, function, or commitment whereby the product is not a goal in itself, but enabling the performance. Secondly, the service is mainly a non-physical action or operation whereby the performance is optimized over time”.

Van den Brink (2016) combined this definition with the definition of buildings given by Prins (1992). A building within the circular economy hereby becomes:

“A collection of products that together form an entity that can be described as a building. A building is as such a collection of interrelated products at different scale levels” (Van den Brink, 2016, p. 12).

A collection of products forms the building, which delivers a performance and a subsequent service to the user(s) of this building. Hereby products become service products and because a building is a collection of interrelated products a building becomes a service.

2.2.3. Product-Service-Systems in the real estate sector

The performance approach of the real estate sector is defined quite well by Straub (2009, in Selviaridis & Wynstra, 2015, p.3514). Here, it is said that the performance-approach of real estate is “[...] the practice of thinking and working in terms of ends rather than means. It is concerned with what a building is required to do and not with prescribing how it is to be constructed”. This implies a new way of working and a paradigm shift in the real estate sector. Reim et al. (2015) categorized tactics for companies to implement PSS business models, these categories are (1) contracts, (2) networks, (3) sustainability, (4) product and service design and (5) marketing. These business tactics all have in a certain way influence on the organizational system and business models in the real estate sector. These relations are presented in a Conceptual Framework, which is described in the next section.

2.3. Organizational system

When the real estate sector shifts towards a CE, the relations, roles and responsibilities within this sector and related project organizations will change. A way to represent these relationships is the use of a so-called Conceptual Steering Model. This model is developed by De Leeuw (2002) and also used in the dissertation of Heurkens (2012). This model represents different aggregation levels of organization structures, formal and informal relationships and roles between different actors. In order to frame this research, this model will be used to analyse and describe different relations. The Conceptual Steering Model therefore functions as an analytical model in this research, this model will be further introduced in Chapter 4: Theories.

2.4. Conceptual framework

The conceptual framework of this research is presented in figure 1. According to Miles and Huberman (1994, p. 18) a conceptual model “explains, either graphically or in narrative form, the main things to be studied and the presumed relationships among them”. The setup and relationships are explained below.

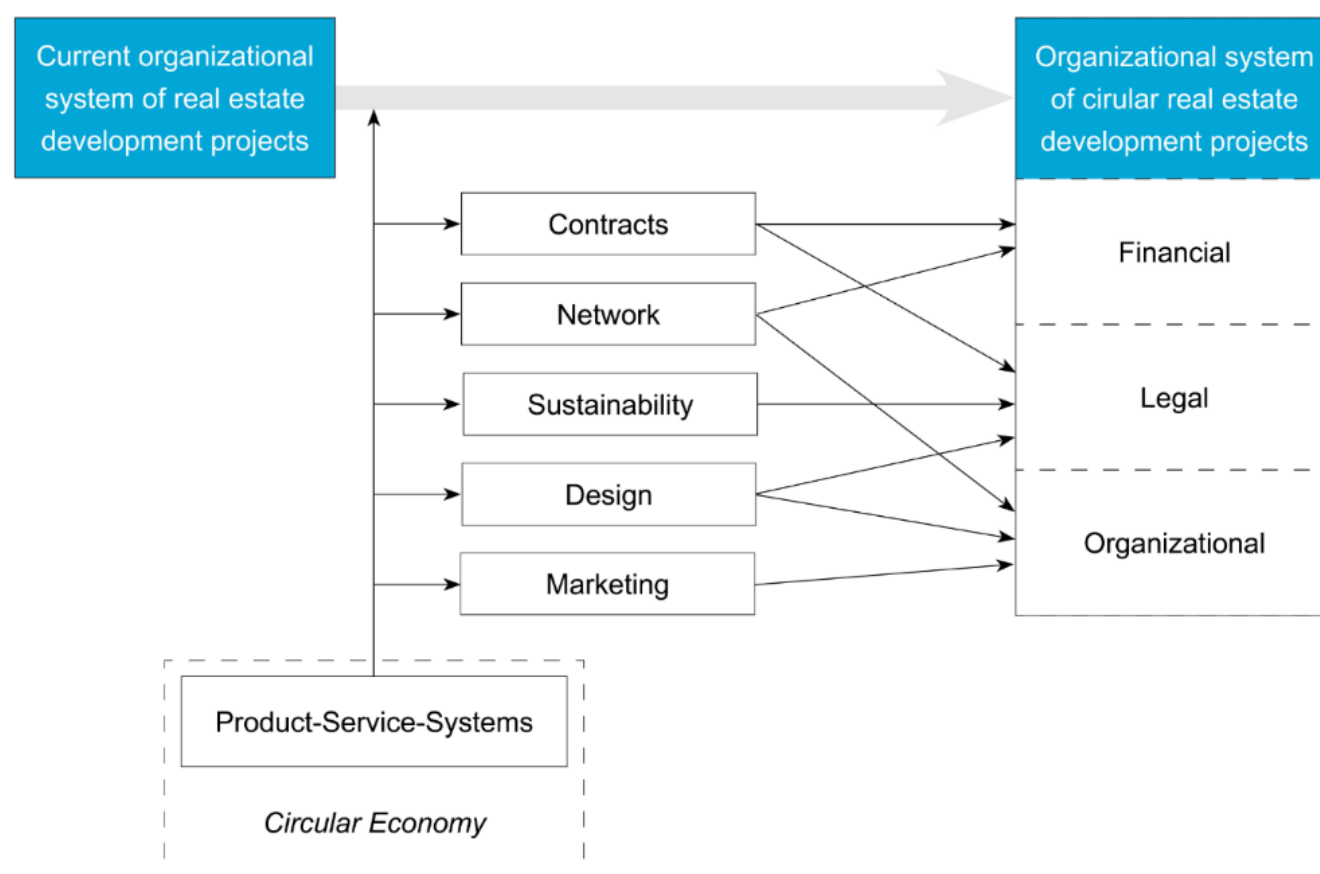


Figure 1: Conceptual framework (own ill.)

Current organizational system → Organizational system of circular RED projects

This research project is embedded in the presumed transition of the current real estate sector towards a real estate sector based on the principles Product-Service-Systems within the Circular Economy. As will be explained in chapter 4, this research takes a management approach and focusses on the organizational system of real estate development projects. Hereby the transition of the current organizational system towards an organization system that fits in a Circular Economy is directed by the implementation of Product-Service Systems.

Circular Economy → Product Service Systems

The concept of Circular Economy is nowadays a very broad definition and there is no common agreement on the definition of it. Therefore the implementation of the Circular Economy in the real estate sector can be seen from different perspectives. In this research, the focus of the implementation of the Circular Economy lies on the implementation of Product-Service-Systems in the real estate sector.

Product-Service-Systems → Contract, Network, Sustainability, Design, Marketing

As described in section 2.2.3 the tactics companies could use to implement Product-Service-Systems in their business model, could be categorized into five tactics. These tactics are categorized by Reim et al. (2015) into (1) contracts, (2) marketing, (3) networks, (4) product and service design and (5) sustainability operational practices.

Organizational system → Financial, Legal & Organizational aspects

The organizational system of real estate development projects could be described by categorizing the project into Financial, Legal and Organizational aspects (De Leeuw, 2002; Heurkens, 2012), see section 4.3,. The Organizational aspects are specified into Tasks & Responsibilities, Financial aspects into Risks & Revenues and Legal aspects into Requirements & Rules.

Contracts → Financial & Legal

As said before, key aspects of contracts are (1) Responsibility and terms of agreement, (2) Formalization and complexity and (3) Risk level. By defining these three aspects, it can be presumed that the Financial and Legal aspects of the organizational system are defined. For example, the terms of agreement directly relate to the requirements the service products must comply to. Secondly, the defined risk level relates to the Risks & Revenues of the Financial aspects.

Network → Financial & Organizational

The key aspects of the network tactic are: (1) Type of partners, (2) Type of relationships and (3) Sharing and coordinating activities. It can be presumed that these three key aspects influence the Financial and Legal aspects of the organizational system. For example, the type of partnerships and the way these relations are shaped relate to the division of tasks and responsibilities in the organizational system of a project organization. Next to this, sharing and coordinating of activities relate to the division of business and therefore to the division of revenue streams.

Sustainability → Legal

Sustainability refers to the key aspects of (1) Improved resource utilization and the (2) Extent of innovation. Hereby sustainability is seen as a core requirement in the behaviour of actors in the real estate development process. Because of this, sustainability refers to the legal aspects of the organizational system.

Product and service design → Legal & Organizational

Functionality and Customization are the two key aspects of the [product and service] design of PSSs. Customization is presumed to influence the level of consumer involvement in the project organization, therefore customization influences the organizational aspect within the organizational system. Next to this, the Functionality of a service is predetermined by the consumer in the user agreement. Therefore the Functionality of the service has a relationship with the Legal aspects of the organizational system.

Marketing → Organizational

When implementing new Marketing tactics, organizations should focus on the (1) Communication of value, (2) Extent of customer [consumer, red.] interaction and (3) Customer [consumer, red.] and market insights. This changes the role of the consumer in the real estate development process and pushes actors in the project organization to collaborate and design differently. Therefore the Marketing tactics influences the Organizational aspects within the organizational system mostly.

2.5. Problem statement

Based upon the provided background in the former section, the next problem statement is formulated:

The shift towards the Circular Economy by implementing Product-Service-Systems in the real estate sector is not taking place at the moment. Real estate developers want to innovate and become service providers, but are blocked by organizational issues of suppliers and financiers concerning responsibilities, liabilities and ownership.

Hereby suppliers should accept new tasks and responsibilities but are not able to accept these and / or don't know how to behave and collaborate.

And secondly, financiers have to be convinced of the added value of servitised real estate projects.

2.6. Research objective

Based upon the defined problem statement, the following research objective is formulated:

Explore possible instruments and means that could be used by real estate developers (1) to incentive suppliers to accept their new role and responsibilities and (2) to convince financiers to invest in servitised real estate projects.

2.7. Research questions

2.7.1. Main question

What is the role of a circular service provider within a real estate development project? And how could real estate developers incentive actors to collaboratively deliver circular real estate development projects?

Actor:	Circular service providers
Object:	Real estate development projects
Subject:	Product-Service-Systems in the Circular Economy

2.7.2. Sub questions

1. What is known about service provision in the real estate sector?
2. What does the organizational system of [circular] real estate development projects look like?
3. How are organizations collaborating and interacting currently in circular real estate development projects?
4. What lessons can current circular real estate development projects learn from the proposed theoretical framework?
5. What instruments and means could real estate developers use to incentive actors to deliver circular services?

2.8. Conclusion

The current linear economy is no longer durable anymore, therefore a full transition towards a Circular Economy is needed, essential in this shift is the implementation of products as services.

Product-Service-Systems are the organizational systems behind the idea of product as services. When companies implement these systems, they should focus on five categories of business tactics of Reim et al. (2015), These five business tactics have a presumed relation with different aspects of the organizational system of real estate development projects. These relationships form the conceptual framework of this research.

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3. Methodology

The objective of this chapter is to present and underpin the chosen research methodologies for this research project. This is done by presenting the type of study and the research design. Since the case studies, lessons-drawing model and the expert meetings play are key research instruments, these are defined more detailed. The chapter ends with a reflection on research ethics as well as the validity and the reliability of the chosen research methods.

3.1. Type of study

The aims of this research project is to explore possibilities for actors in the real estate sector to behave, interact and collaborate in order to make a shift of the real estate sector towards a Circular Economy possible. Since this research is about generation of new theories it has an inductive character. Therefore a qualitative research strategy is appropriate (Bryman, 2012).

The first part of the research that relates to the theoretical shift of the influence on actors – and especially the service providers – on a shift towards a servitised real estate sector. This has a more explorative character. An explorative research is “[...] undertaken with the objective [...] to explore an area where little is known about. [...] Explorative researches are also conducted to develop [...] tools and procedures” (Kumar, 2014, p. 11). Therefore this type of research is appropriate since this graduation research relates to developing new instruments and means. According to Barendse et al. (2012) empirical research and social studies belong to the empirical sciences, a classic research process of formal and empirical research projects is shown in Figure 2 and Figure 3. These cycles are used as inspiration for the research strategy presented later in this report.

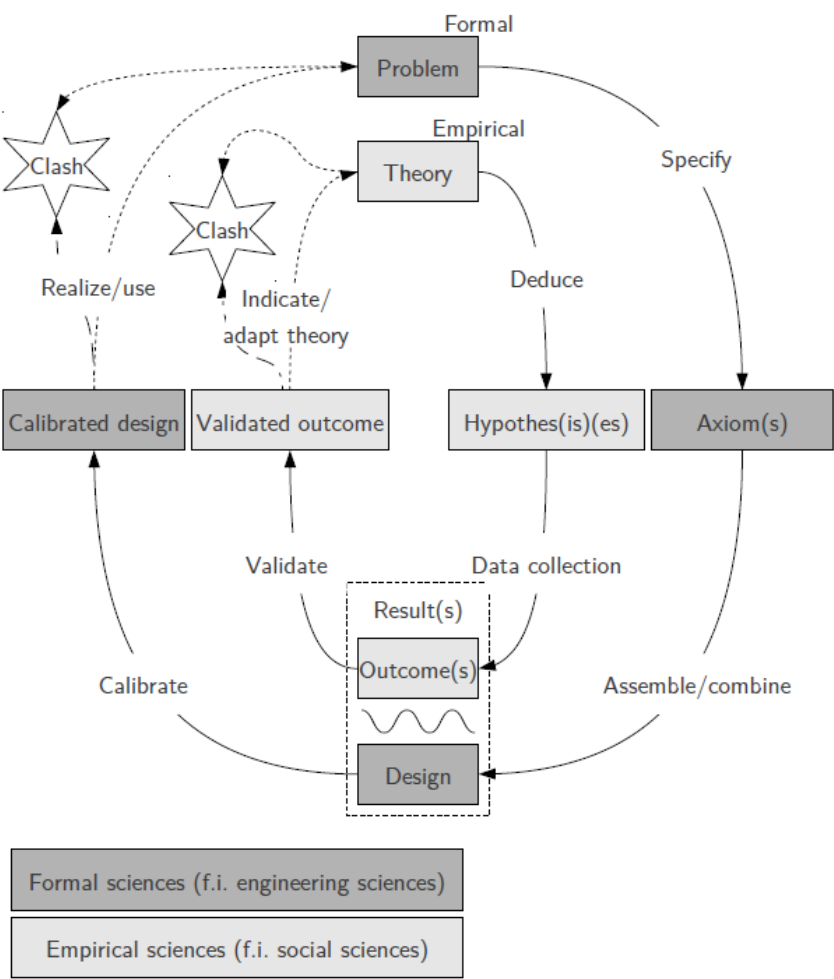


Figure 2: Cycles of formal and empirical sciences (Barendse, Blnekamp, De Graaf, Van Gunsteren, & Van Loon, 2012, p. 5)

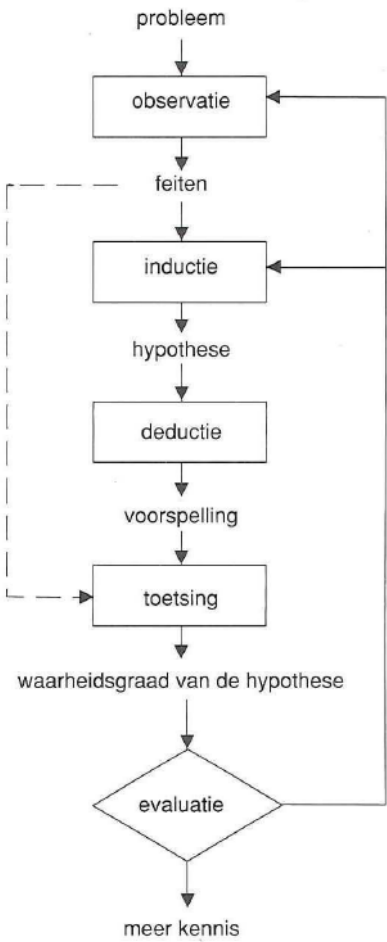


Figure 3: Cycle of empirical scientific research [in Dutch] (Roozenburg & Eekels, 1991, p. 101)

3.2. Research design

In order to answer the main research question and reach the objective of this research project, several research ‘steps’ are needed. This research is designed in such a way, that every sub-question refers to one of those steps:

1. The first question refers to literature research is therefore observational.
2. The second question conceptualizes the related knowledge and aims to build a theoretical framework.
3. The third question deduces the developed theories by applying it in practice.
4. The fourth question tests the hypothesis by comparing theory and practice.
5. The fifth question provides a synthesis between theory and practice by evaluating and validating the outcomes with experts.

In this section, the objectives of these steps are related to their research question and related research instrument. Afterwards, an overview of these steps is visually presented.

3.2.1. Step 1a: Observation

The first part of the graduation process consists of a **explorative literature review**. The purpose of this literature review is to get an overview of concepts and theories related to Circular Economy and the related real estate development process.

An explorative literature review is sometimes referred to as a ‘narrative literature review’ and provides researchers “[...] an initial impression of the topic area that they intend to understand through research” (Bryman, 2012, p. 110). Next to this goal, the first stage of the literature review is to explore possible research gaps (Bryman, 2012, p. 98). Since there was not a very clear idea at the start of what the research this process had a very iterative character. The strategy used in this part of the research process shows some similarities with ‘snowball sampling’ (Bryman, 2012, pp. 202-203). This literature review process will took place until some weeks after P1.

During this phase, an initial problem statement was formed and a research direction was chosen.

Table 1: Objective, question and methodology for research step 1a: Observation

Objective:	Getting an impression of the topic area and explore possible research gaps
Question:	What is known about service provision in the real estate sector?
Methodology:	Explorative literature review

3.2.2. Step 1b: Specification

Step 1a and step 1b linked to each other and show a lot of overlap. This because these steps were made during the preparations of the P1 and the P2. During these phases, the research subject was explored and the research problem was defined. During these early stages of a research project, the character of the process is very iterative. Edmondson and McManus (2007) explain that when more data is collected the scope of subsequent decisions will decrease. Therefore it is important to spend sufficient time iterating in the first phases of the research process When research questions are becoming more focussed, the research design will be further elaborated and refined (Edmondson & McManus, 2007).

