

An aerial photograph of a roundabout in the Netherlands. The central island is a large, circular stone structure with a complex, multi-tiered design. The roundabout is surrounded by asphalt roads with white dashed lines. Several cars are visible: a red car at the top, a white car on the left, a blue car on the right, and another red car at the bottom. The surrounding area includes green grass and trees.

# A BEST VALUE APPROACH TO PUBLIC PROCUREMENT

Stimulating the transition towards a circular infrastructure sector in the Netherlands

A. van Veenen  
December 2018

*“Awareness is the greatest agent for change”*

- Eckhart Tolle

# A BEST VALUE APPROACH TO PUBLIC PROCUREMENT

Stimulating the transition towards a circular infrastructure sector in the Netherlands

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# PREFACE

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The last couple of months, I dived in the topic of circular economy and the public procurement practices in the Netherlands. Before I started the graduation process I had not even heard of the concept circular economy and now, after 9 months, I feel like I've only touched upon a small part of the whole concept, it being so broad and complex. During the journey of this research I met and interviewed many enthusiastic, dedicated individuals who made it their personal mission to stimulate the circular economy in their own way. I believe that people like this are the backbone of the transition. Even though laws, rules and organisational structures shape the context of our projects, it is the people and their commitment to make a change who determine whether the circular ambitions become successful in the end. These people inspired me to look critically at the current working practices in the infrastructure industry and I hope this research can help public authorities to initiate, procure and realize circular projects. By the end of the process, I also became a strong believer that we have to do something to make the transition. I gained many insights through this research that I will take to my future job to keep working on a more circular infrastructure sector.

My thesis would not have been of the quality it is now without the help of my graduation committee. From the first moment they supported my research topic and they gave me all the room to shape the research in my own way. First, I would like to thank my first supervisor Lizet Kuitert, for helping me to become a researcher. She taught me to be open and objective during interviews and critical and reflective when analysing the answers. Her constructive feedback and many, many comments always triggered me to think one step further and reflect on what the outcomes actually meant for this research. Next, I would like to thank my second supervisor, Leon Hombergen, for his positive energy and personal advice. He always asked me if I was still enjoying the graduation process and told me that taking a break sometimes is good for the process. Thirdly, I would like to thank my professor, Monika Chao-Duivis, for becoming the chair of my committee when my initial professor could not fulfil this task anymore. Besides, Monika provided me with insights in the legal aspects of this research and always had a critical, but righteous view at my writing. Lastly, I would like to thank my company supervisor, Jasper Flapper, for his enthusiasm and knowledge. Besides the actualities in the circular and Best Value worlds, I learned a lot from him personally. Somehow he could point out my insecurities, and even though I did not always like it, he pulled me out of my comfort zone to improve my personal skills.

Furthermore, I would like to thank some other people that supported me throughout my studies and the graduation process. First, I would like to thank my parents for their unconditional support throughout my whole studies. Most of the time they had no clue what I was doing, but they were always impressed about my work and the effort I was putting into it. Furthermore, I would like to thank my boyfriend Stan for his endless energy and company during our study sessions in the weekends. During setbacks he was there to motivate me and he provided me with the confidence to finish this last piece of my studies satisfactory. I would also like to thank all my friends who I could talk to about the "thesis life". Over many dinners and cups of coffee they helped me to put the graduation process in perspective. They read and corrected parts of my thesis and provided the social distraction that was needed from the, sometimes, lonely moments. Lastly, I would like to thank my colleagues at Antea Group. From the first day on they made me feel welcome, answered all my questions and showed a lot of interest in my work as well. It was a nice working environment for the past couple of months. Thank you for letting me be a part of that.

A. van Veenen  
Delft, December 2018

# EXECUTIVE SUMMARY

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The last couple of years the concept of the Circular Economy (CE) has been gaining more and more attention. The Netherlands want to become a CE as well and the government presented a national policy programme including goals to reach a CE in 2050. One of those goals is that Dutch public authorities should procure all their projects 100% circularly by 2030. Practice shows that in the infrastructure sector public authorities start with high circular ambitions, but throughout the procurement process it seems to diminish. Public authorities tend to specify their need in detail, and make little use of the knowledge and experience that is present in the supply chain. The fact that the circular ambitions are only partly reached after the realization of the project makes the public procurement process not very effective. A possible contribution to increase this effectiveness can be a specific procurement approach that focusses on utilizing the experience from the supply chain, called the Best Value approach (BVA). However, no literature so far has described the opportunities of the BVA as an approach to procure circular infrastructure in the Netherlands.

The goal of this research is to create a guideline for Dutch public authorities about how they can procure circular infrastructure more effectively by making use of the BVA. This results in the following research question: *In what way, if any, can the Best Value approach contribute to the effectiveness of public procurement in order to stimulate the transition towards a circular infrastructure sector in the Netherlands?*

## RESEARCH APPROACH AND METHODS

In order to answer the research question a qualitative research is conducted with several research methods. First, a literature study is done to provide insight in the concepts of public procurement in the Netherlands, procurement of circular infrastructure and the BVA. To define effective procurement of circular infrastructure and its current status in the Netherlands, interviews are held with Dutch public authorities. The answers of the interviewees resulted in several factors that are beneficial for effective procurement of circular infrastructure. These factors are compared to the current practices in the Netherlands and categorized in a Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis. The outcomes of the SWOT analysis are combined with the theory of the BVA to determine which aspects of the BVA can contribute to more effective public procurement of circular infrastructure. These aspects are captured in a conceptual model, which is subsequently validated by a focus group. The validated model and its practical application are used to describe the guideline for public authorities.

## RESULTS

### THEORETICAL INSIGHTS

The starting point of this research is that a circular infrastructure sector is driven by the procurement processes of public authorities. This is defined as circular procurement, which is a regular procurement process that incorporates circular aspects in order to procure, realize and safeguard circular infrastructure over its whole life cycle. The way in which this is done is called a tender and the rules for public authorities are laid out in the Aanbestedingswet 2012 and European Directive EU/2014/24. One important focus point is that besides ensuring the technical aspects of circularity in the specifications and criteria, also collaboration with the supply chain should be sought. A more open approach from public authorities is required to provide contractors with room to offer innovative circular solutions.

The BVA is an approach to public procurement which focusses on utilizing the experience of the supply chain. This is done by looking for the expert contractor who can prove with dominant

information (metrics) that he understands the need of the public authority, is able to execute the contract, and is able to identify and mitigate risks. Instead of detailed requirements, abstract project goals and functional specifications are used. The contractor is assessed based on a price ceiling and four fixed sub-award criteria: project capabilities, risks, value added, and interviews. The contractor with the best scores is asked to enter the clarification phase in which the offer is planned out in detail. Furthermore, the expert contractor determines Key Performance Indicators (KPI's) on which the project is monitored in terms of costs, time and performance with the weekly risk report. Also the BVA requires a more open approach from public authorities to provide room for contractors to make a distinguishing offer.