Therefore the related research question is similar to the one of step 1a. The objective of step 1b and the related methodology differs. The goal of step 1b is to gain knowledge of the research subject, gain insight in the perspectives of practitioners and to define the research problem clearly. This is done by a **systematic literature review** and **explorative interviews**. The explorative interviews were conducted in the form of **unstructured interviews**, as described by Bryman (2012).

Table 2: Objective, question and methodology for research step 1b: Specification

Objective:	Gain knowledge of the subject, gain insight in the perspectives of practitioners, define research problem and research objective
Question:	What is known about service provision in the real estate sector?
Methodology:	Systematic literature review, explorative interviews

3.2.3. Step 2: Induction

After the problem statement and the research objective are defined, the inductive phase of the research project starts. This inductive period aims to define the related concepts clearly and generate a theoretical framework. This theoretical framework will function as a hypothesis for the research.

The related research question refers to the development of the hypothesis, since the hypothesis is the outcome of the induction. In order to answer the research question a **systematic literature review** is used, the aim of this is to provide an account of the literature that is comprehensive. Since little academic literature is available about Circular Economy in the built environment, a meta-ethnography method is used whereby master theses of former MBE-student were the main source (Bryman, 2012).

Table 3: Objective, question and methodology for research step 2: Induction

Objective:	Define concepts, define theoretical framework and generate a hypothesis
Question:	What does the organizational system of [circular] real estate development projects look like?
Methodology:	Systematic literature review

3.2.4. Step 3: Deduction

Deduction is “an approach to the relationship between theory and research in which the latter is conducted with reference to hypotheses and ideas inferred from the former” (Bryman, 2012, p. 711). The goal of this deduction is to test the developed theoretical framework – being the hypothesis from the second step – in practice. Hereby the goal is to create understanding of the application of Product-Service-Systems in the current real estate sector.

In order to do this, **case studies** will be conducted to ‘investigate a contemporary phenomenon within its real-life context’ (Yin, 2014). Hereby a multiple-case study design is used where after a cross-case synthesis is conducted. The design of these case studies will be further elaborated in section 3.3.

Table 4: Objective, question and methodology for research Step 3: Deduction

Objective:	Create a better understanding of the application of PSSs in the current real estate sector
Question:	How ow are organizations collaborating and interacting currently in circular real estate development projects?
Methodology:	Case studies

3.2.5. Step 4: Testing

The outcomes of the case studies provide a better understanding of the current practice of servitization and the application of circular principles in the real estate sector. By comparing these outcomes with the before defined hypothesis, inspirational lessons can be drawn using **case-based lessons drawing** for these actors to move interact, behave and collaborate in a way that fits in a Circular Economy. This step is further explained in section 3.4.

Table 5: Objective, question and methodology for research step 4: Testing

Objective:	To draw inspirational lessons for service providers and related actors in the current real estate sector
Question:	What lessons can current circular real estate development projects learn from the proposed theoretical framework?
Methodology:	Lesson drawing

3.2.6. Step 5: Synthesis

The lessons learned from the former step should be validated in order to increase the trustworthiness of the findings. This is done by conducting two **expert-meetings** with experts in the field. Hereby one expert-meeting will be conducted with an ‘insider-panel’ consisting of persons involved in the projects that were subject to the case study research and an ‘outsider-panel’ which consists of persons that were not involved in those project nor working for organizations involved in these projects. This is underpinned in section 3.5.

Table 6: Objective, question and methodology for research step 5: Synthesis

Objective:	To validate the lessons learned and to provide recommendations for involved actors
Question:	What instruments and means could real estate developers use to incentive actors to deliver circular services?
Methodology:	Validation interviews / expert-meeting

The steps of the research process are visually summarized into one flowchart, which is presented in figure 4.

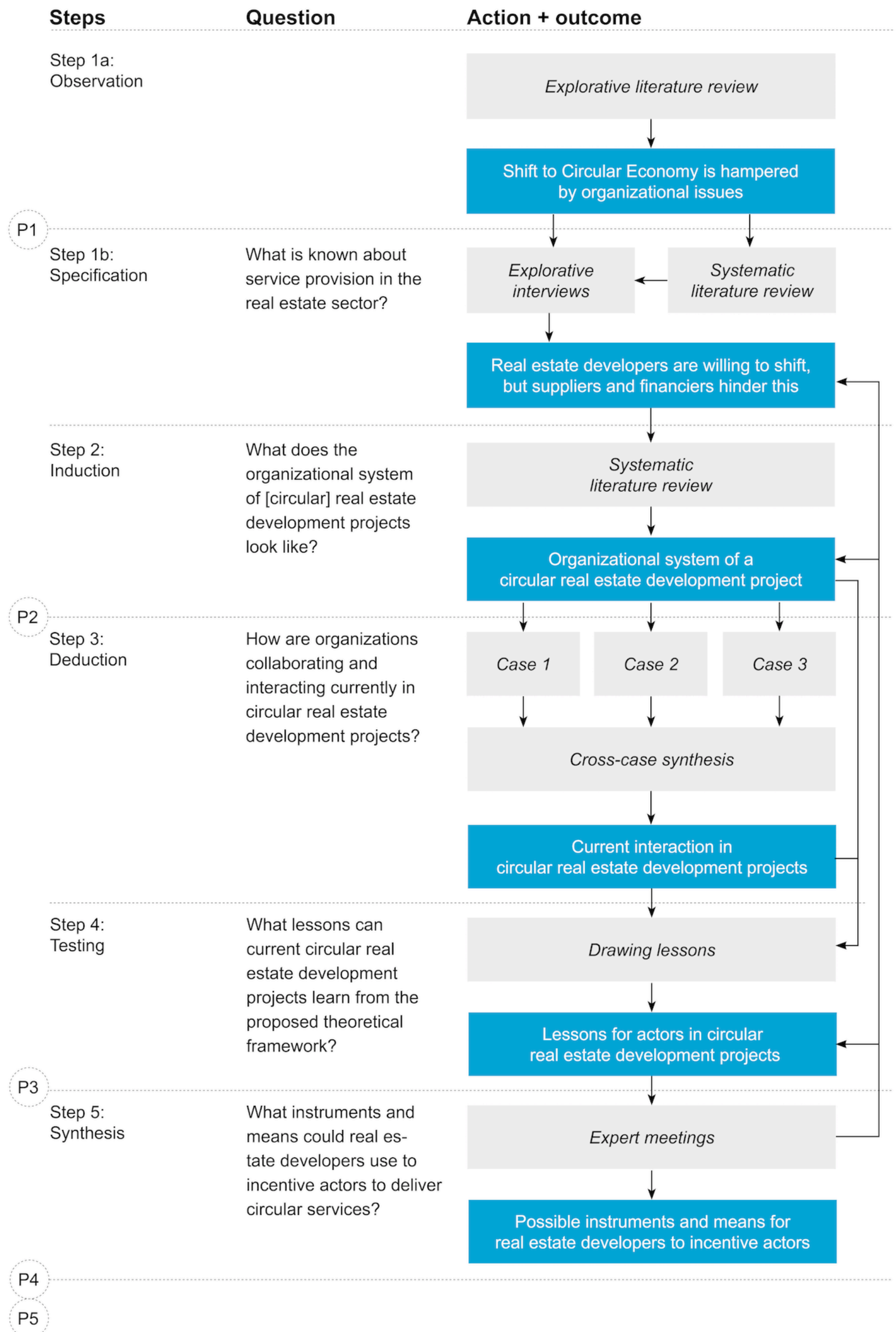


Figure 4: Research process (own ill.)

3.3. Case studies

As explained in the former section of this chapter, case studies will be used to deduce and test the developed theoretical framework in practice. Hereby case studies form the link between theory and practice. In this section the research method of the case studies part are presented and underpinned.

3.3.1. Choosing case studies as research method

The reason to choose case studies to be part of the research process is that this research opts to solve real-life problems. Therefore it is important to link this research with practice. It is often argued that while doing scientific research theoretical knowledge is more valuable than practical knowledge. But since predictive theories do not exist in social sciences, it must be concluded that “context-dependent knowledge is, therefore, more valuable than the vain search for predictive theories and universals” (Flyvbjerg, 2006, p. 224). Therefore case studies are chosen to deduce the developed theoretical framework.

Critics of case study research say that case study research holds a bias towards verification, which means that there would be a tendency to confirm the researcher’s own beliefs. However, Flyvbjerg (2006) argues that the possibility of falsification is bigger than the possibility of verification. This because the researcher himself has the possibility to adjust the hypothesis during the research process because he can reflect on the data found in the case studies.

3.3.2. Research questions

As discussed in section 3.3, the first step is to clarify precisely the substance of the study question. The sub-question that will be answered by conducting case studies in this research project is:

How are organizations collaborating and interacting currently in circular real estate development projects?

3.3.3. Linking to propositions

As described in section 3.2, the case studies in this research will be used to deduce the theoretical framework which is the outcome of the first and second sub question. The proposition that applies to the case studies in this research is therefore the theoretical frameworks. By doing this, a hypothetico-deductive approach will be used (Flyvbjerg, 2006).

‘Theoretical proposition’ will be used to rely on while analyzing the case studies. This deductive approach was also the original objective to conduct case studies. Hereby the theoretical framework guides the case study analysis and helps to organize the analysis (Yin, 2014, p. 136).

Since the case study research process follows a deductive approach, a so-called analytic generalization will be used (Yin, 2014). By doing this, the real life situation will be generalized at a higher conceptual level than of the specific case. Hereby the outcomes of the analyses of the case can be connected to the developed theoretical framework.

The link between the develop analytical framework and the way the case studies are linked with the developed theoretical framework are presented in figure 5. In this figure, the CS/CU framework as discussed in section 4.2 is linked with the research strategy for the case studies.

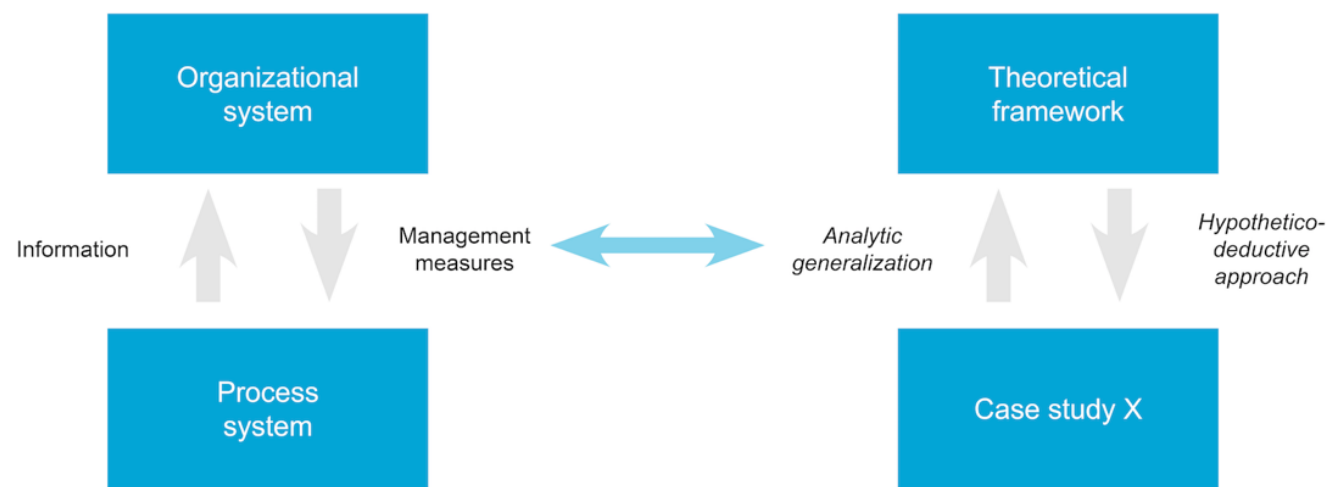


Figure 5: Research strategy for the case studies linked with CS/CU configuration (own ill.)

3.3.4. Sampling

In this research three cases will be analyzed during the case study period. Some author say that often one case study is enough to generalize findings. For example, Flyvbjerg (2006) tries to argue that single-cases studies can be used to generalize findings. But when he comes to his conclusion he admits that “formal generalization is overvalued as a source of scientific development, whereas ‘the force of example’ is underestimated” (Flyvbjerg, 2006, p. 228).

In the perspective of the author, formal generalization is necessary to come to scientific conclusions and deduction and/or induction of theories. Therefore a case study consisting of one case cannot be used to generalize outcomes, unless the content of the case is not much influenced by its context. Bryman (2012, pp. 69-70) mentions hereby that the findings from one case cannot be generalized unless it is a representative case.

Since in the real estate sector, every project is unique and strongly influenced by its context, conducting a single-case study is questionable. Moreover, since the concept of circular / servitised real estate development projects is so new, there are no representative cases available. That’s why a multiple case-study approach is appropriate and used in this research project.

This research involves a qualitative research design. This means that an information-oriented selection procedure is most appropriate (Yin, 2014). This procedure maximizes the utility of information from small samples. Hereby the expected information content forms the basis of case selection (Flyvbjerg, 2006). Since the objective of conducting case studies is to test the developed theoretical framework, the case studies that will be analyzed should contain elements of the theoretical framework. Therefore a criterion sampling method is appropriate, in this method cases are selected on the basis of meeting particular criterion (Bryman, 2012).

In order to select appropriate cases, the next criteria were formulated:

- The project should be in the development, realisation or operational phase.
- **Scenario 1:**
 - Within the real estate development project, at least one product is – or will be – leased based on its performance.
 - a. This product should be part of the three ‘core’ layers of a building defined by Brand (1995). This means: the product is part of the structure, skin or services.
 - b. The product group consists of several components, hereby several organizations in the supply chain were / are mutually dependent on each other.
 - c. The supplier of the leased product remains responsible for at least the take-back of the product after the product lifecycle.

- d. Preferably, the supplier will also be responsible for maintaining and operating the product.
- e. In the real estate development project, one organization is recognizable as being a service provider
- **Scenario 2:**
Within the real estate development project, the real estate developer is already acting as a service provider and remains involved in the project during the operations phase.

As said before, the idea of circularity and servitization in real estate development projects is new and quite specific. Therefore the amount of potential case studies is limited and only three cases could be selected, these cases are chosen as object of research. These cases are:

1. New office building for the Triodos Bank – Zeist
2. Redevelopment of project 'Basisweg' – Amsterdam
3. Office building 'Boutique' – Amsterdam

These content of these cases will be further explained in Appendix C: Case studies.

As a matter of fact, the three selected cases also differ in process and subject of the case. Therefore the selected cases form also a 'maximum variation case'-sample (Flyvbjerg, 2006). This because one Case 1 is a newly built facility, Case 2 is a redevelopment project and in Case 3 the real estate developer acts as a service provider.

All case studies are projects of OVG Real Estate (OVG). This relates to the fact that the researcher conducts a graduation internship during the graduation process. This company is chosen because OVG:

- ... is dedicated to develop sustainable [and circular] buildings³.
- ... is the only real estate developer that develops buildings which are appropriate for case study research in this research project.
- ... has a market position that allows them to push innovation in the real estate sector.
- ... is developing a new business strategy related to the research subject.
- ... has experience with guidance of graduation interns from MBE.
- ... offered a possibility to conduct a graduation internship during the graduation period (May 2017 – January 2018).

More about OVG Real Estate can be found in Appendix C: OVG Real Estate.

3.3.5. Data collection

During this research project, the researcher will conduct a graduation internship at OVG Real Estate. This real estate developer is the developer of the three abovementioned case studies. This internship allows the research to directly access sources for conducting case studies. The next sources of evidence, as described by Yin (2014), will be used while conducting case study research:

- *Participant observation:* As a graduate intern the researcher might become involved in the projects that are subject to the case study research.
- *Semi-structured interviews:* interviews with project team members, suppliers, financiers, consumers and other members of the project organization.
- *Documentation:* Case / project document analysis, administrative documents progress reports, internal records, proposals and other case related documents.

³ <http://ovgrealestate.com/about-us/sustainability>

It is acknowledged that participant observation comes with major challenges towards potential biases. This is caused by the special role of the researcher within the project, which can influence the credibility of the case studies and the outcomes of the research (Yin, 2014). In order to prevent a tunnel vision in this research, an external validation will take place in a later stage of the research project, see section 3.5.

3.3.6. Data analyses

In this section, the unit of analysis of the case studies, the analytic strategy and analytic techniques will be introduced.

Unit of analysis

The unit(s) of analysis in the case studies are: *current circular real estate development projects*.

In this definition of the unit of analysis are three concepts recognizable: (1) real estate development projects, (2) circular and (3) current. These concepts are defined as follows:

- *Real estate development projects*: a project is a unique set of processes consisting of coordinated and controlled activities with start and finish dates, undertaken to achieve a (defined) objective (Winch, 2010). Hereby the objective is to deliver a constructed built facility.
- *Circular*: Based on the principles of the definition of servitised real estate as presented in section 0 and whereby products are applied in the form of Product-Service-Systems.
- *Current*: Projects that are in the development, realisation or in-use phase at the moment this research project is being conducted.

The rationale for studying the real estate development project as a whole and not the often-referred organizational system can be found in section 4.3.2. In short, the unit of analysis is the process system, this will be abstracted further into the organizational system. This is done because an organizational system is difficult to study since it is not a specific phenomenon or set of decisions that happens in reality.

- The process system as referred to in section 4.3.3 is similar to the whole real estate development project in reality.
- Hereby the organizational system is the 'managerial system' that steers the process system (i.e. real estate development project). See section 4.2.

The objects of study are the way organizations involved in circular real estate development projects, these organizations should contribute in a certain way to the delivery of circular products, or servitised products.