## **EMPIRICAL INSIGHTS**

The research focusses on the possible contribution of the BVA towards *effective* public procurement of circular infrastructure. This is defined as procurement where the initial circular project ambitions and goals are met after the realization of the object of the contract. Many factors related to the effectiveness of circular procurement are found. Because the circular infrastructure sector is in its infancy, incentives, motivation, ambitions and knowledge should be developed by public authorities in the first place. Furthermore, room should be provided in the tender specifications and criteria for the supply chain to come up with innovative circular solutions, and the circular ambitions should be monitored after the contract award.

However, the actual execution of public procurement is not always going so well. Public authorities seems to struggle with providing the supply chain with the right conditions to offer circular infrastructure solutions. They find it hard to formulate circular project ambitions and to assess offers based on functional specifications objectively. Looking at the procurement process itself, contracting authorities tend to be controlling. They have little faith in the supply chain and prefer to make use of many technical specifications and award largely on price instead of quality. Lastly, the circular ambitions are hardly monitored after the award of the contract. This all leads to poor realisation of the circular project ambitions.

## **MODEL DESIGN AND APPLICATION**

The BVA may be ideal for public authorities to let go of their controlling role and to provide room for the contractors to come up with circular solutions. However, making use of the BVA will not automatically lead to circular infrastructure solutions. First, public authorities have to prepare their internal organisation towards life cycle thinking, and circularity should become a part of the project through circular project ambitions and specifications. Moreover, a restricted procedure should be used in order to preselect a contractor with a similar circular vision. Lastly, circularity should be monitored, safeguarded and evaluated after the contract award.

Considering the aforementioned finding, the BVA is split up in separate BV elements and, based on the theory and interviews, it was found that the following elements have potential to contribute to the effectiveness of the current practice: KPI's, project goals, project capabilities, value added, functional specifications, large quality ratio, price ceiling, clarification phase, and weekly risk report. The contributing BV elements are captured in a model, which is shown below (figure A). This model can be used by Dutch public authorities as a guideline to determine which BV elements can be used to procure circular infrastructure more effectively. It depends on the level of control of the public authority and the flexibility of the project environment when certain BV elements can be used. Based on the intersection of both variables, the model shows which BV elements are recommended to use in the procurement process. It is important to note that the coloured layers are cumulative, so for example, at the top right all layers are applicable.

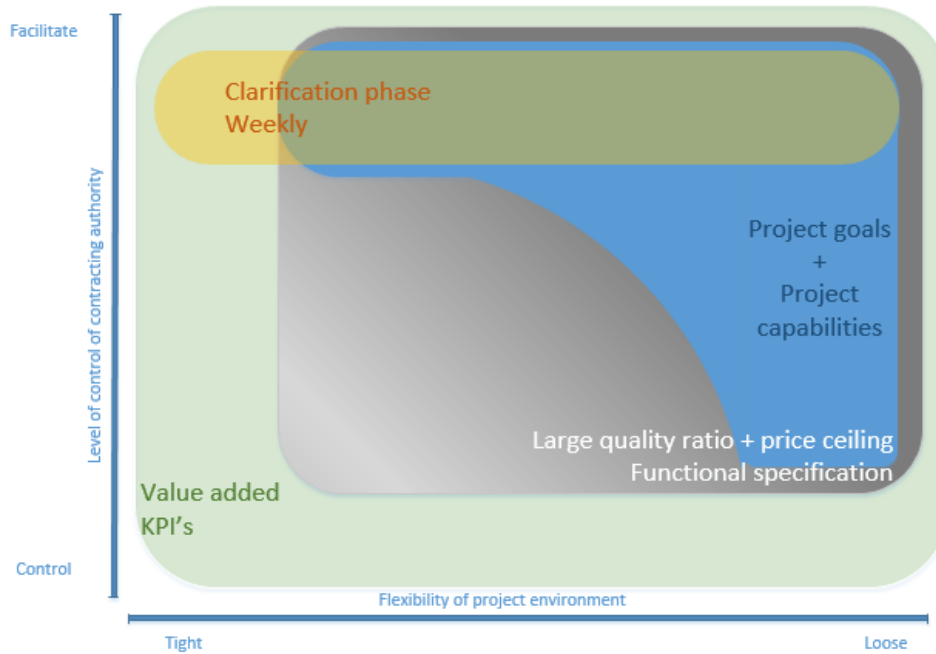


FIGURE A: BV ELEMENTS THAT CONTRIBUTE TO EFFECTIVE PROCUREMENT OF CIRCULAR INFRASTRUCTURE

The model helps to raise awareness within public authorities what their current level of control is and what kind of circular project they have in mind, and if these conditions are suitable for making use of the BVA. If desired, steps can be taken to become more facilitating, or a different circular project can be considered. It can be assumed that each zone in the model contributes to the effectiveness of the current practice. The more BV elements are used, the more effective the procurement process will be. However, the aim of the model is not to force public authorities to make use of as many BV elements as possible. If the internal organisation and intended project are not suitable for certain BV elements, they should not be used. Public authorities should not strive for the most effective approach available, but look at which approach suits the organisation and project best.

But how can the model be used? For each coloured area in the model an advice is formulated how the recommended elements of the BVA can be applied in the procurement process. An example: if the public authority has an average level of control and the project environments is a bit loose, according to the model the grey area should be followed. This means that all the BV elements related to the grey area, but also the BV elements of the green area should be applied. When these BV elements are connected to the procurement process, combined with the general aspects needed for circularity it looks as follows (figure B).