The focus of this study implies the form of collaboration and interaction to deliver circular products. Therefore it is logical to focus mainly on the actors that have direct influence on this, these actors are.

- The real estate developer [service provider]⁴
- The suppliers [service suppliers]
- Architects
- The financier
- The consumer [the client / end-user]

⁴ The text in brackets indicates the terminology used when talking about the Circular Economy

Analytic strategy

Yin (2014) described four general strategies for case study analyses. The strategy that will be used in this research is to 'rely on theoretical propositions'. This because the case studies were based on theoretical propositions. These proposition shapes that data collection plan and helps to organize the analysis because it described the explanations and relations to be examined (Yin, 2014).

In practice, this means that a focus will lie on data collection using the Conceptual Steering model as explained in Section 4.3. Hereby the Conceptual Steering Model functions as an analytical model for the case studies. Hereby the next concepts of the real estate development projects are being generalized:

- Organizational structure
 - o Tasks
 - o Responsibilities
- Financial structure
 - o Risks
 - o Revenues
- Legal structure
 - o Requirements
 - o Rules

While generalizing the case study narratives into the organizational system of the project organization, a 'pattern matching' technique will be used. This analysing technique compares the empirically based outcomes with the outcomes of a prediction (Yin, 2014). In other words, it means that the patterns [outcomes, red.] of the case studies will be compared with the predefined theoretical framework.

Analytic technique

The analytic technique used in this research will be a cross-case synthesis (i.e. cross-sectional case study design) (Bryman, 2012; Yin, 2014). While analysing the case studies, the derived information will be linked to analytical model as explained above. Hereby the different case studies will be seen as individual research studies. Since the analytical model refers to the organizational system of a project organization, the outcomes of each case study will be a description of the organizational system of each case study. The outcomes of the individual case studies will be compared with each other. Hereafter a general overview of the current state of circular / servitised real estate development projects will be given. This conclusion will serve as input for Step 4: Testing. In this step, lessons will be drawn for the real estate sector using the 'Case-based lesson drawing'-method.

3.4. Case-based lesson drawing

In this research, the comparison of the current state of actors in the real estate sector with the theoretical framework makes clear where actors stand concerning their shift towards a circular Economy. Hereby an overview of similarities and difference will be made. Hereafter, a discussion about possible new steps how these actors could behave, interact and collaborate in their shift towards a Circular Economy can be made. This method is based upon the 'case-based lesson drawing model' used by Huijbregts (2017, pp. 54-55). The lesson-drawing model used is presented in figure 6.



Figure 6: Process of comparative research and lesson drawing as adopted in this research (based on Huijbregts, 2017)

3.5. Expert panel(s)

The outcome of the Step 4: Testing / Lesson drawing are lessons for actors in current real estate development projects. In order to enhance the credibility of these recommendations, validation meetings with experts will be held.

There are basically two methods to shape these meetings; (1) individual semi-structured interviews with experts or (2) an expert-panel in the form a focus groups (Bryman, 2012). Because group interaction in focus groups enhances quality of the outcomes, the second method is the most favorable.

3.5.1. Expert meeting participants

The expectation is that the recommendations derived from the former step will apply to several actors in the supply chain. These recommendations are based on case studies, hereby a relatively small amount of actors are involved and probably these actors all have a similar mindset. This derogates to the external validity of the recommendations because the results are “generalized beyond the specific research context in which it was conducted” (Bryman, 2012, p. 711).

Next to this, it still remains important to validate the recommendations that apply to the organizations and actors that were object of research during the case studies itself. This relates to the internal validity of the outcomes.

So, the members of the expert meeting should involve persons that are involved in the conducted case studies and expert which were not. However, in focus groups, people tend to influence each other and each other's opinion. Therefore the most ideal solution would be to hold two different sessions:

- One expert panel with actors that were involved in the projects that were subject to research during case studies.
- One expert panel with actors that were not involved in the case studies, nor working for companies involved in those case studies.

Side notes:

1. *As mentioned by Bryman (2012), focus groups are difficult to organize. If not enough time is available to organize two sessions or not enough persons can be found for both sessions, only one focus group / expert panel meeting will be held.*
2. *If the recommendations only apply to a small amount of actors, it is better to hold individual semi-structured interviews to validate the proposed recommendations to prevent peer pressure from other actors.*

3.5.2. Content of the meeting

As said before, the input for the expert meetings are recommendations for actors in the current supply chain. During the sessions, a quick overview of the research project will be given and the main concept be introduced. Then the recommendations will be presented in the form of propositions (*in Dutch: stellingen*). The validation of the recommendations will take place in the form of a discussion between the members of the expert meeting.

3.6. Research ethics

One week before the P2, the researcher filled in the “Ethics review checklist for human research”-checklist. The answers on all the questions of the self-assessment were ‘no’. Therefore the researcher presumes there are no major ethical issues involved in this research project.

However, as described above, the case study research will focus on the roles, responsibilities and collaborations between several organizations within circular real estate development projects. Since the topic of the research itself is quite new, it is highly probable that the researcher has to work with information that is under embargo and/or involves company’s secrets.

Therefore the researcher acknowledges that personal details should not be mentioned in the report, just as company names or information that could be linked to these companies. Therefore information should be presented – as described in the course book⁵ – on an ‘aggregated level’

3.7. Conclusion; validity & reliability

According to Yin (2014) articulating a theory what is being studied and what is to be learned helps to strengthen a research design when doing a case study. The quality of the design in relation to social science research are (a) construct validity, (b) internal validity, (c) external validity and (d) reliability. In this section, the relation between these four concepts and the research design is evaluated. This section could therefore be seen as a reflection on the designed research methodologies.

3.7.1. Construct validity

Construct validity refers to “[...] the accuracy with which a case study’s measures reflect the concepts being studied” (Yin, 2014, p. 238). In this research, the construct validity is covered by defining the theoretical framework and analytical framework. From these frameworks, concepts (i.e. operations measures) will be identified and the outcomes of the case studies will be generalized towards these concepts.

Another important aspect of construct validity is the use of multiple sources of evidence. In this resource several types of data sources is used, hereby triangulation of secured. The resources that are used in this research and the related research methods are presented in figure 7.

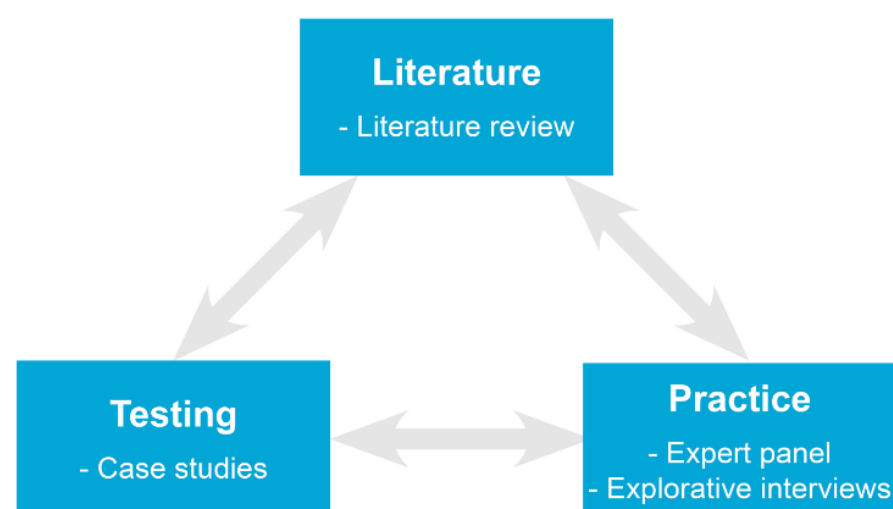


Figure 7: Triangulation in this research project (own ill.)

⁵ Course Book AR3R010 – MBE Graduation Laboratory 2016-2017, version spring 2017, Department of Management in the Built Environment, Faculty of Architecture and the Built Environment, TU Delft

3.7.2. Internal validity

This concept relates to the question “[...] whether a finding that incorporates a causal relationship between two or more variables is sound” (Bryman, 2012, p. 712).

In order to secure the internal validity of this research, a pattern matching technique will be used to link the theoretical framework with the generalization of the case studies and the to-be developed recommendations.

3.7.3. External validity

External validity concerns “the extent to which the findings from a case study can be analytically generalized to other situations that were not part of the original study” (Yin, 2014, p. 238). Since the research topic of this research is quite specific and new in practice, there are not much case studies available. Moreover, the case studies that are available are all subject of study during the case studies.

An attempt to be able to generalize these findings will be done by conducting an ‘outsider focus group’. Hereby actors that have knowledge about the research topic but that are not in some way related to the case study projects are invited to take part in a focus group meeting wherein the proposed recommendations will be verified.

3.7.4. Reliability

Reliability refers to “[...] the consistency and repeatability of the research procedures used in a case study” (Yin, 2014, p. 240). In order to provide insight in the research procedure of the case studies, a case study protocol will be developed. Next to this, as much steps as possible will be made operational.

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4. Theories

The used analytical framework is discussed in this chapter. Firstly, several management principles are explained. Secondly, the concept of systems steering is introduced. Thirdly, the Conceptual Steering Model is explained, which serves as the analytical framework in this research. At last, a conclusion is provided.

4.1. Management principles

4.1.1. Management from an instrumental perspective

Management in the built environment implies acting towards a certain goal. In order to reach these goals, manager use certain instruments. This means that “Management is getting thing done... with people”, and management can be seen as being in command of – a part of – an organization so that processes – internal and external – are tuned in and end up well (Bruil & Heurkens, 2012, p. 26). According to Daamen (2010) actors in [urban] development practice are in constant search for effective and efficient ‘strategies’ needed to produce successful outcomes of projects (in Heurkens, 2012). This instrumental view on management implies “the total process of planning, decision-making and administering of all aspects of an action or system from its inception to its termination” (Bruil & Heurkens, 2012, p. 26). Therefore it is important to analyse the whole spectrum of management activities related to development processes. This refers to the Conceptual Steering Model, explained later in this chapter.

4.1.2. Project and process management

In the built environment, management is often about management of projects and management of processes. Project management herein can be defined as “the structuring, organization, coordination, monitoring and evaluation of all activities that are necessary for the establishment of a project (Wamelink, in Bruil & Heurkens, 2012, p.33). Next to this, a central element is that project management is the division of the project into phases, therefore project management becomes ‘management through phasing’ (Bruil & Heurkens, 2012). Process management, in the meanwhile, can be defined as “complexity management within networks of people” (Wamelink, 2009, p.411, in Bruil & Heurkens, 2012, p.35). Hereby a process organization consists of inter-organizational networks whereby the different organization, parties and actors have equal relationships with each other. Main difference between projects and processes is that projects are seen as closed systems and processes as open ones. Process-oriented approaches are therefore suitable for analyzing the environment and gain insight in the context (Bruil & Heurkens, 2012). Since real estate development projects are seen as fundamentally open, a process-oriented method will be used in this research.

This means that management in this research will be seen quite broadly. This implies that management measures can be applied by organizations inside and outside the project organization. Conclusively: “Management consists of any type of directive influence the realizing of construction projects” (adopted from Heurkens, 2012, p.52).

4.2. Systems steering

A systems approach considers reality as a system, “in which the whole is more than the sum of the parts” (Bruil & Heurkens, 2012, p. 65). Hereby a system can be defined as “[...] a collection of objects

[...] being associated to each other in such a way that no element or groups of elements are isolated from the whole” (De Leeuw, 2002, p.96, in Bruil & Heurkens, 2012, p.65).

As said before, management is, besides many other things, about steering. Systems steering can be seen as applying influence with the aim to reach certain objectives or goals. Hereby a distinction should be made between (1) the system which is steered (i.e. the Controlled System) and (2) the system which steers (i.e. the Controlling Unit) (Bruil & Heurkens, 2012), see figure 8.

It is logical that the Controlling Unit [CU] steers the Controlled System [CS], hereby the CU applies goal-oriented measures in order to steer the CS towards predetermined objectives or goals. On the

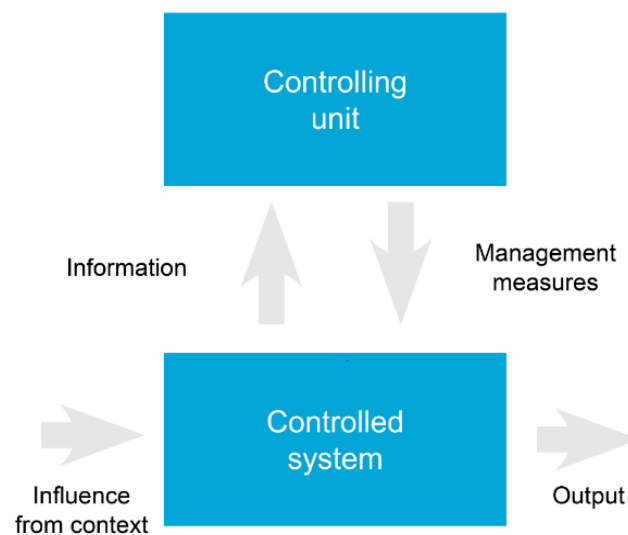


Figura 8: The CU/CS configuration (after De Leeuw, 2002, and Bruil & Heurkens, 2012)

other hand, the CS also sends information to the CU, in the form of feedback (De Leeuw, 2002). In the next section, this systems steering model will be implemented in its context.

4.3. Conceptual steering model

In the built environment, contextual influences and relationship are of big importance. This is mainly because the time period from initiative to completion covers a long time span, therefore the influence of the context or environment is a big risk factor. Looking at the contextual steering model of De Leeuw (2002), which is used in the dissertation of Heurkens (2012, pp. 54-55), the CU/CS configuration is recognizable and placed in its context. The conceptual steering model of De Leeuw (2002) (as described by Heurkens, 2012) is presented in figure 9. Hereby the concepts are already

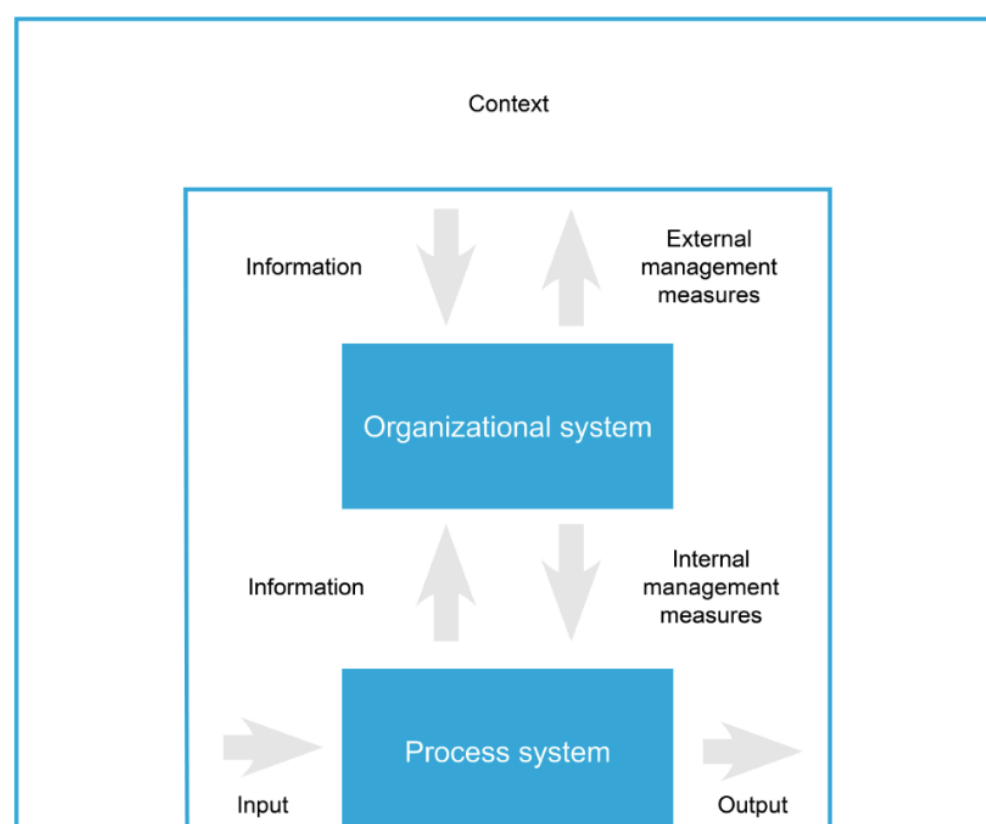


Figure 9: Conceptual steering model (after De Leeuw, 2002, in Heurkens, 2012)

linked to real estate development processes. Hereby the CU is referred to as the organizational system and the CS the process system.

The conceptual steering model is not a representation of reality, but provides a conceptual model that explains all sorts of mechanism occurring in project. In order to analyse and explain the conceptual steering model, some aspects are chosen. Some of these aspects are based on the aspects chosen in the dissertation of Heurkens (2012).

4.3.1. Context

The context refers to the different levels of surrounding of which a certain empirical object is part of. This context might be subject of change. The context shapes conditions in which a circular real estate development project takes place (Heurkens, 2012). The context is sometimes also referred to as the project environment, according to Wamelink (p. 411, in Bruil & Heurkens, 2012) “the project environment – or context – is the total sum of external influences within which a project is formulated, assessed and completed”.

The external environment can influence a project in a variety of ways that could have a different impact on the overall performance of the process. One of the most commonly used methods to analyse external effects of project is the PESTLE-analysis. Hereby the total external environment is subdivided into Political, Economic, Social, Technological and Environmental influences. Hereby the external Opportunities and Threats per category are identified (Bruil & Heurkens, 2012).

4.3.2. Organizational system

The organizational system represents different aggregation levels of organization structures, formal and informal relationships and roles between different actors. In case of this research project the organizational system refers to formal and informal relationships of the project organization (Heurkens, 2012). The organizational structure herein can be defined as “the sum of the ways an organisation divides its labour into distinct tasks and then coordinates them” (Bruil & Heurkens, 2012, p. 57).