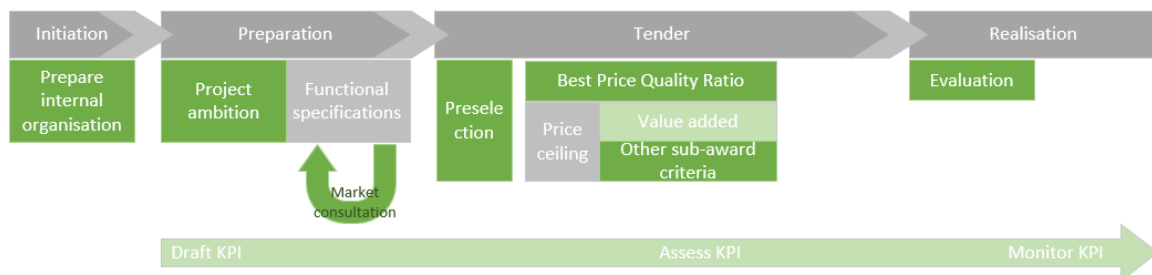


FIGURE B: PROCUREMENT PROCESS GREY AREA



## **LIMITATIONS OF THE MODEL AND PRACTICAL RECOMMENDATIONS**

However, there are some limitations that have to be taken into account when using the model. First of all, public procurement of circular infrastructure is still in an experimental phase. Small (pilot) projects are initiated by public authorities, but such pilots are most of the time procured with national procedures for small projects, and not suitable to be procured with the BVA. Furthermore, few circular infrastructure projects are finished, which makes it hard for contractors to gather metrics to underpin their offers. These limitations result in few elements of the BVA that can be of use for the majority of public authorities. The most important recommendation for public authorities is that if they want to make use of the model, they have to be self-aware about what procurement approach suits their organisation and projects best. In line with this, it is recommended for public authorities to check if their intended circular project can be procured with a restricted procedure, and if the supply chain is able to make an offer, underpinned with metrics. If this is the case the model can be of great added value. If not, public authorities should stimulate the supply chain to monitor their performances so that they will be able to underpin offers with metrics in the future.

## **CONCLUSION**

The BVA is a great approach for public authorities that want to find the expert contractor who can realize their circular ambition. Procuring circular infrastructure requires an open approach, which can be facilitated by the BVA. The BVA helps public authorities to provide room for contractors through project goals, functional specifications, and awarding on quality. Furthermore, within the approach dominant information is used, which makes the assessment of offers objective and transparent. This is considered helpful to procure circularly more effectively and stimulate the transition towards a circular infrastructure sector. However, the approach seems to be introduced too early. Few circular infrastructure projects are realized, and therefore the majority of the contractors is not ready to make an offer based on metrics. More circular infrastructure projects should be realized and monitored in order to gather metrics for future projects. The benefits of the BVA cannot be exploited, yet.

## **DISCUSSION**

The results of this thesis have proved its scientific value by researching the use of BV elements to procure circular infrastructure. Also, by the end of the research no scientific literature describes this relation. This means that the knowledge gap about the relation between the two procurement approaches, despite the limited contribution of the BVA, is touched upon.

## **RECOMMENDATIONS FOR FURTHER RESEARCH**

The infrastructure sector is still in its infancy when it comes to circularity. It is therefore recommended to conduct a similar research in 3-5 years or look at the application in other sectors that are further in the transition. Then more (experienced) persons can be interviewed, and the model can be implemented and evaluated. Furthermore, this research is limited to the point of view of the public authority. It is very interesting to research the point of view of the supply chain to get insight in what they prefer in circular tenders. The definition of effective procurement of circular infrastructure entailed also factors that could not be influenced by the BVA, therefore another recommendation is to look at those factors. Lastly, the BVA is not the one and only solution towards effective procurement of circular infrastructure. Also other approaches to procure circular infrastructure, like Early Contractor Involvement (Dutch: bouwteam) or Rapid Circular Contracting could be looked into.

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# LIST OF ABBREVIATIONS

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CE	Circular Economy
BPQR	Best Price Quality Ratio
BV	Best Value
BVA	Best Value Approach
ECI	Environmental Cost Indicator
EMAT	Economically Most Advantageous Tender
KPI	Key Performance Indicator
LCA	Life Cycle Analysis
LCC	Life Cycle Costs
SMART	Specific Measurable Achievable Realistic Time-related
SWOT	Strength Weakness Opportunity Threat
TRL	Technology Readiness Level

# Introduction

Chapter 1 – Introduction

Chapter 2 – Research design



# 1 INTRODUCTION

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The concept of global warming acquires more and more attention all over the world. Extreme weather conditions and natural disasters occur more often and the average global temperature is rising (Rijksoverheid, 2016). The world's population is growing exponentially, resulting in a higher global energy demand. This puts pressure on finite energy resources like oil and gas (Abas, Kalair, & Khan, 2015), because we are now consuming more than the Earth can regenerate (Ellen MacArthur Foundation, 2013; Nace, 2017). In reaction to this, a transition is being proposed to change our current economy into a circular economy (CE) in which products are no longer disposed at the end of life, but kept in use (Ellen MacArthur Foundation, 2013). The Netherlands want to become a CE as well (Ministerie van Infrastructuur en Milieu & Ministerie van Economische Zaken, 2016). In the beginning of 2018, a national policy program was presented with strategic measures to reach a CE in 2050. One part of this policy program is the "Transition-agenda circular construction economy", stating that the polluting Dutch construction sector (see green frame) has to become circular in 2050 (Nelissen et al., 2018).

The Dutch construction industry responsible for 40% of the national waste production, 50% of raw materials consumption, 40% of the total energy use (Schoolderman et al., 2014).

## 1.1. PUBLIC PROCUREMENT TO STIMULATE A CIRCULAR ECONOMY

The role of public authorities is pointed out in the Transition-agenda (Nelissen et al., 2018). The Dutch State and all other decentral public authorities procure annually for more than 60 billion euros (Ten Haaf, 2017, p. 107) and therefore a large impact can be made if they start procuring circular products. This need for more procurement of circular products is underpinned by a study of TNO: "*the government can encourage circular business cases, especially in the initial phase, by demanding the use of circular products or services in government procurement tenders*" (Bastein, Roelofs, Rietveld, & Hoogendoorn, 2013). In this way the government can set an example and function as a launching customer by stimulating the supply chain towards offering circular solutions. The supply chain will namely not invest in circular solutions if no one asks for it (Chao-Duivis, 2018, p.14). The research of Adetunji, Price, & Fleming (2008) demonstrates that public authorities are powerful enough to initiate change towards a more sustainable supply chain. So, public procurement can be used to create an economy that is more innovative, resource and energy efficient, and socially-inclusive (European Commission, 2017). The need for more public procurement of circular products is highlighted in a specific goal in the Transition-agenda: Dutch public authorities should procure all their projects and works mostly circularly in 2023 and 100% in 2030 (Nelissen et al., 2018).

The Transition agenda distinguishes two branches within the construction sector: building and infrastructure (Nelissen et al., 2018). Where in the building sector also private clients operate, in the infrastructure sector the majority of the clients is public of nature (Ten Haaf, 2017, p. 108). The importance of public authorities then becomes more evident and therefore, this research will focus specifically on the infrastructure sector.