In order to analyse the organizational system, Heurkens (2012) analyses three different institutional aspects: organizational, financial and legal. These institutional aspects that are further analysed are tasks and responsibilities (refers to organizational aspects), the financial aspects are subdivided into risks and revenues and the legal aspects are subdivided into requirements and rules. In order to get an overview of the whole organizational system, each of these concepts and arrangements will be assigned to involved actors in the project organization.

4.3.3. Process system

The process system is the system that is subject of research while conducting case studies, which are in this research circular real estate development projects. This process is managed by the project organization of the organizational system. The process system relates to the whole development process in order to deliver and / or manage the real estate development project (Heurkens, 2012). The process system in real estate development projects are sometimes referred to as black boxes since it is very difficult to grasp all the influences, processes and strategies used that influence the process system. Black boxes are considered as part of systems whereby only relations between the black box and its context are relevant (Heurkens, 2012). In the real estate industry the exact throughput is often difficult to analyse and determine because of the complexity of said processes.

4.3.4. Relations

The three components (context, organizational system and process system) as describe above are linked to each other, these relationship reflect the dynamics that are present in- and around certain project. Heurkens (2012) mentions hereby that a changing context could influence the processing system which is considered as input for the process. This could for instance be shifts in economic circumstances. This information is send to the organizational system, which is in place to manage underlying processes. This information is processed and could lead to adaptation by the organization to cope with changes. These changes are referred to as management measurements.

Internal management measures are according to De Leeuw (in Heurkens, 2012) aimed at influencing the structure or objectives of the project, and external management measures are used to influence the structure or objectives of the project surroundings. This means that internal management measures are used by actors to realize an effect on the output of the real estate project itself.

Next to this, the organizational system itself is influenced by information or signals that are coming from project surroundings. But the organizational system itself could also influence the project surrounding using external management measures. Hereby the external environment is steered in order to achieve project objectives (Heurkens, 2012).

4.3.5. Output

As can be seen in figure 9, the output of the process system flows back into the 'context', in case of real estate development projects the output is mostly a constructed building.

In a circular built environment, products will be delivered according to the service it delivers. Hereby the service provided with it should yield a certain degree of utility (i.e. a performance) for the user. Therefore the output of the related process should be measured according to the performance it delivers. Selviaridis and Wynstra (2015, p. 3507) define 'output' as the "[...] direct results of the service activity or production process itself, whereas 'outcomes' are defined as the value derived by the customer from a given service or product". Hereby output is linked to effectiveness and outcome to efficiency:

- *Effectiveness:* Degree to which objectives are met, this is the degree to which circular servitization actually takes place.
- *Efficiency:* Extent to which servitization place against a minimum use of time and costs, hereby the degree to which the used organizational structures fits circular service provision is valued

4.4. Conclusion

This research is about the organizational change needed to transform the current real estate sector towards a Circular Economy. In order to conduct this research, a management perspective is needed.

In the real estate sector, management is a complex and ambiguous. Therefore an open-system approach is used in this research project. In this perspective, it is the controlling unit (the organizational system) that manages the controlled system (the process system), this CS/CU configuration is influenced and shaped by its external context. In order to describe and analyze the conceptual model, the three main concepts (context, organizational system and process system) were further defined. The output of the process system will be valued according to its effectiveness and efficiency, which relates respectively to the degree to which circular service provision actually takes place and the degree to which the used organizational structure fits circular service provision methods.

5. Products as services in practice

The aim of this chapter is provide insight in the consequences of the implementation of the concept of 'Product as services' and 'Product-Service-Systems' on a business and project organization. This is done by describing the five 'business tactics' as discussed by Reim et al. (2015). This is followed by a discussion about Supply Chain Management, in this section the focus lays on the role of the central service provider in the supply chain. This chapter ends with a conclusion.

5.1. Business tactics

The performance approach of the real estate sector is defined quite well by Straub (2009, in Selviaridis & Wynstra, 2015, p.3514). Here, it is said that the performance-approach of real estate is "[...] the practice of thinking and working in terms of ends rather than means. It is concerned with what a building is required to do and not with prescribing how it is to be constructed". This implies a new way of working and a paradigm shift in the real estate sector. Reim et al. (2015) categorized tactics for companies to implement PSS business models, these tactics are discussed below. These tactics can be defined as "the company's residual choices at an operational level [...]" (Reim et al., 2015, p. 66).

5.1.1. Contracts

In a PSS business model, contracts are based on the performance of the service. This form of contracting is also known as 'Performance-Based Contracting' [PBC], this concept can be defined as "the contractual approach of tying at least a portion of supplier payment to performance" (Selviaridis & Wynstra, 2015, p. 3505). When the service provider implements PBC-methods in its development projects the service provider facilitates "[...] supply chain coordination and collaboration to realise end customer outcomes by aligning incentives among supply chain actor's" (Selviaridis & Wynstra, 2015, p. 3506). Hereby the suppliers will be incentivised to think the other way around and start thinking about value delivery towards consumers instead of revenue creation for themselves.

A PBC contract is designed to address all aspects related to providing the service and to state the rights and liabilities of involved parties clearly. Key aspects herein are the delivered performance of the service, incentives and risk allocation (Reim et al., 2015; Selviaridis & Wynstra, 2015). Therefore a better implementation of PBCs is needed to convince suppliers and financiers to shift towards a Circular Economy model in the real estate sector.

In order to design PBCs successfully, measurable outcomes, appropriate incentive structures as well as an appropriate mix of contractual and relational governance mechanisms are needed. When a PBC is defined successfully, it leads to "increased efficiency, improved spending accountability, innovation, budget flexibility, value for money and inclusion of social and environmental objectives into specified outcomes" (Selviaridis & Wynstra, 2015, p. 3517).

5.1.2. Marketing

In a PSS, marketing should be used differently than in the current real estate sector. In a PSS business world, there is an "[...] anticipation of market demands and trends with integrated concept design", hereby "[...] market and client information is lead into the supply chain" (Vrijhoef, 2011, p. 239). Therefore market insight is key in introducing PSS in the real life world.

Secondly, Reim et al. (2015) mentions that service providers need to communicate the added value that will be delivered with PSS clearly, this because consumers take a solution that is totally different compared to current approaches. Finally, the interaction with the consumers changes. This means that a closer relationship with the consumer is needed to build trust and common understanding. Hereby, as mentioned earlier, consumers become earlier involved in the development process and only state their requirements for the built facility.

5.1.3. Networks

The implementation of a PSS into the real estate industry needs system optimization, new production process, new ownership relations, networks and chains. Moreover, the complexity of the aforementioned processes will increase while the need of different parties working together will increase (Prins et al., 2015; Selviaridis & Wynstra, 2015; Van den Brink, 2016). According to Kazemi (2016) the need for collaboration between the supplying parties is big, this because the traditional approach based on costs and revenues for the individual organization has to transform into an integrated relationship around one goal.

Van Staveren (2016) explains that some links in the supply chain of the real estate sector should be changed. However, if one link in the system is changed, other links in the system are effected as well. Thus, “[...] the application of CE principles in the supply chain affects the whole chain and its involved actors” (Van Staveren, 2016, p. 28). The shift towards a Circular Economy does not only affects organizations in the supply chain of one real estate development project, but does affect the whole real estate sector. Currently, organizations systems disappear after completion of a certain project. But in the Circular Economy these organizations remain involved during the whole lifecycle of a project. This because the project team remain responsible for the overall performance of the building and therefore the performance of individual building components, see section 7.2.2.

Organizations are together responsible for the overall performance of their delivered service and become therefore mutually dependent on each other. Therefore, they should collaborate in order to deliver enhanced performance (Van Staveren, 2016). Hereby single actors fulfil more functions than in a traditional real estate development process, which implies that integration of different actors in the supply chain is needed.

5.1.4. Product and service design

Aligning physical product characteristics with services to be offered is very important while implementing a PSS. Hereby the ability of the product to be maintained, upgraded and reused are focus points (Reim et al., 2015). This refers to the Living Building Concept [LBC], in this concept, the function and circumstances of built objects are constantly changing. Therefore all involved parties in the supply chain should supply integrated products that should be able to cope with changes in terms of demands throughout the entire lifecycle of a project. This results in a shift from demand-driven supply towards a supply-driven demand in the project organization. Hereby the demands of clients remain on a higher aggregation level, and the supplying parties must offer an integrated solution based to this demand (De Ridder & Vrijhoef, 2007).

Hereby it does not matter in what spatial form the supplier delivers services towards its consumers. The supplier should always deliver services according to the demands of the consumer during the whole project lifecycle. This means that when circumstances and/or conditions change, or the consumer has new demands, the service supplier must change its delivered services towards the consumer. This leads to a situation whereby the supplier is incentivized to develop products that are standardized, but also be able to adopt flexibility.

5.1.5. Sustainability

According to Tukker (2015, p. 76) “Product-Service Systems (PSS) have been heralded as one of the most effective instruments for moving society towards a resource-efficient, circular economy and creating a much needed ‘resource revolution’”. This because it is believed that PSS improve the efficiency of resource utilization and business model innovations play a crucial role in achieving greater levels of sustainability (Reim et al., 2015).

In this research, the implementation of PSS is linked to the implementation of the Circular Economy in the real estate sector. Therefore the concept of sustainability is seen as identified as a core requirement in the behaviour of actors in the real estate development process.

5.1.6. Overview

Table 7 provides an overview of the tactics to implement PSS business models as described by (Reim et al., 2015). Herein the business tactics are further specified into key aspects to implement these tactics.

Table 7: Business tactics and key aspects of operationalization (based on Reim et al., 2015)

Tactics	Key aspects
Contracts	Responsibility and terms of agreement
	Formalization and complexity
	Risk level
Marketing	Communication of value
	Extent of customer [consumer, red.] interaction
	Customer [consumer, red.] and market insights
Network	Type of partners
	Type of relationships
	Sharing and coordinating activities
Product and service design	Functionality
	Customization
Sustainability	Improved resource utilization
	Extent of innovation

5.2. Supply Chain Management

In this section, the concept of supply chain management and supply chain integration are introduced and briefly discussed. The goal of this is to provide background information about the implications of the implementation of PSSs in the real estate sector.

To start, the concept of supply chain management should be clarified. Firstly, a supply chain can be defined as: “the network of organization that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate customer” (Christopher, 1992, in Vrijhoef & Koksela, 2000, p.170). Supply Chain Management focusses hereby on the entire supply chain and aims to increase the alignment and transparency of the supply chain. Hereby the functional and corporate boundaries are passed, which implies that improvements in terms of integration of business processes can be a focal point (Vrijhoef & Koskela, 2000).

5.2.1. Vertical integration

The implementation of Product-Service-Systems refers closely to vertical integration. This because product-centric services, require from the service supplier and service provider to take care on maintenance activities that were normally conducted by the customer. This because the time the supplier remains responsible for the delivered products is extended towards the in-use phase and even the end-of-life phase of a product (Reim et al., 2015; Selviaridis & Wynstra, 2015).

The concept of vertical integration is described by Baines, Lightfoot, and Smart (2011, p. 948) as “the extent to which a firm owns and takes responsibility for its upstream suppliers and its downstream customers”. Backward vertical integration hereby implies taking over activities of suppliers and forward vertical integration concerns taking over activities that would normally be carried out by customers (Baines et al., 2011).

According to Baines et al. (2011) vertical integration of real estate developers is a response to two driving forces. The first one being a pressure to deliver contractual obligations to customers. The second one being an internal pressure to deliver these services as efficient and effective as possible. This means that vertical integration in the real estate sector comes from the supply side as well as from the demand side in the real estate sector. Therefore alignment of organizations and actors in both sides of the supply chain is needed.

5.2.2. Demand and supply systems

According to Vrijhoef and De Ridder (2005) more integrated and longer-term supply chain arrangements are heralded to be more efficient and effective, which leads to higher levels of client value and profitability. Eventually the overall performance of the supply chain would be enhanced. In order to achieve this, a centralised supply chain control should be established. This to synchronise different supply chain activities and align demand and supply using a ‘collaborative system approach’ (Vrijhoef & De Ridder, 2005). In the shift of the real estate sector towards a Circular Economy, it is presumed that this centralised supply chain control will be executed by the real estate developer.

Since the complexity in the real estate sector is relatively high, a collaborate system approach is difficult to establish. Many parties are involved in both the demand and the supply side in construction, hereby many interest and views should be taken into consideration. This also relates to the perception of value creation, hereby views and interests could be interfering with each other (Vrijhoef & De Ridder, 2005). In figure 10, the value demands and supply system in construction is presented.

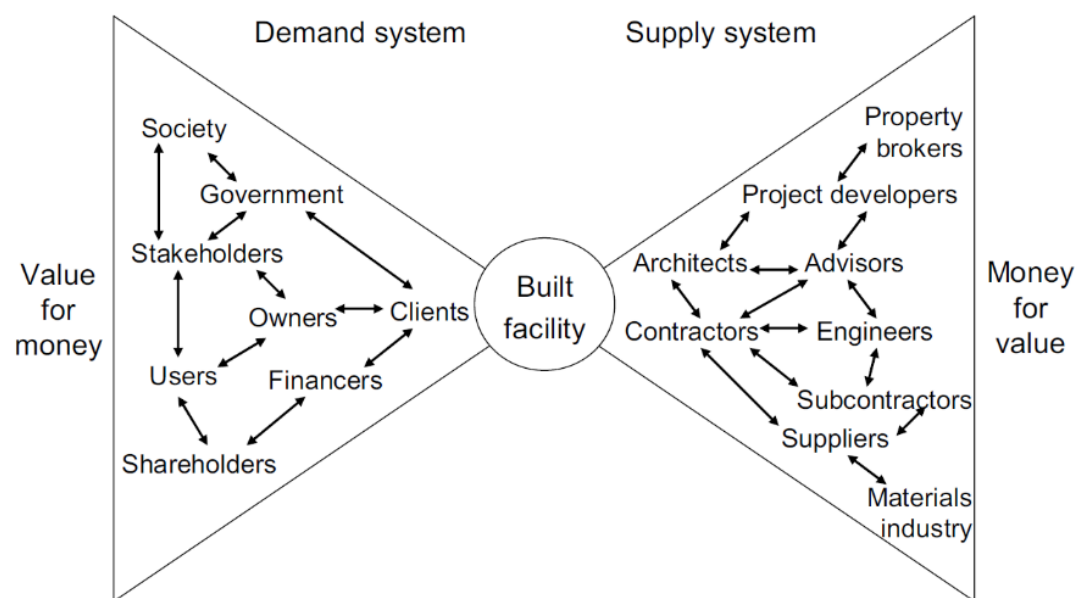


Figure 10: Value demand and supply system in construction (Vrijhoef & De Ridder, 2005)

In order to increase the effectiveness, both systems [demand and supply] need to be more integrated in order to align the large number of parties involved. According to Vrijhoef and De Ridder (2005) two new parties should be introduced to integrate the demand and supply system separately. This would respectively be the demand systems integrator and the supply system integrator, see figure 11. In this research not two new parties will be introduced, but the two new roles would be executed by one service provider.

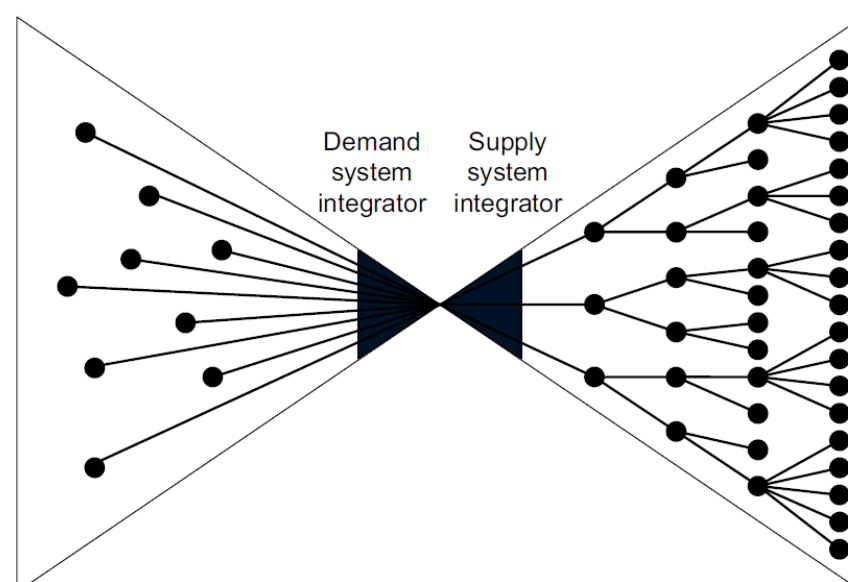


Figure 11: The central role of the demand and supply system integrator (Vrijhoef & De Ridder, 2005)

Client driven supply chain integration

In the current real estate sector, the client often represents many other clients, users and stakeholders. In this case the client is the demand system integrator and takes care of the procurement of the building. The type of procurement influences the used contract and thereby the degree of supply chain integration. This influences the supply chain performance and the delivered value to the client, this makes the client himself a dominant factor in the success of the supply chain integration (Vrijhoef & De Ridder, 2005).

However, clients do not often have long-term relationships, this hinders long-term collaboration and the integration of supply chains in the current real estate sector. If clients have the power to shift their procurement strategies towards a situation whereby long-term relations are preferred, increased system integration would have a chance to develop itself. This because the trust needed to develop this pain-and-gain sharing relationship cannot be achieved in single projects (Vrijhoef & De Ridder, 2005). In situation where this type of integration was applicable, clusters of firms for longer periods of time were achieved.

Supplier driven supply chain integration

At the supply side, parties could shift towards more integrated production and business formats, this by project-independent collaborations with other parties in the supply chain. Next to this, parties could internalise neighbouring activities or other business. This creates operational and competitive advantages because of higher levels of productivity and efficiency by delivering better client value (Vrijhoef & De Ridder, 2005).

Currently these approaches mostly focus on concepts relating to modular production networks. Standardization of components within the supply chain are herein the basis of speed and flexibility, which thrives collective competitive advantage to competitors. This fits in the concept of open building and the Living Building Concept (De Ridder & Vrijhoef, 2007; Vrijhoef & De Ridder, 2005).

The introduction of a 'Living building Concept' reduces the role of the client within the development process of a building. Normally demand is leading supply, but in a PSS in the real estate sector supply is leading demand. 'hereby suppliers must respond adequately to the demands of consumer. Hereby suppliers must keep services 'fit for purpose' during the lifecycle of a project, under changing conditions and changing demands of the consumer itself (De Ridder & Vrijhoef, 2007). The flexibility of servitization makes it possible for supplier to introduce new technologies, concepts and materials during the contractual period. This could boost innovation and efficiency within its organization and between its partners (De Ridder & Vrijhoef, 2007). This means that the supply chain should be capable of delivering buildings proactively in the way consumer goods are being delivered. These must be totally pre-designed and pre-developed, but still be flexibility to cope with changes in the demand of the consumers (De Ridder & Vrijhoef, 2007).

5.3. Conclusion

When Product-Service-Systems will be implemented into the real estate sector companies should change their way of doing business. This could be operationalized by describing these measures in relation to business tactics. These business tactics could be categorized into five categories. These categories all have a different kind of impact on the organizational system. In this chapter the business tactics were explored and afterwards the concept of supply chain integration was introduced.

The connection with supply chain management is made because the implementation of Product-Service-System should align the supply chain and push the integration of this supply chain. According to Vrijhoef (2011) suppliers, for example, establish mutual relations with other suppliers to predevelop integrated prefabricated subassemblies and integrate their processes with each other. Project developers could, for example, develop product concepts useable for multiple projects and develop these as life cycle solutions (Vrijhoef, 2011, pp. 238-239). Therefore the different actors in the real estate sector become more interwoven and mutually dependent on each other.

6. Current real estate projects

The aim of this chapter is to define a starting point for the real estate sector to transform towards a circular real estate sector. Hereby the development process (i.e. process system) of current real estate development projects is described as well as a typical organizational system of a real estate development project.

6.1. Process system

6.1.1. Industry characteristics

When the real estate sector is compared with other industries, it becomes clear that the real estate industry stands out for several reasons:

- There is a complex network of stakeholders
- Real estate has a long time life-cycle
- Real estate is complex
- Real estate has to comply with building law
- Real estate projects should fit in their location
- Different clients and stakeholders are involved per phase in one single project
- A complete production chain is established on site for one single object

(Vrijhoef, 2011; Wamelink & Bennekom, 2010)

So, the real estate industry is often considered as a project-driven industry which is characterized by the temporality of the involved project organizations and one-of-a-kind production chain whereby one single product is the output of a complete project.

6.1.2. The development process

In practice, the development process of real estate projects is fragmented into five main phases. These five phases are defined by Nozeman et al. (2008) and Antink et al. (2014) into:

1. *Concept definition:* One or several parties take the decision to study a potential development location or idea for a real estate concept on points as market opportunities, feasibility, and social, technical and organizational points.
2. *Design:* The plan that is the end-result of the initiative phase will be further developed into a feasible in the second phase. At the end of the re-development phase there the technical design is completed, the end-users of the building are known and several parties in the supply chain are selected. The signing of the contract with the main contractor will be seen as the end-point of the (re)development phase.
3. *Construction:* This phase is also known as the construction phase. In this phase the building is actually constructed, this period therefore ends at the moment the building is delivered to the owner.
4. *In-use:* In this phase the real estate product is already officially transferred to the owner. This is only the case if the developer, owner, developer are not the same organization. This phase covers the operation and maintenance of a building over its useful life.

5. *End of Life*: This moments is when the real estate product has ended its technical, economical or functional lifespan. Most often, buildings will be redeveloped or demolished at this point in time.

6.1.3. Relationships in the development process

Real estate development projects could be seen as temporary coalitions of firms, whereby “a number of independent firm coming together for the purpose of undertaking a single building project and that coalition of firms having to work as if it were a single firm, for the purposes of the project” (Winch, 2010). Most projects are often one-off and therefore these coalitions are most often teared down after project delivery. Next to this, there is a different composition of stakeholders in each stage of the real estate development process, this is presented in table 8.

Table 8: Involved stakeholders par phase (Antink et al., 2014)

Phase	Involved actor
Concept definition	Public authorities
	Developers
	Capital providers
	Designers
Design	Developer
	Designers
	Engineers
	Consultants
Construction	Developers
	Contractors
	Material & equipment suppliers
In-use	Owner
	Developer
	Facilities manager
	End-user(s)
End-of-life	Owner
	Demolition contractor
	Recycler

Because of the different composition of stakeholders in each stage of the real estate development process, the current real estate development process focusses on transactions of products by suppliers rather than overall performance of the constructed peace of real estate (Kazemi, 2016).

As can be seen in Table 8, the developer is present in all the stages of the development processes. In contrary to many other actors involved in real estate development projects, the developer has therefore – in most cases – a long term perspective. Next to this, the developer not only has to cope with different interest, but also the huge amount of stakeholders involved in a real estate development project makes it difficult to configure and coordinate the supply chain (Antink et al., 2014).

As said before, because of the different context and project of subject, the way actors in a real estate development projects cooperate is different in every project. A rough framework wherein the relations within a project organization itself are presented in figure 12. In this figure, the phases of concept definition and design are merged into one phase because many of the involved parties are involved in both phases and the activities in both phases are quite similar. Both phases together could also be

classified as the general development process. Next to this, only the developer and owner are involved in more than one phase. The rest of the involved parties have therefore only a short-term perspective. This leads to business to business relationships and lowest cost tendering whereby the only goal is to make a building that fit current needs. This leads to the existence of a split incentive between the business models of the current supplying parties with a short term vision, based on selling their products; and the business models of users with a long term-vision, based on demand for services that fit their organization's needs (Kazemi, 2016).

At last, it should be noted that Figure 12 is not an hierarchical organizational framework, but a framework that gives a rough indication about the relations between involved parties in the supply chain of a real estate development project.

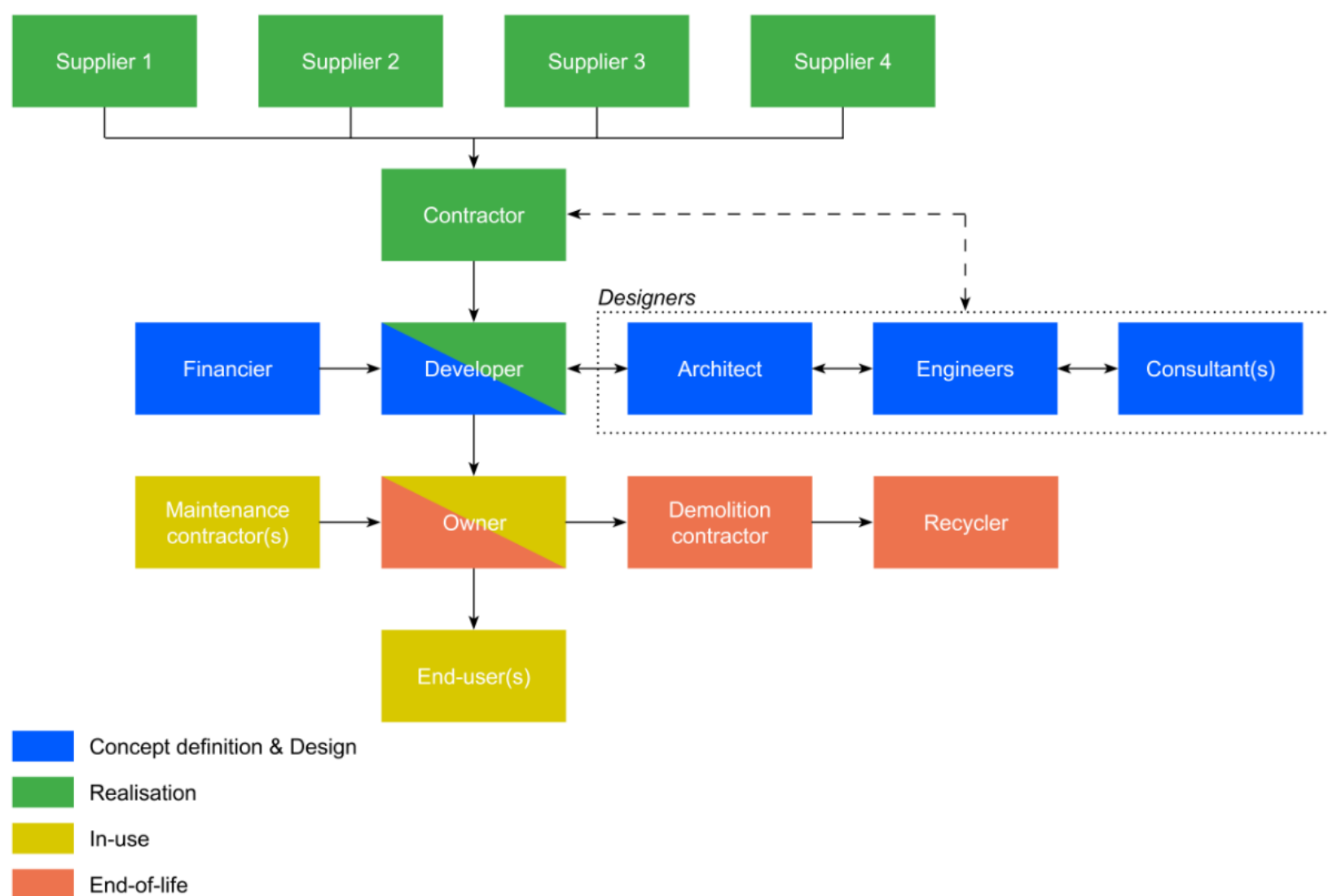


Figure 12: Relations within the current supply chain of a real estate development project. Based on Antink et al. (2014), Rampersad (2016), Kazemi (2016) and Van den Brink (2016).

6.1.4. The traditional supply chain

The traditional supply chain of the real estate sector is – as said before - characterized by the high level of segregation of different activities. Hereby the focus lies on the transaction of products, these transactions are based on relations based on economic transactions (Vrijhoef & De Ridder, 2005; Vrijhoef & Koskela, 2000). Hereby the goal is to maximize the economic profit at every transaction instead of value creation throughout the supply chain.

Hereby clients buy products if this adds value to them, suppliers produce these products when this also delivers profit to them. In the meanwhile, clients want to increase the value added and suppliers want to increase their profit. This concept is presented in figure 13.

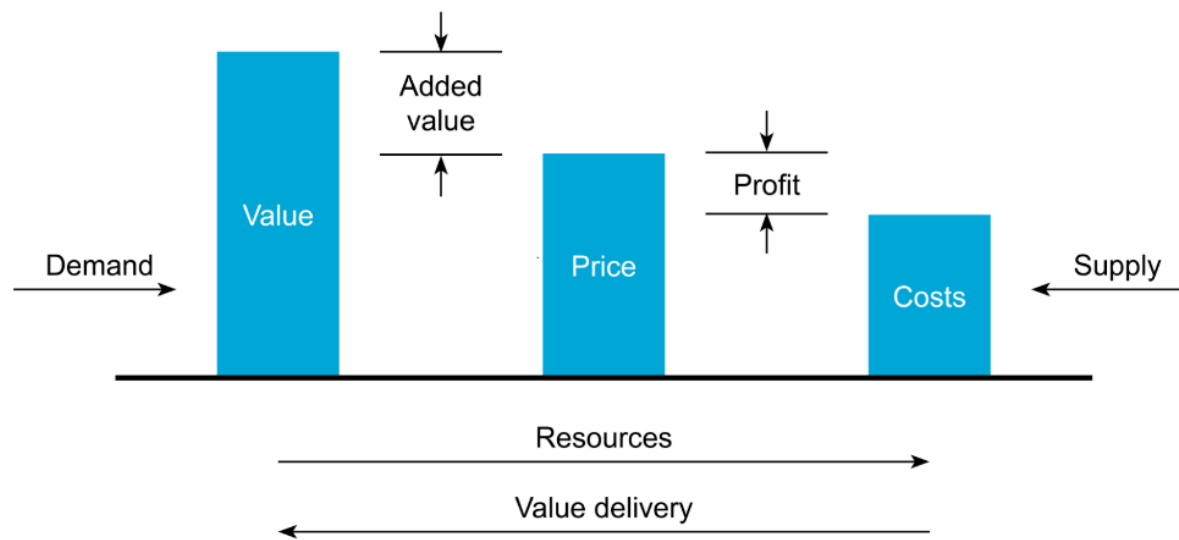


Figure 13: Basic transaction model: value, price and costs (Vrijhoef & De Ridder, 2005)

The supply chain of the real estate sector could be characterized by the next functions and structures:

- A typical supply chain in the real estate sector is set up around one single product. Hereby the 'construction factory' is set up especially for that specific product, whereas in for example the car industry, where multiple product are the output of one factory.
- This temporary supply chain produces one product, this makes it an instable, fragmented and separated supply chain. Especially the separation between design and construction is very typical for the real estate sector.
- Every project creates a new product or prototype, which makes repetition difficult. Hereby the process to come to this product can be quite similar if projects are of a similar kind.

(Vrijhoef & Koskela, 2000)

Figure 14 shows the typical configuration of a traditional supply chain, in this figure it can be seen that the current supply chain forms a rather linear process. This implies that organization can handle independently from each other and handle in their own interest (Winch, 2010).

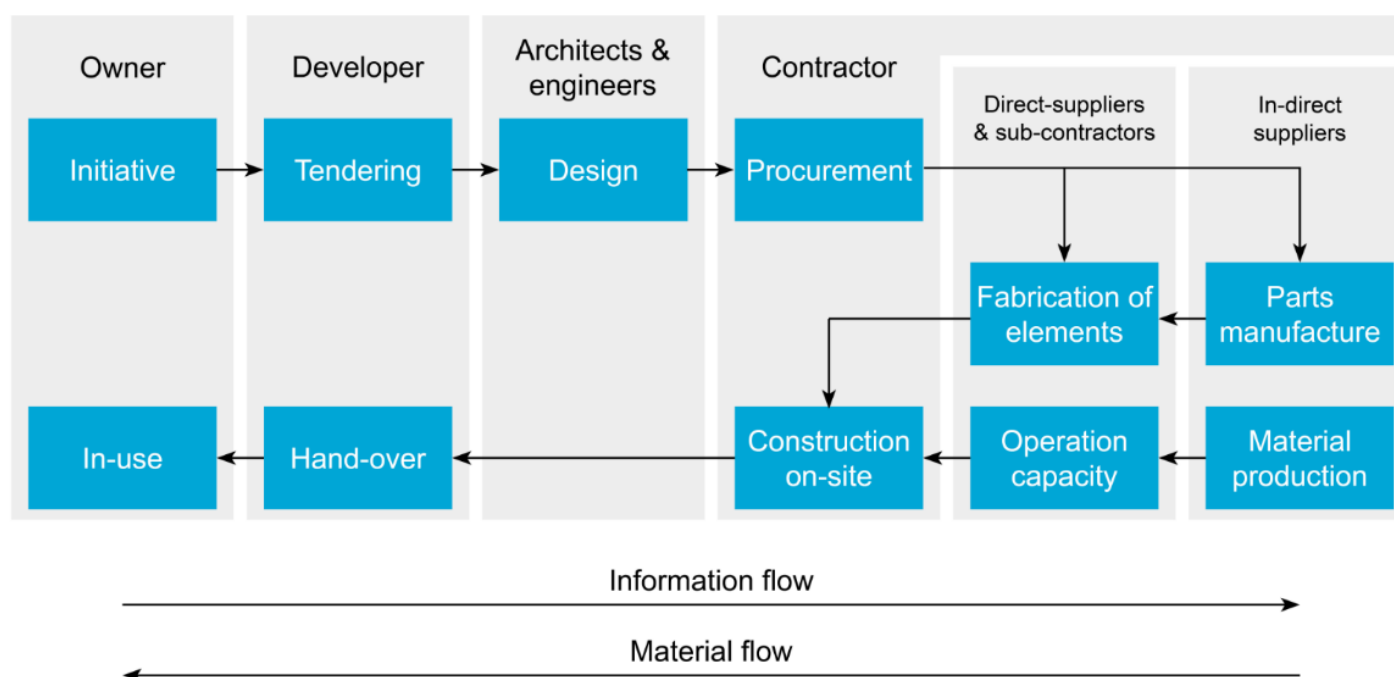


Figure 14: Typical configuration of a supply chain in a real estate development project (Vrijhoef & Koskela, 2000, p. 173)

Next to this, also the way buildings are actually being build is quite conservative. De Ridder and Vrijhoef (2007, p. 877) elaborate this by stating that “ the majority of people working in the sector assume that the world does not change during the lifetime of a building”, this can be concluded from the ongoing trend contracts that cover multiple tasks (from construction to maintenance, financing and

operation) are outsourced over long periods (for example 40 years). In these contracts, fixed outputs and prices are established. Hereby end-users and innovative suppliers are excluded and the contractual parties create high risks for themselves. By doing this, buildings are created with “yesterday’s technology, with today’s ideas for tomorrow’s people” (De Ridder & Vrijhoef, 2007, p. 878).

At last, the position of the client is very weak and supplying parties are able to abuse their power in the supply chain. This because of so-called ‘project-statics’ (De Ridder & Vrijhoef, 2007). This means that, supplying parties are expected to deliver what is put in the initial brief established by the client. If changes occur in this brief, these supplying parties make much more profit by introducing high transaction costs. In the perspective of the client this is quite unfair since this actor mostly does not have a clear image what his demands are at the very start of a project (De Ridder & Vrijhoef, 2007).

6.2. Organizational system

6.2.1. Developers

As can be seen in figure 12, the developer is the ‘spider in the web’ in a real estate project and is considered to have the most influence in a project since this actor acts most often on behalf of the client. In this research, special attention will be paid to this actor since it can be assumed that this actor will undergo the biggest change in a shift towards a Circular Economy and has the position to incentive other actors to make a shift towards a CE possible.