### 1.1.1. CURRENT PRACTICE OF PUBLIC PROCUREMENT

The amount of tenders with circular aspects has increased over the last couple of years, but the number is still very limited. A quick browse through TenderNed, the Dutch platform for public tenders, shows that at the beginning of 2018, only in 1% of the tenders of works circular aspects are included. For this percentage to be 100% in 2030, a lot of work needs to be done.



Several procurement approaches have already been adopted in the Netherlands to facilitate public authorities to procure circularly. The most well-known approach is the “Green Deal Circulair Inkopen”, developed by MVO Nederland, NEVI, Kirkman Company, Rijkswaterstaat and PIANOo (MVO Nederland, 2018a). Many Dutch clients, engineering firms, contractors, and other companies have signed this Green Deal and more and more pilot projects are being initiated. The leap from pilot to common practice now needs to be made.

If a public authority strives for circular infrastructure, it is important that after the procurement process this ambition is reached. Effective public procurement is therefore key to realize circular infrastructure. However, practice shows that public authorities start with high circular ambitions, but throughout the process it seems to diminish because of underlying business processes (Green Deal Circulair Inkopen, 2016). Public authorities tend to specify their need in detail, and make little use of the knowledge and experience that is present in the supply chain. They have to be open to ask for this experience when they want to realize circular infrastructure (Economic Board Utrecht, 2018). Multiple researches state that a more open, functional need seems necessary for realizing circular ambitions (Chao-Duivis, 2018; Padding, Croon, Haastrecht, & Dijkstra, 2015; Ten Haaf, 2017; Van Haagen, 2018). However, formulating an open need and assessing functionally specified tenders is still troublesome for many public authorities (Van Haagen, 2018). The fact that the circular ambitions are only partly reached after the realization of the project makes the procurement process not very effective. A possible contribution to this effectiveness can be a specific procurement approach that focusses on utilizing the experience from the supply chain, called the Best Value approach (BVA).

#### **1.1.2. ANOTHER APPROACH: BEST VALUE**

In short, the BVA aims to identify and utilize experience from the supply chain in order to select the best “expert contractor” for executing the contract (PIANOo, 2017). In order to maximally utilize the experience of the expert, the BVA requires a shift of paradigm from control to letting go of minimum requirements and inspection (van de Rijt & Santema, 2013). The public authority defines an open need, in terms of project goals instead of many fixed requirements, which gives the supply chain more design freedom to use their creativity and knowledge (van de Rijt & Santema, 2013). This freedom can stimulate the supply chain to be innovative and offer circular solutions. The expert contractor is found based on dominant information that proves his qualities. This makes the assessment of offers more objective and it can be a solution to the struggle of public authorities that assessing functionally specified tenders is troublesome.

The philosophy to make use of the expertise in the supply chain can be helpful for public authorities who are not familiar with circular infrastructure. Furthermore, the BVA aims to maximize the result and improve the performance quality of projects (Wenselaar, 2011). This performance is safeguarded through monitoring the project weekly, based on predetermined Key Performance Indicators (KPI's). So, the BVA seems to facilitate contracting authorities to formulate an open, functional need, and it also provides a handhold to assess the offers to this need. This all may help to achieve public authorities' circular ambitions more effectively. However, the use of the BVA to procure circular infrastructure is not scientifically proven yet.

#### **1.2. PROBLEM DEFINITION**

The previous sections illustrate that the current procurement practice of most public authorities is, generally seen, not very effective when it comes to realizing the circular ambitions for infrastructure projects. The BVA seems to include some aspects that may contribute to the effectiveness of public procurement of circular infrastructure. The concepts of CE and public procurement have already been researched widely and the BVA is already commonly used in the infrastructure sector (Rijkswaterstaat, 2013). However, no literature so far describes the opportunities of the BVA as an approach to procure circular infrastructure in the Netherlands.

It is not known if it is possible to procure circular infrastructure more effectively by making use of the BVA and subsequently how this can be done. This indicates a research gap that can be highly relevant, both scientifically and practically.

**1.2.1. SCIENTIFIC RELEVANCE**

Multiple researches have been done already about the procurement of circular products. It was found that circular procurement follows the same directives and legislation as traditional procurement (Chao-Duivis, 2018; Ten Haaf, 2017; Van Haagen, 2018). These researches focus on how public authorities can incorporate circular aspects in their tenders. However, there is not as much scientific research done about the practical application of procurement of circular products. It can mainly be found in evaluation reports drafted by public authorities or knowledge platforms like Green Deal Circulair Inkopen (Green Deal Circulair Inkopen, 2016). Furthermore, most reports focus on other sectors like furniture and facility management. This underpins the need for scientific research about the current practice in the infrastructure sector.

Besides the research conducted in the field of public procurement, research is also done in the field of the BVA. For example, Loppies (2015) points out the added value of performance based specifications in procurement of circular products and suggests to look further into the opportunities of the BVA. Furthermore, a successful study was conducted on the use of BVA to procure sustainable waste management service (Corea, Kashiwagi, Gajjar, & Romero, 2016). However, this is again in the field of facility management and not in the infrastructure sector. This research will build onto the researches about public procurement of circular products and the application of the BVA, focussing on the infrastructure sector. The potential use of the BVA to procure circular infrastructure effectively can definitely be a contribution to the scientific field of public procurement.

**1.2.2. PRACTICAL RELEVANCE**

Besides the scientific relevance, this research can also contribute to the current practice of the BVA to procure circular infrastructure projects. Apparently, public authorities are already experimenting with the combination. The Province of Noord-Brabant is procuring an infrastructural project with the BVA, which contains circular ambitions. On the other hand, the current procurement practice of most public authorities does not seem very effective when it comes to realizing the circular ambitions for infrastructure projects. The outcome of this research can help public authorities in a practical sense to procure circular infrastructure more effectively. It can be helpful to go from pilot to common practice and become a part of a solution towards the transition to a circular infrastructure sector.

**1.3. RESEARCH GOAL AND OBJECTIVE**

The goal of this research is to create a guideline for Dutch public authorities about how they can procure circular infrastructure more effectively by making use of the BVA. The objective of this research is to find out what the possibilities of the BVA are to procure circular infrastructure. It will be researched if, and in what way the BVA can be used to make public procurement of circular infrastructure more effective (red circle, figure 1).

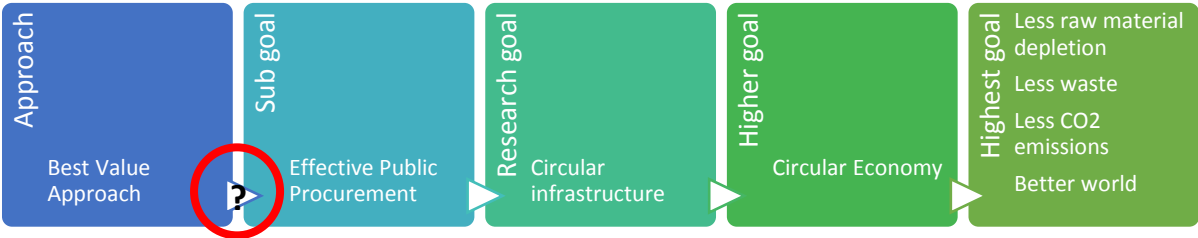


FIGURE 1: RESEARCH OBJECTIVE

#### 1.4. RESEARCH QUESTION

From the previous sections it can be concluded that there is a knowledge gap about the relation between the BVA and public procurement of circular infrastructure. This research will focus on the question if the BVA contributes to the effectiveness public procurement of circular infrastructure and if so, how this can be achieved. To find an answer to the knowledge gap, the following research question is formulated:

*In what way, if any, can the **Best Value approach** contribute to the **effectiveness of public procurement** in order to stimulate the transition towards a **circular infrastructure sector** in the Netherlands?*

This research question is too broad to be answered directly. Therefore, the research question is split up in multiple sections, followed by sub-questions to give more insight in the concepts of circular infrastructure, (effectiveness of) public procurement, and the BVA.

The definition of public procurement of circular infrastructure in the Netherlands:

- 1a. What is public procurement in the Netherlands?*
- 1b. Where can circular infrastructure aspects be incorporated in the Dutch procurement process?*

The definition of the Best value approach:

- 2a. What is the Best Value approach and how is it applied in Dutch public procurement?*
- 2b. Can the Best Value approach be used to procure circular infrastructure?*

The current practice of public procurement of circular infrastructure in the Netherlands:

- 3a. What is effective public procurement of circular infrastructure?*
- 3b. What are the strengths, weaknesses, opportunities and threats of the current practice in the Netherlands?*

The combination of the Best Value approach and public procurement of circular infrastructure:

- 4. Which elements of the Best Value approach can strengthen the current practice of public procurement of circular infrastructure and under which conditions?*

It should be noted that the procurement process of each infrastructure project is different, and therefore it is not possible to develop a “one size fits all” approach. The BVA will therefore most probably not be the only and ultimate solution towards a more circular infrastructure sector in the Netherlands. There are also other procurement approaches, which may be more effective in some cases. However, the focus of this research will be on the opportunities and limitations of the BVA as a public procurement approach for circular infrastructure.

#### 1.5. READING GUIDE

This research report is structured in the following way. In chapter 2, the research design will be presented, including the research approach and corresponding methods. Then a series of theoretical chapters will follow. In chapter 3 the public procurement process will be discussed in general before circular infrastructure aspects are connected to it in chapter 4. In chapter 5 the philosophy and theory of the BVA will be elaborated on. It is then concluded whether it is possible to procure circular infrastructure with the BVA in chapter 6. After the theoretical chapters, an empirical part with insights from practice follows. Chapter 7 contains a definition of effective public procurement of circular infrastructure and an analysis of the current practice in the Netherlands. Then the analysis and validation of the contributions of the BVA to the current practice are described in chapter 8, and the application of the results are described in chapter 9. After the practical view, conclusions will be drawn and an answer to the research question will be formulated in chapter 10. Lastly, in chapter 11 the research will be discussed and recommendations for further research will be presented.

## 2 RESEARCH DESIGN

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In this chapter the details of this research will be discussed. In section 2.1 the research approach will be presented. Then in section 2.2 the research methods to gather, analyse and validate the data will be described. Section 2.3 contains the research strategy and an overview of how the presented methods are connected to the research questions and chapters in this report.

### 2.1 RESEARCH APPROACH

The next two sections will explain which approaches are selected for conducting this research and why these approaches are chosen.

#### 2.1.1. QUALITATIVE METHOD

Since there has not been a lot of research conducted on the combination of the BVA and public procurement of circular infrastructure, and there is not a lot of scientific literature available on both topics, an open, empirical research approach will be followed. This means that this research will focus on the design of a new theory, which is called an inductive research approach (Gioia, Corley, & Hamilton, 2013). Accordingly, this research will be qualitative of nature (Lucassen & olde Hartman, 2006). The qualitative method can be used for an in-depth analysis of the topics and for gathering much detail from a relatively small group of persons. Based on the outcomes of this analysis, the new theory of “BVA to procure circular infrastructure” can be developed.

#### 2.1.2. PRACTICE ORIENTED RESEARCH

Because there has been little scientific research conducted about the use of the BVA to procure circular infrastructure, it is not expected that the answer lies in theoretical sources. Therefore, this research is considered practical of nature. A problem is observed, and its solution lies in the investigation of this problem. This process is comparable to a practice-oriented research which aims at solving a practical problem by using knowledge to intervene in a situation and change it in a positive manner (Verschuren & Doorewaard, 2015). The practice-oriented approach is accompanied by the so-called intervention cycle. This circle consists of five steps which help to solve practical problems. According to Verschuren & Doorewaard (2015) these steps are:

- Problem Analysis: A problem is identified, whose problem it is, and why it is a problem.
- Diagnosis: A cause to the problem can be found.
- Design: With the diagnosis in mind a solution can be designed to solve the problem.
- Intervention: The implementation of the designed solution.
- Evaluation: The intervention is evaluated to check if the desired outcome has been reached.

This research focusses on the second (diagnosis) and third (design) step of the intervention cycle, and not on the implementation of the solution and the evaluation afterwards. The problem is defined in the introduction, but more substance can be given to it. Why is it that the public procurement practice does not seem effective right now? Therefore the underlying causes of the problem will be investigated and a solution to the problem will be proposed. It is assumed that the solution lies within the BVA, but it is not known yet if this is the case and if so, which aspects of it can be contributing.

## **2.2. RESEARCH METHODS**

In order to give substance to the two research approaches and to answer the research questions a combination of several research methods will be used to gather the data for the analysis of the problem, design of the solution, and validation of the outcomes. The methods can be divided in four phases: theoretical exploration, empirical exploration, design, and validation.