Tasks & responsibilities

The added value of a developer is that this actor initiates, manages and steers a project on its own time, costs and risk. This return will be created by putting bricks and mortar together by the development team. By doing this, the developer creates value which lies in the fact that usable space will be provided over time with associated services (Miles, Berens, Weiss, & Urban Land Institute., 2000, p. 4).

According to Miles et al. (2000) a general characteristic of a developer is that he is proactive and want to make this happen. Next to this, real estate developments involves long-term commitments and mistakes are extraordinary expensive. Regardless of the division of risk in a project, the developer is responsible for managing all aspects of a project and must be able to act under high pressure and high uncertainty (Miles et al., 2000).

The overall goal of a developer is to create “[...] maximum possible return with a minimum commitment of time and money, at lower possible risk.” (Miles et al., 2000, p. 36). The return can be a mixture of the next components:

- The development fee, which is a direct compensation for developing the project
- Profits deriving from sale to long-term investments
- A long-term equity position
- Personal and professional satisfaction
- Enhanced reputation

Risk & revenues

Generally speaking, a developer invests time and money into a project with the goal to create maximum possible revenues. These revenues will be maximized if (1) the right products are delivered (2) at the right moment on (3) a desired location.

This uncertainty and pressure relates to the fact that developers create, imagine, fund, control and orchestrate the process of development from beginning to end. By doing this a developers takes the biggest risk in a project, but typically receives the greatest rewards (Peiser & Frej, 2004, p. 3).

6.3. Conclusion

In this chapter, an overview of the current real estate development process as well as an overview on the project organization of a typical real estate development project is given. Hereby, special attention is given to the role of the real estate developer.

From this, it can be concluded that current real estate development projects can be characterized by its complex network of stakeholders, different and complex networks of stakeholders in every phase, technical complexity of the built facility, inference from the context location and the segregation of different activities.

The project developer is the central organization in the project organization and therefore the 'spider in the web'. This organization also has the biggest influence since this actor initiates, manages and steers a project on its own time, costs and risk.

7. Circular real estate projects

This chapter introduces a possible process and organizational system of a circular real estate development project. The main input for this chapter is the description of chapter 5, wherein the concepts of servitization and supply chain management are introduced. This concept is faced with the description of the current real estate sector from the former chapter.

Similar to the former chapter, the description of the process system of a circular real estate development process is introduced before the related organizational system is described.

7.1. Process system

7.1.1. The development process

A possible process system of the real estate sector is based on the introduction of servitization within the real estate sector and the description of the current real estate sector in chapter 4 and the organizational system of different actors in the first two sections of this chapter. There is in literature no clear model or precedent available of a servitised process system in the real estate sector. Therefore the literature review presented in former chapters is combined with available literature of Vrijhoef (2011), Kazemi (2016) and Van den Brink (2016).

Concept definition

As opposite to the traditional real estate development process, a circular real estate development process starts with the end-user in mind instead of exploring market opportunities and financial feasibility. This leads to an end-user centred design process whereby consumers look for performance ambitions and service provider try to provide these by integrating services provided by service suppliers. In the concept definition phase, the initial performance requirements are inventoried and the service provider makes a rough selection of possible service suppliers to meet the desired requirements. This leads to early involvement of the service suppliers.

Design

In the design phase, a definite selection of the service suppliers is being made. The early involvement of the service suppliers is important because the design of the building is subordinate to the available products. This leads to a different way of designing. Traditionally, the architects designs a building and selects afterwards the appropriate materials to realize the design. In a circular real estate development project, the task of the architects is to make a design of the building based on the available products and their related services. This involves a joint-decision making process between architects, engineers, the service provider and service suppliers to integrate the different products in order to develop one building and to enhance the overall performance of the constructed building.

Construction

In general, the service provider is responsible to deliver services towards the consumers and the service suppliers are responsible for the performance of the individual delivered services. In this perspective, it are the service suppliers that are being responsible for constructing the building. But since construction is complex and service suppliers would be extremely mutual dependent on each other during construction one focal organization is needed to orchestrate the construction process itself. Therefore the involvement of a contractor remains necessary. The responsibilities of the

contractor would therefore to merge the different products into one built facility. Hypothetically, this could also be service-based and therewith the contractor delivers ‘construction as a service’. After delivery, the contractor might become responsible for the connecting parts of the different products.

In-use

As mentioned often before, the maintenance and operation of the services and the products will be done by the service suppliers. Needless to say, when during the in-use phase of a building the consumer wishes to change the performance requirements, the service suppliers are responsible for changing the delivered services and products.

End of Life

When the consumer decides to end the end-user agreement with the service provider or decides to change the performance requirements in such a way that one or more service suppliers cannot deliver their services anymore, the service supplier(s) should take back their products. These products must then brought back into a closed loop.

7.1.2. Relationships in the development process

The description of the activities per phase of the former chapter are combined with the description of the organizational system in section 7.2 to get an overview of the relationship in the development process of a circular building. First, an overview is presented of the involved actors per phase in the project and second the relationships are presented visually.

As can be seen in table 10, the composition of stakeholders of a circular building project differs remarkably from the composition of stakeholders in a traditional real estate development project of table 8.

Table 10: Involved stakeholders per phase

Phase	Involved actor
Concept definition	Public authorities
	Service provider
	Consumer
	Service suppliers
	Financier
Design	Service provider
	Consumer
	Architect
	Engineers
	Service suppliers
	Financier(s)
	Consultan(s)
Construction	Service provider
	Consumer
	Service suppliers
	Contractor
In-use	Service provider
	Consumer
	Service suppliers
	Contractor
End-of-life	Service provider
	Consumer
	Consumer

The most obvious difference between Table 10 and Table 8 is that the Consumer, Service Provider and Service suppliers are present in all the phases. This is because their roles are stretched forward and/or backward into the supply chain compared to a conventional real estate development project. This makes a circular real estate development project less fragmented than the earlier explained conventional real estate development project.

Because of their extended involvement throughout the real estate project, the service supplier (former supplier) gets a long-term interest in the real estate development project. In the conventional real estate development project, only the project developer (now service provider) has a long term interest in the project. Since the three 'main' actors in the organizational structure of the project now have a long-term perspective and are increasingly mutually dependent on each other, it can be assumed that the level of collaboration and herewith the efficiency within a real estate development project will increase.

Although the way actors collaborate differs in every real estate project – also in a circular real estate development project – an attempt is made to visualize the relationships within a circular real estate development project organization, see figure 15. In this figure the relationships and dependencies are presented across the different project phases. It should be noted that Figure 15 is not an hierarchical organizational framework, but rather a framework that provides a rough indication about the relationships between the involved parties in the supply chain of a circular real estate development project.

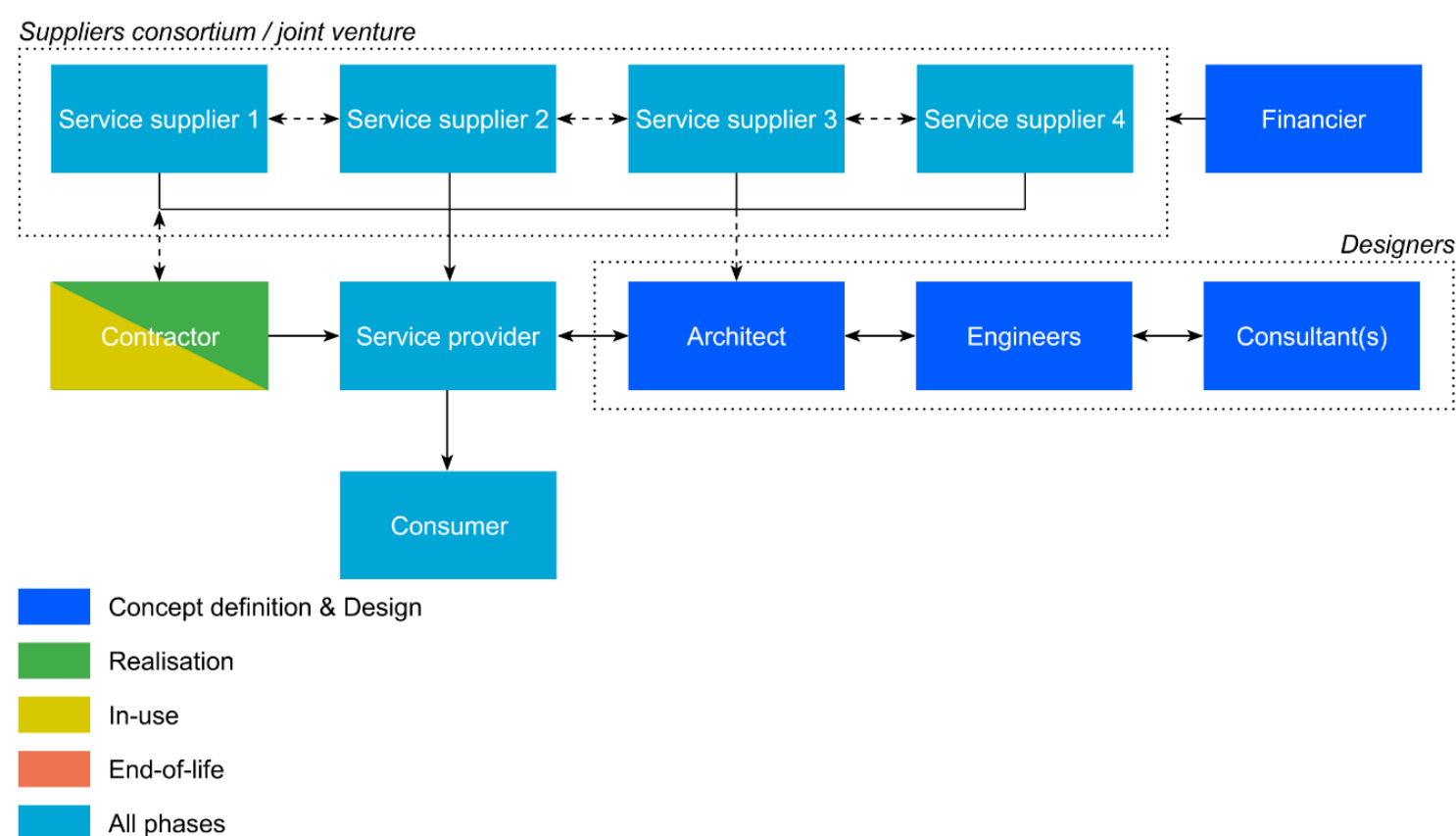


Figure 15: Relations within a circular real estate development project (own ill.)

As can be seen in figure 15, a circular real estate supply chain is less hierarchical than the supply chain of a conventional real estate development project, presented in figure 12. Also, the supply chain of a circular real estate development project could be typified as a network structure instead of a top-down flowchart. This relates to the needed collaboration and the appearance of joint ventures or consortia of suppliers to deliver a circular real estate development project.

In a circular real estate development project less actors are directly involved. This can be explained by the fact that existing organization extend their scope and integrate backward and/or forward into the supply chain, hereby taking over tasks and responsibilities of other actors.

7.2. Organizational system

In his research, Van den Brink (2016) makes distinction between two different kind of service providers, based on a study by Baines and Lightfoot (2013):

1. *Pure service providers*; they focus on delivering services without having any physical, underlying product. This are for example consultancy firms.
2. *Manufacturing service providers*; this are combinations of manufacturers and pure service providers. This kind of company offers services based on underlying products.

Service suppliers vs. service providers

The second kind of service providers [manufacturing service providers] have a lot in common with the aforementioned definition of buildings and related performance and services. It has to be taken into notice that the abovementioned service providers are different kind of service providers. The service providers of Baines and Lightfoot (2013) are in the perspective of the Circular Economy service suppliers, since they only supply products and do not provide, in the perspective of the real estate sector, the whole building. Therefore a distinction should be made between service suppliers and service providers.

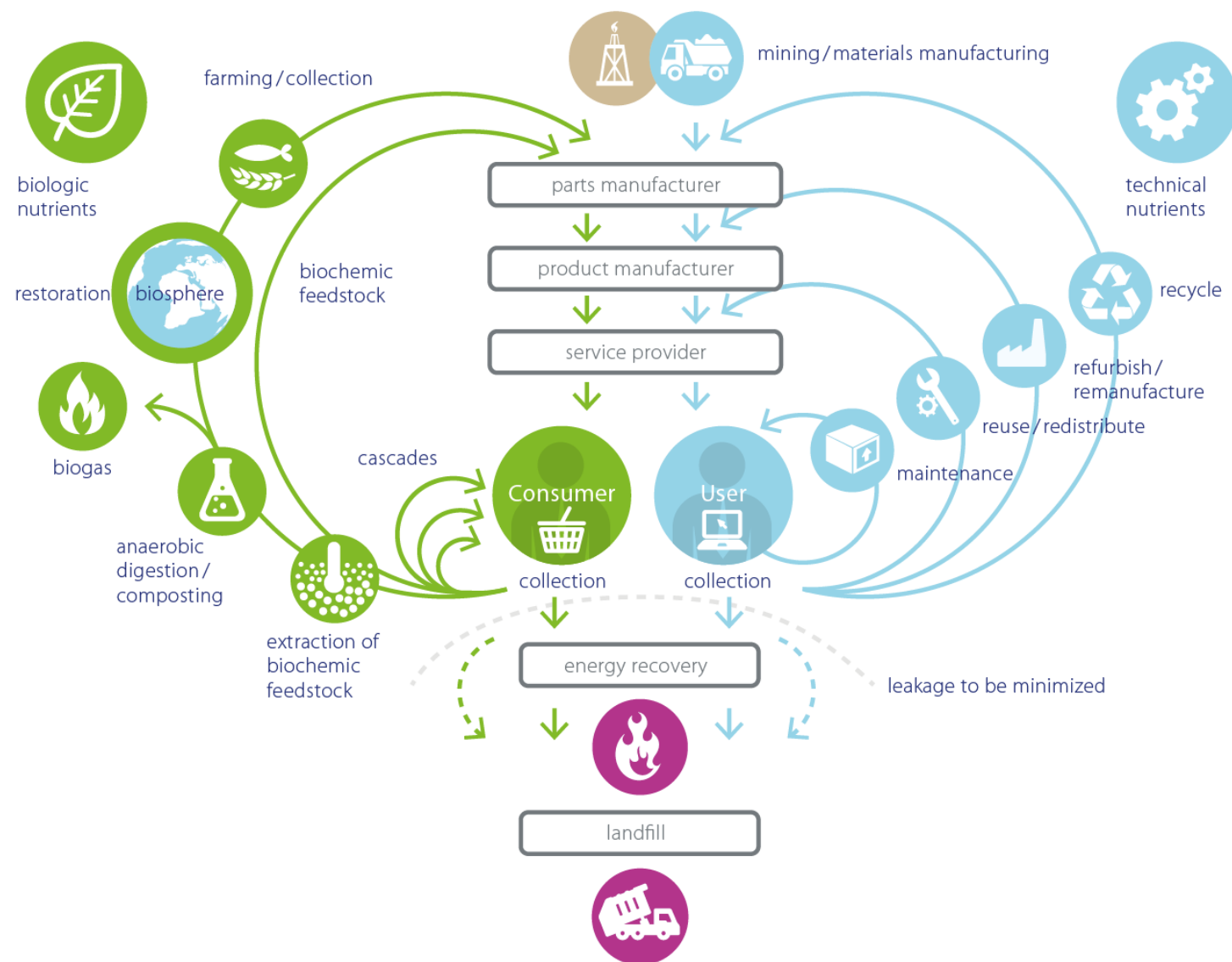
- *Service suppliers*: are the traditional suppliers of products, but in the CE they provide these products in the form of services. This are manufacturing service providers, they will be introduced in section 7.2.2.
- *Service providers*: are the organizational ‘spiders in the web’ aligning demands of the clients with services provided by the suppliers. This are pure service providers. These will be introduced in section 7.2.1.

Therefore both service providers and service suppliers are being defined in this section. While defining the role of the service provider, it became apparent that also the role of the client – being the consumer in the perspective of the CE – is also important. Therefore the organizational system of the service providers, service supplier and consumer will be discussed in this chapter.

7.2.1. Service providers

If the real estate sector shifts towards a Circular Economy whereby Product-Service-Systems are put in place, some pressure will be put on the collaboration between supplying parties to collaborate for a longer period. This is difficult to arrange since historically parties in the real estate sector do not often partner together since there is no strong focal firm on the supply side (Van den Brink, 2016). In the CE, this central organization is present and is called the service provider. This party is placed in between the supplying parties, clients and the other stakeholders in the project organization.

The Ellen MacArthur Foundation (2013a) also proposed the idea of a service provider as a central organization, but this service provider is not defined clearly and is presented as a fixed organization with unclear relationships and operations, see figure 16.



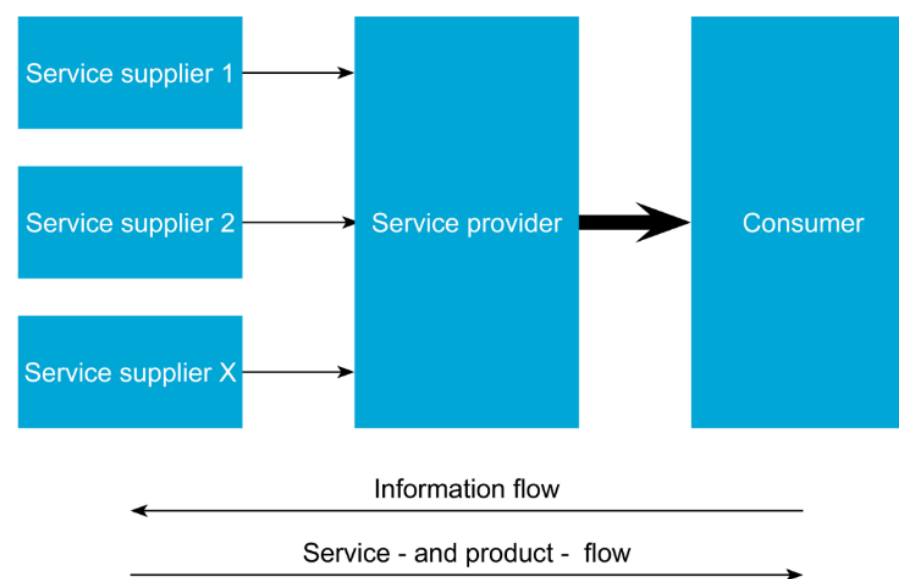


Figure 17: Configuration of a possible circular supply chain (own ill.)

This has some practical implications, according to Kazemi (2016, p. 127) the service providers is responsible for translating the consumer functional demand into innovative solutions, hereby aligning the different services provided by the service provider in a physical and performance-service perspective. Next to this, the service provider “[...] should make a platform for joint decision making between the team and the suppliers, since the suppliers have the best knowledge regarding the components [and related services, red.]” (Kazemi, 2016, p. 127).

Risks & revenues

The added value of the service provider in the real estate sector becomes clear when we refer back to the concept of supply chain integration. In a circular real estate sector, the service provider would be the what Vrijhoef and De Ridder (2005) call the demand and supply system integrator. This because the service provider is responsible for managing the transaction between the service provider and the consumer(s), and the transaction between the service provider and the supplying parties. The service providers gets a coordinating role within the supply chain.

Hereby the service provider stands in direct contact with the consumer and with the different service suppliers, the service provider becomes hereby the main contact point for the consumer and respectively for the individual service suppliers.

In the current real estate sector, the real estate developer takes the biggest risk in a project, because this actor invests his own (or loaned) equity (Peiser & Frej, 2004, p. 3). This business model will probably no longer function anymore in a servitised Circular Economy because the service provider (former real estate developer) does not have to purchase any physical goods anymore to develop a building. This stems from the theory that suppliers will remain ownership over their delivered materials. Therefore it are not the service providers that need the biggest portion of funding to build and deliver real estate projects. But it are the service suppliers that need long-term equity funding, see section 7.2.2.

So, what is then the added value of a service provider in a servitised Circular Economy? As said before, the service providers delivers a services towards the consumer in the form of a constructed building. This building is tailor-made to the client’s specific demands, hereby the service provider should make sure that the delivered services meet a certain performance level over a determined period of time by prescribing a total quality approach and specify proper compliance or the supply chain (Van den Brink, 2016; Vrijhoef, 2011, p. 238). Hereby the service provider takes over responsibilities and tasks from the consumer. De Ridder and Vrijhoef (2007) explain that hereby the

demands of the consumer remain on a higher aggregation level. At last, the service providers deliver the actual building and manages the entire development (Vrijhoef, 2011, p. 238).

In the perspective of the suppliers, the service provider adds value by providing incentives to innovate, test new methods and work more efficiently and effectively. Hereby suppliers are in a way forced to establish mutual relations with other suppliers and form consortia or joint ventures (Vrijhoef, 2011). As discussed further in this chapter, suppliers will develop specific and generic systems for service delivery towards consumers. This system delivery will potentially lead to scale benefits which could lead to more stable revenue stream in the long term, see also section 7.2.2 about Service suppliers.

Box 1: Underpinning of the changing role of the real estate developer in a circular real estate development project

Real estate developers as service providers

In his thesis, Van den Brink (2016) concludes that the question: ‘How does this organization [the service provider, red.] relate to the current supply side stakeholder in the construction process?’ remains unanswered. However, in the interviews held by Van den Brink it was said that developers and contractors see themselves as the new service provider since they are already the coordinating and assembling party within the real estate sector.

Next to this, in the different business models developed by Van den Brink (2016) it is assumed that the roles of the main-contractor and developer will disappear when a consortium is formed to realize circular real estate development projects. Currently, these parties play a central role within the real estate development process and it is highly probable that these parties do not want to forfeit their positions in the real estate sector.

As said before, the real estate developer is ‘the spider in the web’ between the involved actors and plays the role of client for the supplying parties (Nozeman, Fokkema, Laglas, & van Dullemen, 2008). Because of their current position in the real estate sector, they have a large impact on changes within the real-estate chain. It can be hypothesized that they will change their role into a service provider since this party will also act as a central ‘spider in the web’ and be responsible for the transaction between the service provider and the client / user(s) as well as the transaction between the service provider and the supplying parties. Hereby the service provider is responsible for the overall performance of the delivered services, which is comparable with the current tasks and responsibilities of a real estate developer.

7.2.2. Service suppliers

Manufacturers and suppliers in the current real estate sector become service suppliers in the Circular Economy. As said before, they will not sell products anymore, but lease products to clients according to the service a product delivers. Hereby their involvement and responsibility will be extended throughout the life cycle of the product and related materials (Mont, 2002).

Tasks & responsibilities

Since consumers only define what services they want, the biggest challenge for suppliers is basically reversing the supply chain. This means that the supply chain should be capable of delivering buildings proactively in the way consumer goods are being delivered. These must be totally pre-designed and pre-developed, but still be flexible to cope with changes in the demand of the consumers (De Ridder & Vrijhoef, 2007). Moreover, “[...] the supplier offers products that are based on Circular Economy requirements: nontoxic, with specific performance level and flexible [and should be fully recyclable or reusable, red.]” (Kazemi, 2016, p. 128).

The introduction of a 'Living building Concept' reduces the role of the client within the development process of a building. Normally demand is leading supply, but in a Circular Economy in the real estate sector supply is leading demand. 'hereby suppliers must respond adequately do the demands of consumer. Hereby suppliers must keep services 'fit for purpose' during the lifecycle of a project, under changing conditions and changing demands of the consumer itself (De Ridder & Vrijhoef, 2007). The flexibility of servitization makes it possible for supplier to introduce new technologies, concepts and materials during the contractual period. This could boost innovation and efficiency within its organization and between its partners (De Ridder & Vrijhoef, 2007).

In her master thesis, Kazemi (2016) conducted several interviews. One of the topics of these interviews was the collaboration between supplying parties. Hereby one of her interviewees made an interesting statement about 'complex components':

"For example, you have these joint ventures between Philips and Douwe Egberts they had a joint venture to make a coffee machines and one of them supplied the coffee and the other one the machine, and they'd made something together and they had a new market proposition. And that was a very fruitful successful cooperation. And they worked a long for a very long time together. They had the same focus and the same interest and I believe that if you would like to have CE being successful, then the focus of all those organizations within the chain should all be on the long term effects, the life cycle of the asset." (Kazemi, 2016, p. 128).

This refers back to the implications of the LBC 'push market' described by De Ridder and Vrijhoef (2007). Hereby bottom-up organizational chains could be used to delivered integrated and scalable solution to delivers services to consumers. According to Vrijhoef (2011, p. 238) these concepts establish integrated processes from design to delivery, whereby different suppliers must work together to develop an integrated concept. Moreover, next to extending their scope forward into the supply chain, supplier integrate their processes with other parties such as the builders. Hereby suppliers might take over some tasks of the traditional contractor.

Kelly and Male (2001, in De Ridder & Vrijhoef, 2007) explain that it is essential that client value is captured by integration of 'the team' (i.e. service suppliers and service provider) from the initiation of the project throughout the whole project lifecycle. This should lead to advanced supply strategies, which is also beneficial for their own organization. This implies that working together in a circular real estate sector will be more complex for the involved supplying parties when compared to contemporary real estate development projects. Therefore there needs to be a tighter organization on the supply side's part in a circular real estate sector as the need to work together will increase (Van den Brink, 2016).

Risks & revenues

Suppliers must extend their strategies beyond project delivery and change their model into 'continuous value delivery', also known as 'life cycle value delivery' (De Ridder & Vrijhoef, 2007). Hereby the industry delivers value in the form of services, suppliers must therefore shift from a delivery system in a price-based environment towards a higher level of performance-based competition (Parmar et al, 2004, in De Ridder & Vrijhoef, 2007).

In practice, the service suppliers are paid periodically based on the overall performance of the delivered services. Hereby the liability of the quality of the overall performance remain at the service suppliers (Kazemi, 2016; Stahel, 2008; Van den Brink, 2016).

Because the consumer is able to change its demands during the whole project lifecycle (from initiative to end-of-life) some risk is put on the shoulders of the suppliers to keep the delivered services up-to-date with the demands of the consumer. Hereby the responsibility for the costs associated with changing the delivered products lies at the supplier. Therefore the suppliers must be sure the delivered products are designed in such a way that they are able to adapt appropriately.

7.2.3. Consumers

Tasks & responsibilities

The role of consumers change as well when shifting towards a servitised real estate sector. Instead of being a client a procuring different products and establishing concrete specifications for products. Clients will become consumers and establish frameworks for ‘procurement space’. Hereby it is necessary to know “ what value against what costs is delivered, but leave open the way how this is achieved” (De Ridder & Vrijhoef, 2007, p. 884). Because of servitization within the ‘Living Building Concept’ the consumer can easily change his demands and therewith changing its building. Next to this, decision making is easier and makes the building better suited to its demands compared to current practices (De Ridder & Vrijhoef, 2007).

However, according to Loppies (2015), the service supplier should have a certain freedom in the way he delivers services. If the performance requirements are too much detailed, the ability and/or possibility of service suppliers to deliver services it too much narrowed. This hampers the attractiveness for supplier to join a project because a supplier wants to deliver its standardized subsystems.

Risks & revenues

As said before, the consumer does not receive ownership of a certain product that delivers him the service, but just leases the user rights. Therefore the consumer receives actually value for money instead of products for money. The added value for the consumer herein lays that the consumer just pays for the delivered services and not for transactional costs made throughout the supply chain (Kazemi, 2016). This creates value-added services for consumers, according to Reim et al. (2015, in Kazemi, 2016) there are three different business models possible when delivering services, hereby value can be categorized into value creation, value delivery and value capturing, see table 9.

Table 9: Comparison of PSS business model (Kazemi, 2016)

	Product-oriented	Use-oriented	Result-oriented
Value creation	Provider takes responsibility for the contracted services	Provider is responsible for the usability of the product or service	Provider is responsible for delivering results
Value delivery	Provider sells and services the product sale and service (e.g., maintenance or recycling)	Provider assures the usability of the physical product along with service	Provider actually delivers result
Value capturing	Customer pays for physical product and for the performed services	Customer can make continuous payments over time (e.g. teasing)	Customer payments are based on outcome units, they pay for the result

In a PBC, the price is based on the actual delivered performance during the in-use phase of a project. This creates an incentive for supplying parties to work more efficiently and reduce their transaction costs. As stated before, the network of partners is important to enhance the performance of the delivered services in the supply chain. Opposite to the arrangement of legal matters in the current real estate industry, the relationship between parties should start with building a relationship, then talking about organizational issues and finally arranging the legal aspects. This creates common understanding of all demands and possible solutions, before the project is organized and fixed in a contract (De Ridder & Vrijhoef, 2007). According to De Ridder and Vrijhoef (2007) this should lead in the end to equal partnering based on mutual cooperation. Joint interests are hereby guaranteed and transaction costs should be diminished.

Requirements & rules

In order to receive the appropriate service, the contract-agreement between the consumer and the service provider should define the correct performance indicators, terms and conditions. Next to this, the end-user is responsible to pay a periodic payment to the service provider (Kazemi, 2016).

7.3. Conclusion

In this chapter, a possible process system and organizational system of a circular real estate development project is explored and presented. The main differences with a conventional / current real estate development project is the way value is delivered. Hereby involved actors have to reverse their way of thinking and should think in delivering value for the client instead of revenues for themselves.

This influences the development process in many ways. For example, designers have to make the design of the building based on the available products and their related services. During construction, the contractor will only provide 'construction as a service' and the current power in the supply chain of this actor will hereby evaporate. Another important conclusion is that the number of actors in the project organization is less compared with a current real estate development project. This means that existing parties disappear but the tasks and responsibilities of organizations in a circular real estate development project will increase. Because the number of tasks and responsibilities will increase, these organization receive a long-term commitment to the project. Next to this, the project organization of a circular real estate development project is less hierarchical than a conventional one.

In the second part of this chapter, three main actors in a circular real estate development project are discussed. Since these actors become more interwoven with each other, the way these actors collaborate and interact with each other in a real estate development project differs from the conventional approach. In the end, it is all about aligning the demand of the consumer with the different service supplied by the service suppliers.

8. Dissemination

The objective of this chapter is to make clear for who the results of this research are relevant and for which reason. This is done by explaining the deliverables of this research project and their relevance from different perspectives.

8.1. Deliverables

In the perspective of the author, the deliverables and outcomes of this research are twofold. This implies that there are deliverables for science and deliverables for practice.

8.1.1. For science

The conclusions of the graduation research itself relate to possible instruments and means that could be used by real estate developers to incentive suppliers to accept their new role and responsibilities and to convince financiers to invest in servitised real estate projects.

8.1.2. For practice

The outcomes of the graduation process and related graduation internship will be a kind of 'service menu'. In this menu, consumers could choose different types of services on different service levels. Behind these standardized packages lie standardized organizational systems / design methods / development processes and / or product systems.

8.2. Relevance of results

8.2.1. Societal relevance

As described in Chapter 1, the Dutch government opts to transform the Dutch economy into a Circular Economy by the year of 2050. This research will stimulate this shift by providing concrete means and instruments that could be used by real estate developers to incentive a shift of the real estate sector towards a Circular Economy. This helps to reduce the real estate sector's impact on the environment in terms of loss of resources, energy use and raw materials detraction.

8.2.2. Scientific relevance

The shift of the real estate sector towards a Circular Economy is not happening because of the ongoing discussion between market parties about the occurring shift in responsibilities, liabilities and ownership. Many graduates and scholars such as Kazemi (2016), Van den Brink (2016), Stigter (2016), De Grauw (2015), Kok et al. (2013), Van Staveren (2016) and Mentink (2014) have studied the implementation of the Circular Economy in the construction / real estate sector. But all failed to come with a clear solution to overcome these obstacles.

The recommendations and conclusions drawn in this research will add knowledge upon the already existing body of knowledge about the implementation of the Circular Economy in the real estate sector. And, most important, the outcomes of this research try to help to overcome the existing barriers that exist in practice.

Side note: *This report is written halfway the research process, therefore the promise that the outcomes will actually break down existing barriers.*

In contrast to the abovementioned research project, this research project mostly focusses on the implementation of Performance-Service-Systems in the built environment. The former research projects didn't take this perspective exclusively. Next to this, this research project is written from the perspective of the real estate developer and fits also in the wider context of a more user-centred approach of real estate development.

8.2.3. Sectoral relevance

In all the above mentioned research projects, the researcher was confronted by the above mentioned obstacles and did not provide a clear solution to overcome these. The goal in this research is to remove these obstacles by primarily focusing on Product-Service-Systems. It is assumed that if PSSs could be introduced in the real estate sector, the transition of this sector towards a Circular Economy is already there. These obstacles will be removed by focusing on case studies whereby already products as service or other types of services are implemented. The lessons that can be drawn from these cases could be generalized into a wider context.

Besides the fact that the outcomes of this research contribute to the implementation of a Circular Economy into the real estate sector, but also support the implementation of business service models and provide a new perspective on real estate development.

The 'service menu' could function as inspiration for the graduation company to enhance their service provision towards their future clients and could hereby support the implementation of their new business strategy.

8.3. Conclusion

The outcomes of this research project are targeted to be twofold. The conclusion of the research are possible instruments and means that could be used by real estate developers to incentive suppliers to accept their new role and responsibilities and to convince financiers to invest in servitised real estate projects

Therefore the conclusion and recommendations of this research project are relevant for science since they try to overcome an already often analysed problem and could be used by real estate developers that want to go 'circular' or work more service based.

Another deliverable of this research project would be a kind of 'service menu', this service menu could support the implementation of the new business strategy for the graduation company.

9. Planning

Start - P2

During the period before the P1, an explorative literature review was conducted. This type of literature review was conducted until some week after the P1, until the main research direction was defined. Hereafter a period started whereby a more systematic approach was used to review the existing literature. In the meanwhile, explorative interviews were conducted and the graduation internship at OVG Real Estate started. In the first month of the graduation internship, the focus lay on the definition of case studies, development of the theoretical framework and writing the P2 report.

P2 – P4

At the moment the P2 took place, the systematic literature review is not completely finished, the case study protocol must be further defined and still some explorative interviews have to take place. Goal is to finish these before the summer holiday starts.

When these documents are ready, the actual case study research could start after summer. It is also possible that some information about the case studies is gathered before the summer break starts. In the 1,5 month after the summer break, the case study research will take place.

The goal is to have processed the outcomes of the expert panel into a report during P4. Since there are only 4 weeks between P3 and P4, the expert panels should take place in the weeks around P3. This means that the ‘lesson drawing’ should take place in the first two to three week of October and the cross-case synthesis in the last two weeks of September / the first two weeks of October.

P4 – P5

The aim is to have the biggest part of the conclusions and recommendations ready during P4. This gives time in the period between P4 and P5 to develop a ‘service menu’, which is the practical outcome of this research. Next to this, by having as much conclusions and recommendations ready during P4, the mentors can provide feedback on as much outcomes as possible and there is enough time enhance the quality of the conclusions, recommendations and the report in general.

The above described scheme is presented in figure 18, a larger version is added in Appendix D.