### **2.2.1. THEORETICAL EXPLORATION THROUGH LITERATURE STUDY**

The first method is a literature study where previously done research is used to provide understanding of the definitions used in this research (public procurement in the Netherlands, procurement of circular infrastructure and the Best Value approach). First, search engines like Google, Google Scholar, and Scopus and TU Delft repository were used to find scientific papers, reports, books, previous graduation theses, Dutch procurement legislation and news articles to gain a first insight in these topics. Then more precise information was found by looking at the references used in scientific papers and previous graduation theses. Also the website of PIANOo and the book of Essers & Lombert (2017) were extensively used to get more insight in public procurement. It was found that there was not that much scientific research available about the procurement of circular infrastructure. Therefore, also reports from practice, for example the “Green Deal Circulair Inkopen”, were used. This is in line with the practice-oriented research approach.

The output of the literature study is a theoretical basis about the concepts of public procurement of circular infrastructure and the BVA. This basis was subsequently used to conclude if the BVA is suitable to procure circular infrastructure. The sub-questions 1a – 2b were all answered by the literature study.

### **2.2.2. EMPIRICAL EXPLORATION THROUGH INTERVIEWS**

The second research method is empirical, and includes conducting interviews. This is one of the most common methods to gather qualitative data (DiCicco-Bloom & Crabtree, 2006; Lucassen & olde Hartman, 2006). Because of the broadness of the research topic, it was decided to conduct semi-structured interviews. An advantage of this is that there is room to deviate from the questions if new information is introduced. However, it may also result in irrelevant information. To mitigate this, a list of questions is prepared, and at the end of the interview it was checked if every topic was discussed. The interviews were held in two rounds: one explorative and one in-depth. The preparation, conduction and analysis of each round will be described in the following sections.

#### *EXPLORATIVE INTERVIEWS*

First, explorative interviews were conducted to define what effective public procurement of circular infrastructure is, which factors contribute to this effectiveness and what the current level of effectiveness in the Netherlands is.

#### **Sample group of explorative interviews**

The preparation of the interviews begins with the selection of the interviewees to create a sample group. This can influence the outcome of the research greatly, because each individual has different experiences with the topic. One important aspect is the representativeness of the interviewees (Lucassen & olde Hartman, 2006). This is a measure of how well the sample resembles the target group, in this case Dutch public authorities in the infrastructure sector. Therefore, mostly public authorities were asked for the interviews, or consultants that work with public authorities. However, for the explorative interviews a mix between public authorities, consultants and contractors was chosen to get an insight from both the demand and supply side.

Another important aspect of the sample group is the sample size. Increasing the sample size can enlarge the reliability of the outcomes, but at least should be strived for a “saturation of answers”. This means that after interviewing a certain amount of persons no new information comes up (Lucassen & olde Hartman, 2006). It is hard to determine in advance how many interviews should be held, but for these interviews an amount of 10 interviewees was considered representative enough.

The interviewees were selected based on their contribution in circular construction / infrastructure projects. These projects were selected based on meetings with the company supervisor of Antea Group and searching on Google for “circular infrastructure projects”. Furthermore, in order to get a reasonable amount of interviewees, also some persons with little experience in the infrastructure sector were interviewed and asked to reflect their experiences on the infrastructure sector. The public procurement process in other sectors is not different, and valuable general experiences can be found. A list of the projects, interviewees and their professions can be found in Appendix B.

### **Strategy for explorative interviews**

In order to get the right information from the interviewees, a list of questions was prepared by the researcher. This list was discussed with the graduation supervisors to make sure the right issues would be addressed. The questions that were used for the interviews can be found in Appendix C. The interviewees were asked to reflect from their profession on a circular construction / infrastructure project that they have participated in or were participating in. Specifics about the procurement process of the project were asked in order to find the do’s and don’ts. Furthermore, questions were asked about success factors and pitfalls for circular procurement of infrastructure in general. Lastly, the interviewees were asked to reflect on how they thought the future (3-5 years from now on) would look like.

### **Analysis of results of explorative interviews**

In order to analyse the explorative interviews, the interviews were recorded and fully transcribed. For validation, the transcripts were send back to the corresponding interviewees. The findings were analysed in a qualitative analytical program, called Atlas.ti. A data structure was created to build the grounded theory of “effective public procurement of circular infrastructure” on. This is a research method that helps to develop a theory by analysing data inductively (Gioia et al., 2013). The process was as follows: the transcribed text was analysed and every relevant part in the text was highlighted and given a code, this process is called open coding. All open codes were then cross-referenced with each other to find common denominators, called axial coding. Lastly, the axial codes were cross-referenced another time to find the core-category, called selective coding (Verschuren & Doorewaard, 2015). These codes were used to describe the factors relevant for a definition and the current practice of effective public procurement of circular infrastructure. The coding and data structures can be found in Appendix E.

### **Output of explorative interviews**

The output of the analysis of the explorative interviews was the definition of effective public procurement of circular infrastructure. Several factors could be pointed out that contribute to this effectiveness, and they were distributed over multiple categories. Another output was a Strengths, Weaknesses, Opportunities & Threats (SWOT) analysis of the current practice in the Netherlands. This SWOT analysis helped to indicate how effective the procurement process is right now and where the BVA could potentially contribute. The explorative interviews contributed to answering sub-questions 3a & 3b.

## *IN-DEPTH INTERVIEWS*

In order to lay a good foundation to make the combination between public procurement of circular infrastructure and the BVA, in-depth interviews were conducted for validation of the outcomes of the explorative interviews.

### **Sample group of in-depth interviews**

The sample group of the in-depth interviews was different compared to the sample group of the explorative interviews. The difference in the selection of interviewees is that for the in-depth interviews only public authorities were interviewed, because they are the target group of this research. In order to get the most specific data about the infrastructure sector, the interviewees were also selected based on their experience with procurement of circular infrastructure projects. Some of the interviewees also had experience with the BVA, which was considered as a bonus. Also for these interviews an amount of 10 interviewees was considered representative enough. The list of the interviewees and their professions can be found in Appendix B.

### **Strategy for in-depth interviews**

In order to get the right information from the interviewees, a list of questions and a procurement process scheme were prepared by the researcher. This list was discussed with the graduation supervisors to make sure the right issues would be addressed. The questions that were used for the interview can be found in Appendix D. The interviewees were asked to reflect from their profession on several circular categories (result of explorative interviews). For each category it was asked if the category was important for procurement of circular infrastructure and in what way factors within the category could contribute to the effectiveness. Furthermore, it was asked in which phase(s) in the public procurement process the factor should be applied. The interviewees were able to write and draw on the procurement process scheme that was brought by the researcher to the interviews.