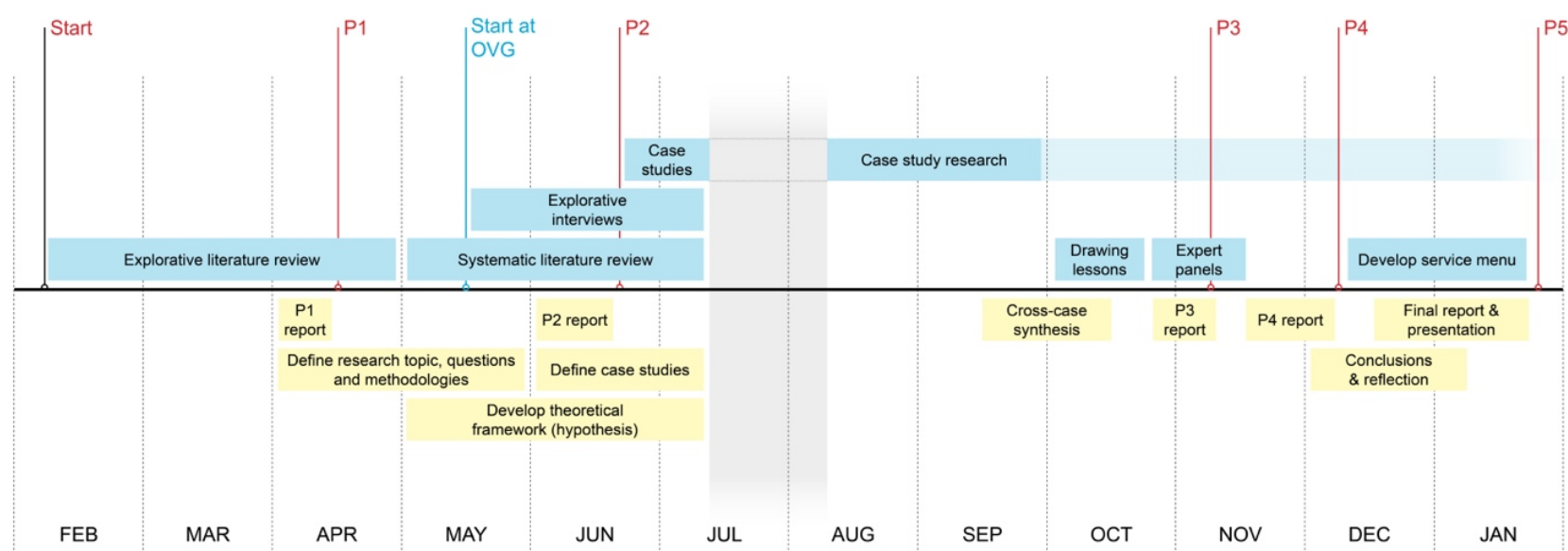


Figure 18: Time planning (own ill.)

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10. Reflection

The aim of this chapter is to reflect upon the research process of the last semester. This reflection hereby focusses on the research topic, process and methods.

10.1. Research topic

10.1.1. Position within the graduation laboratory

This graduation project takes places in the 'Circular Urban living Lab' (CULL), which is related to the chair of Urban Development Management (UDM). At the start of the research process, the focus lay on the development of urban areas and the way public parties could steer circular urban projects in practice. This fitted perfectly in the subject of the graduation laboratory since it combined the concepts of Circular Economy and Urban Area Development.

In the meanwhile, the research topic shifted towards circular real estate development projects, whereby a connection was found with Design & Construction Management (DCM). Hereby the connection with UDM became less tight.

However, in the 'Graduation Research Projects'-handbook⁶ it was stated that the final result of the graduation projects "[...] include tested decision-making, governance (other types of) models for circular development projects and urban living labs, and practical circular urban and real estate development guidelines for the building industry and municipalities". Still, the end-result of this research project relate to decision-making and governance-models for circular development projects. Hereby a same kind of product will be developed, this product relates however to a different scale-level.

Next to this, as can be seen in the Conceptual Steering Model discussed in Chapter 4, the context of these circular real estate developments is taken into consideration while analysing the case studies. Hereby the contextual influences are analysed using the PESTLE-framework, therefore the interaction between public and private parties and other types of collaborations and interactions are taken into account.

10.1.2. Relevance of the research topic

In the original description of the CULL-laboratory, the focus lie on 'effective decision-making and governance models', with a focus on public-private interaction in order to incentive the development of circular urban and real estate development project. This implies a focus on public-private interaction.

Focusing on the collaborations and behavior inside the project organization (private-private) enhanced the relevance of this research since it targets on the biggest obstacles to overcome in a shift towards a Circular Economy for the real estate sector. Secondly, the connection of this graduation research project to a graduation internship enhanced the relevance of the outcomes since they apply to existing challenges that are currently relevant in the graduation company.

⁶ MBE Graduation Research Project spring 2017, MBE Graduation Laboratory AR3R010, Department of Management in the Built Environment, Faculty of Architecture and the Built Environment, TU Delft

10.2. Research process

10.2.1. Personal note

As said before, the research process had quite an iterative character. The relating ambiguity and uncertainty about the research topic and the research process were challenging.. Since I have quite a 'result-oriented'-mindset, the iterative part (whereby time was 'spilled' reading literature that proved later to be not usable) was exhausting. This sometimes caused damage to the overall motivation. However, because of the passion for the subject and the drive to make the best out of the graduation project, the motivation was always found back.

10.2.2. Progress so far

However, in general, the research process went quite well so far. Until now, the biggest amount of time was spent reading literature about the subject, theories and research methods. In the beginning the search for literature was quite explorative and iterative and transformed slowly towards a more systematic search for literature.

When looking at the review of the literature, it can be seen that already a chapter is written about the role of the service provider in a circular real estate sector. However, the part of the literature review that relates to service provision itself is not completely finished. Therefore the part of the literature review that is described in the Chapter 5 should be adjusted.

Another point that could be approved is the style of reporting. Especially during the weeks before the P2 one of the most difficult things was to find a proper way to structure the report. At this moment, the report itself is already quite lengthy and in order to prevent a 'monster-report' at P4 / P5, the reporting style and report structure should be reconsidered.

At last, one of the research methods between P1 and P2 was to hold 'explorative interviews'. Hereby the goal was to have as much of these interviews as possible before the P2 in order to sharpen the research problem and theoretical framework. However, only two real explorative interviews were held so far and these interviews were also not really about the research topic itself. However, during some meetings with colleagues (of which some former graduate students that graduated on a thesis about the Circular Economy) gave me some fruitful insights and direction. In retrospect, it was better if more explorative interviews were held. On the other hand, the meetings at OVG provided me with a solid basis.

10.3. Conclusion

Although the research topic has made a shift away from the original research topic and the graduation laboratory, the graduation topic is relevant since it has a close connection to practice and already executed scientific research.

The research process so far was quite iterative and had its ups and downs. But still the overall momentum remained during the past semester.

Besides the fact that the report is already quite substantive for a P2, some parts of the reports still show some room for improvement. And, some parts of the research process that should be finished at the moment must be finalized as well.

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12. Appendices

Appendix A: Circular Economy

The Circular Economy is currently a ‘hot topic’ among scholars, scientists and in the working field. The perspectives on the definition of Circular Economy varies therefore a lot on the people that use it. In order to frame this research, one general definition of CE will be given and underpinned. Firstly, the general principle of the Circular Economy will be presented and afterwards the definition of the Circular Economy used in this research will be defined.

Core principles

According to the Ellen MacArthur Foundation (2013a, p. 7) the Circular Economy “replaces the ‘end-of-life’ concept of the linear economy with restoration, a shift 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”.

The Ellen MacArthur Foundation (2013a) defined five principles on which the Circular Economy is based:

1. *Design out waste*: Waste does not exist when the biological and technical components of a product are designed by intention to fit within a biological or technical materials cycle, designed for disassembly and refurbishment;
2. *Build resilience through diversity*: Modularity, versatility, and adaptively are prized features that need to be prioritized in an uncertain and fast-evolving world;
3. *Rely on energy from renewable resources*: Systems should ultimately aim to run on renewable sources;
4. *Think in ‘systems’*: The ability to understand how parts influence one another within a whole, and the relationship of the whole to the parts is crucial. Elements are considered in their relationship with their infrastructure, environment, and social context;
5. *Waste is food*: Closing the biological and technical loops.

The concept of Circular Economy [CE] differs from the others sustainable philosophy’s such as cradle-to-cradle since CE focusses on economics, hereby sustainability is a positive side-effect. Whereas cradle-to-cradle and other schools of thought primarily focus on closing the loops and recycling in itself (Van den Brink, 2016). Therefore the CE enables growth by a supportive relationship with ecological, social [and economic] systems (Aminoff, Valkokari, & Kettunen, 2016).

Definition of the Circular Economy

Kazemi (2016), Van den Brink (2016), Stigter (2016), Mentink (2014), Rampersad (2016) and many other scholars mention that a variety of definitions and interpretations of the Circular Economy exist. It is therefore important to make clear which interpretation and definition will be used in this graduation project. This will be done in this paragraph.

One of the most important contributions to the concept of Circular Economy was done by The Ellen MacArthur Foundation in 2013, by publishing a series of reports. In these reports, Circular Economy was defined as:

“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 return to the biosphere, and aims for the elimination of waste through the superior design of materials, products, systems and business models” (Ellen MacArthur Foundation, 2013b).

One of the most fundamental principles in the way circular Economy is seen in this graduation project is that there is a certain economic value creation, this should make it interesting for businesses. It has to be admitted that the definition used in this research is built upon the definitions used in former research projects. This definition is based on the perspective introduced by the Ellen Macarthur Foundation and also used in Kazemi (2016), Mentink (2014), Van den Brink (2016). The definition of Circular Economy will then become:

“An alternative to a traditional linear economy (make, use, dispose) which is based on economic incentive, in which the resources are used in different cyclical material loops, extracting value from them whilst in use and reusing⁷ them in other material cycles.”

Circular Economy according to practitioners

Kazemi (2016) also conducted several interview with practitioners, hereby she asked what they see as important definitions and perceptions of the Circular Economy. This resulted in a list which gives in the perspective of the author a proper overview of Circular Economy. This list is presented below:

- Endless use of materials within time and within a building.
- Looking at buildings and the built environment as a whole with considering the whole life cycle.
- Looking for unknown relations between waste and food and combining new loops into new products or new loops.
- The little inner loops and looking at the economy growth. Thus economics is always in the first position and then how can economics the environment and the people.
- Preserving the resources of the earth in a product and later on as resources for endless period of time, and whether you purchase that product by ownership or lease or performance, it is no factor in being circular or not.
- Flexible design where materials can be taken back to the suppliers.
- Keeping the ownership with the company that can actually best bring this material or this resource back into technical loops.
- The buildings that are designed with future intended uses in mind and materials which can see a flow and endlessly recovering the value.
- To design out waste, to create value and to make sure that the proper person will feel responsibility for the raw materials.

(Kazemi, 2016)

Taking a perspective

The list presented in the former paragraph presents a comprehensive overview of the concept of the Circular Economy. It must be said that in this list many concepts and perspectives are touched. In order to make the concept of Circular Economy workable, special attention will be paid to the economic and organizational part of the Circular Economy. This relates to the last four points mentioned in the list of Kazemi (2016) All these points show ingredients of the concept of ‘products as services’, this concepts will be introduced and defined in the next section.

⁷ Reusing does not necessarily mean without repurposing or changes in the product, as long as the product can save the raw materials. Therefore reusing relates to maintaining the inherited value.

Appendix B: OVG Real Estate



Source for this chapter: OVG Real Estate (n.d.)

Figuur 19: Logo OVG Real Estate
(source: OVG Real Estate)

Who is OVG Real Estate?

OVG Real Estate was established in 1997 and was founded by Coen van Oostrom, who is still the CEO of OVG Real Estate. As a novice in the world of real estate, he saw possibilities that others failed to notice. As such, he managed to create opportunities and to establish special projects. OVG does not settle for a set framework, on the contrary, they question it. As a result, a unique method emerged, which is the guideline for our four business units.

OVG Real Estate is one of the most successful project developers in Europe, leading in the development of office properties. The company has been setting new benchmarks for well-being, sustainability and technology-oriented buildings for over 20 years. Specialized on intelligent and future-oriented solutions, OVG grew from a classic developer into a technology firm.

Vision

Never before did so many people live in urban areas. At present it is more than half the world's population, but it will increase. This new reality is a world where more people are living, working, recreating and travelling with- in a small area.

How does one keep our habitat healthy? How does one most efficiently use natural sources? And how does one cleverly implement the use of new technologies in this respect? OVG Real Estate seeks answers to these questions on a daily basis, because OVG believes that buildings are more than merely a combination of materials.

Pillars

We are convinced that there is always a better way: greener, smarter, healthier. This belief is put into practice through three pillars, which are the foundation of our method: Sustainability, Technology and Well-being.

- *Sustainability*: For OVG Real Estate, sustainability means using natural sources as cleverly as possible to offer buildings that are not only attractive, but also affordable, efficient, healthy and safe. Sustainability is therefore one of the three pillars which forms the basis of everything OVG Real Estate achieves.
- *Well-being*: OVG Real Estate wants to contribute in a healthy environment with its projects. This reflects in our vision on sustainability, but also in our efforts to create a healthy balance between 'living and working'. OVG wants to establish a work environment where people are happy and, above all, healthy. Therefore, OVG alternately makes use of advanced technology as well as logical thinking.
- *Technology*: In order to develop buildings that excel in sustainability and create a healthy environment for users, smart technology is essential. OVG is convinced that in the future, with the aid of technology, even much more is possible to make buildings yet even more intelligent.

Appendix C: Case studies

Case 1: Office Triodos Bank – façade



Figure 20: Artist Impression exterior of the new office of Triodos Bank (source: OVG Real Estate)

Triodos Bank is a global pioneer in sustainable banking, using the power of finance to support projects that benefit people and the planet (Triodos Bank, n.d.). Because this bank is growing they decided to build a new office on domain ‘De Reehorst’ in Zeist. In the design of the building the existing flora and fauna at the domain was very important and the design is inspired on Cradle-to-Cradle building principles.

The intention of the client, Triodos Bank, and the developer, OVG Real Estate, is to lease the façade from the façade-supplier, being Octatube. At the moment of writing (early June, 2017) the developer is starting discussions with the façade supplier in order to challenge Octatube to adopt new business models based on Performance Based Contracting.



Figure 21: Artist Impression interior of the new office of Triodos Bank (source: OVG Real Estate)

Case 2: Redevelopment of Basisweg – climate installations



Figure 22: Birdview project Basisweg Amsterdam Sloterdijk (Source: duurzaamvastgoed.com)

This project is located at the Basisweg in Amsterdam Sloterdijk, it is an existing office building of around 60.000m² and was originally delivered in 1973. The design is characterized by 8 connected towers each consisting of 6 floors, and an ‘annex building’. The building is at this moment in the development phase and the plan is to start the redevelopment in 2020. The building is for a huge part pre-leased to Alliander, which is a ‘network-company’ and is responsibility for the distribution of energy in the form of electricity, (bio)gas and heat and has a strong dedication towards sustainability. Proof of this is their newly built headquarters, which is based on Cradle to Cradle building principles and is designed by RAU Architecten.

The intention of OVG Real Estate is to challenge Eneco to lease installations and deliver the heat as a service. At the moment of writing (early June 2017) the developer is in negotiations with Eneco how to arrange the financial, legal and organizational aspects.

Case 3: Boutique offices – OVG as service provider



Figure 23: Artist impression Boutique offices (source: OVG Real Estate)

Project Boutique involves the renovation of an existing office building near the Amsterdam South-Axis. After renovation, the real estate developer remains involved in the project because OVG Real Estate will act as a service provider in the operation phase of this project.

This by becoming the main tenant of the building themselves and subleasing office space in the form of pre-defined service packages. Hereby the different packages include different kind of office space and service levels.



Figure 24: Artist impression interior Boutique offices (source: de Architekten Cie)

Appendix D: Planning

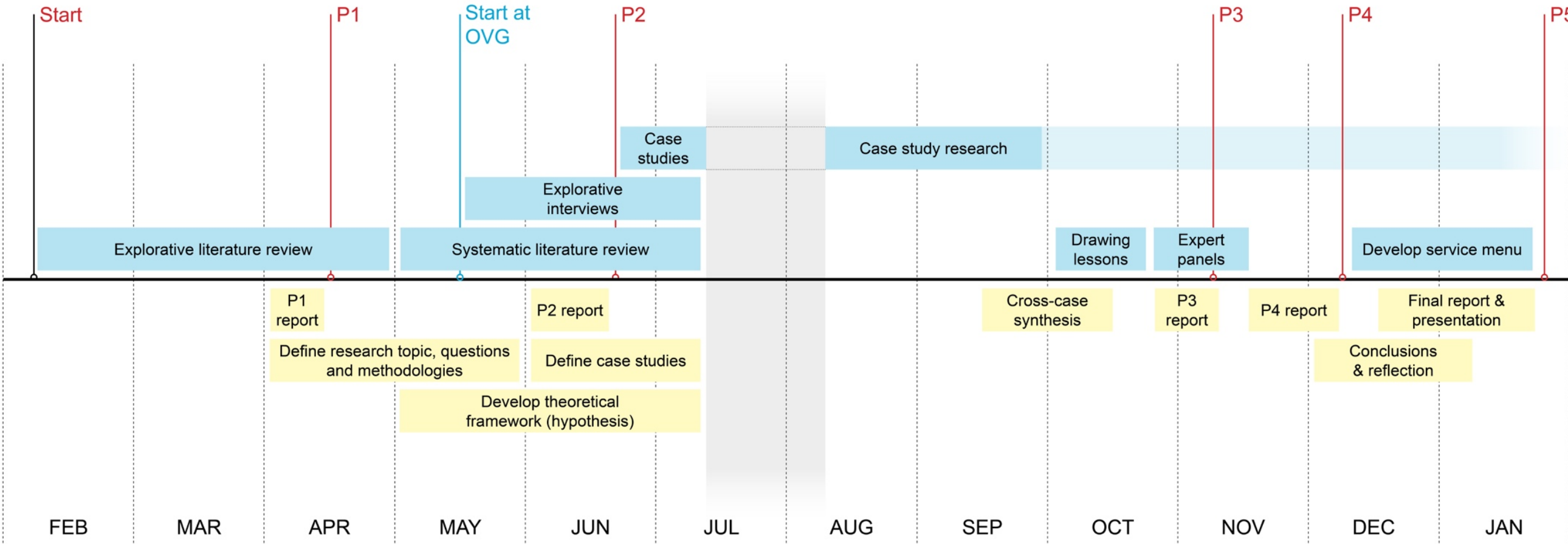


Figure 25: Time planning (own ill.)