### **Analysis of results of in-depth interviews**

Just like the explorative interviews, the recordings were transcribed and send back to the interviewees for validation. The answers were analysed with the same coding structure in Atlas.ti, and some factors were added or deleted (Appendix E). If the total amount of interviewees that mentioned a certain factor, including the interviewees of the first round, was higher than 1/3<sup>rd</sup> of the sample group, the factor was considered valid. With a few exceptions, if the total was below 1/3<sup>rd</sup>, the factor was excluded.

### **Output of in-depth interviews**

The output of the in-depth interviews was the validation of the current factors of effective public procurement of circular infrastructure, and a validated SWOT analysis of the current practice. Sub-questions 3a & 3b were answered completely after the in-depth interviews.

### **2.2.3. DESIGN OF CONCEPTUAL MODEL**

After the empirical exploration phase, enough information was gathered to make a design for the combination between the BVA and public procurement of circular infrastructure. The theory of the BVA and also the answers of the in-depth interviews were used for this. The sample group and preparation of the interviews are the same as described in the previous section. The analysis and output are different, because different parts of the answers were important for this phase.

## *IN-DEPTH INTERVIEWS*

The same interview strategy is followed as described in the previous section. One addition is that if there were factors mentioned by the interviewees that were comparable to the BVA, the researcher mentioned the part of the BVA that may relate to that factor. In this way it was

determined if parts of the BVA could contribute to the effectiveness of procurement of circular infrastructure. The answers that related to the BVA were highlighted in the transcripts by hand and listed clearly in an Excel file (Appendix H). For each interviewee was noted if they said something about a certain aspect of the BVA and why it could (not) be a contribution to effective procurement of circular infrastructure. Also the conditions needed for using these aspects were retrieved indirectly from the answers.

#### *THEORY ON THE BVA*

The outcomes of the SWOT analysis were compared by the researcher to the theory on the BVA. Based on this comparison and extra input from the in-depth interviews (Appendix H) was established which aspects of the BVA could contribute to the effectiveness of the current practice of procurement of circular infrastructure and under which conditions.

The output of this phase was a list of separate elements of the BVA that could contribute to the effectiveness of procurement of circular infrastructure. After discussions with the graduation supervisors, fellow students and colleagues, a conceptual model was designed which shows the potentially contributing BV elements and under which conditions they can be used in the public procurement process. The output contributes to answering sub-question 4.

#### **2.2.4. VALIDATION THROUGH FOCUS GROUP**

The in depth-interviews provided the information to make the combination of the BVA and effective public procurement of circular infrastructure in the form of a conceptual model. In order to validate the results a focus group was organised. A focus group is also a research method to gather qualitative data (Wilkinson, 1998). The difference with an interview is that in a focus group multiple persons are present and they can react to the answers of others.

#### *SAMPLE GROUP OF FOCUS GROUP*

Because this research focusses on two different procurement approaches, experts in both fields of the BVA and public procurement of circular infrastructure were invited to reflect on the results from their point of view. Also the participants of the focus group were employees of public authorities or consultants that work for public authorities. For the focus group an amount of 6-8 persons was considered representative enough (Wilkinson, 1998).

#### *STRATEGY FOR FOCUS GROUP*

During the focus group the contributing elements of the BVA were discussed one by one in a presentation, including the conditions to apply them. For each element was discussed if it may contribute to effective circular procurement and why. After consensus between the participants was reached, the next element was discussed. Besides the separate elements, some discussion points related to the application of the BVA to procure circular infrastructure were looked into.

#### *ANALYSIS OF RESULTS OF FOCUS GROUP*

Just like the interviews, the focus group session was recorded and transcribed. A summary of the session was sent back to the participants for validation. Then the findings were compared to the conceptual model in order to determine if the inclusion of certain BV elements was valid, doubtful or invalid.

#### *OUTPUT OF FOCUS GROUP*

The findings of the focus group were used to adjust the conceptual model, resulting in a final model. The final model can be seen as a guideline for public authorities to procure circular infrastructure more effectively with the use of (some) elements of the BVA. This final model was used to extract and discuss the final results and limitations of the research. These were



subsequently used to formulate an answer to the research question and practical recommendations for public authorities.

**2.3. RESEARCH STRATEGY**

As mentioned in section 2.2., the research methods were used within several process phases of this research. Each research method has a certain output that will be used in the next phase. How the methods are used and their contribution to answering the sub-questions (SQ) and research question (RQ) are captured in the research strategy scheme on the next page (figure 2).

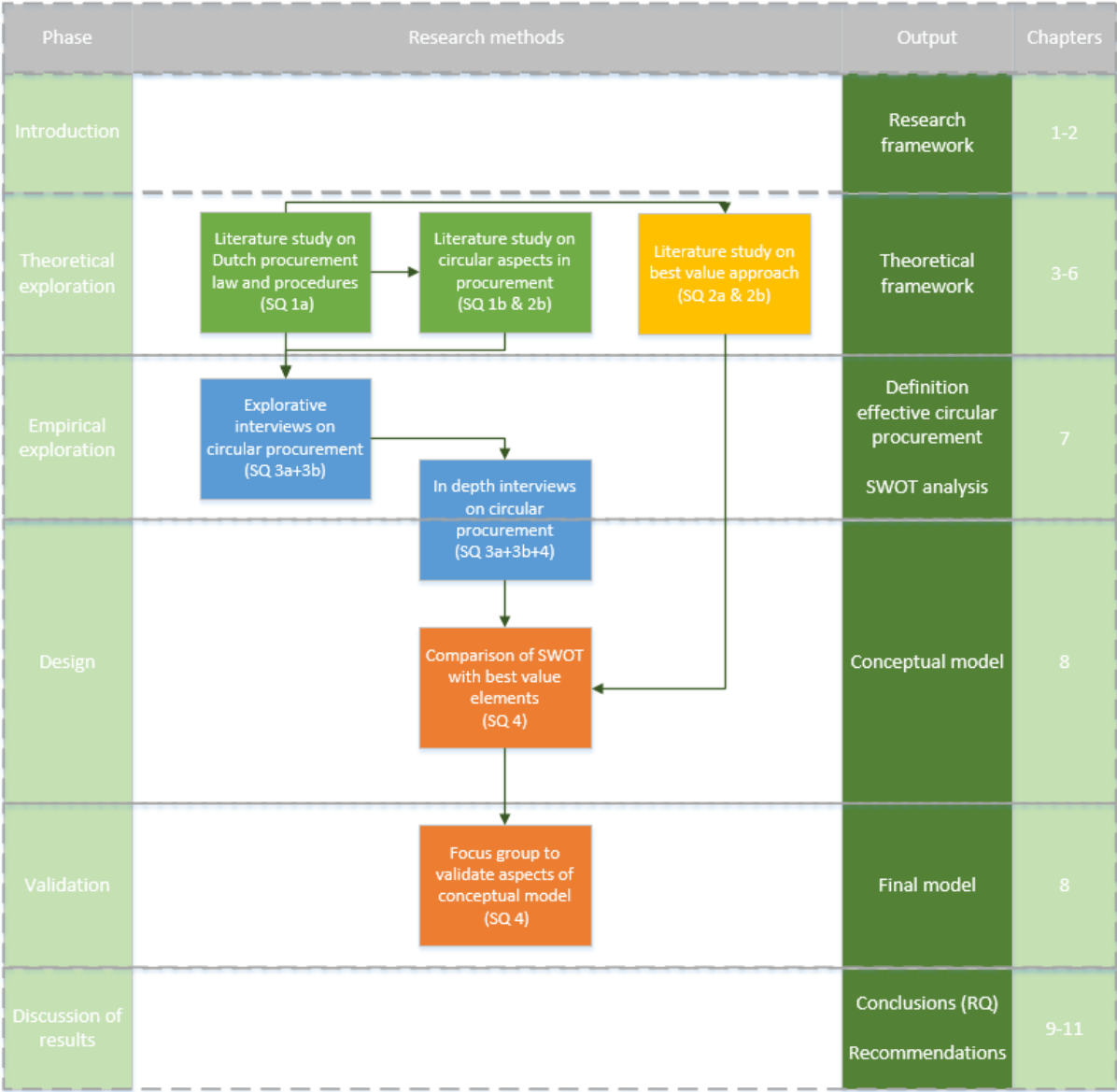


FIGURE 2: SUMMARY RESEARCH STRATEGY. OWN ILLUSTRATION



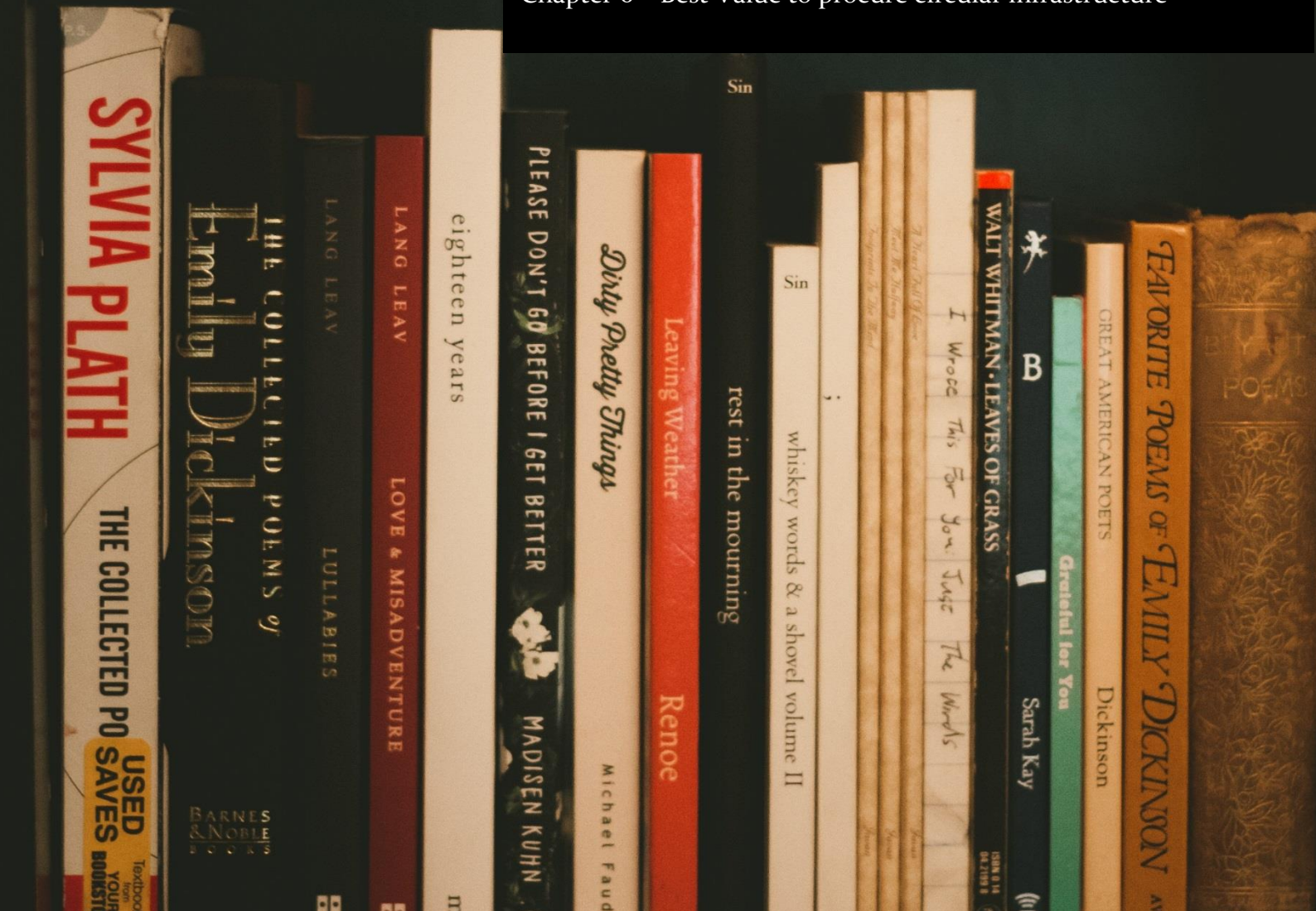
## Theoretical exploration

Chapter 3 – Public Procurement in the Netherlands

Chapter 4 – Procurement of circular infrastructure

Chapter 5 – The Best Value approach

Chapter 6 – Best Value to procure circular infrastructure



# 3 PUBLIC PROCUREMENT IN THE NETHERLANDS

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The main topic of this research is about the public procurement of circular infrastructure. In order to understand how this can be done, the public procurement process needs to be explained in general. This chapter will provide an overview of the most important aspects related to public procurement. First, a short explanation of construction clients will be provided in section 3.1. Then the European Directives and Dutch procurement legislation will be explained in section 3.2. and applied to the procurement process in section 3.3. In section 3.4. a summary is provided and the sub question “*What is public procurement in the Netherlands?*” will be answered.

## 3.1. CONSTRUCTION CLIENTS

In order to specify what public procurement is, a short elaboration will be given on what a what a public construction client is. Generally, a construction client is “*a natural or legal person for whom a structure is constructed, or alternatively the person or organisation that took the initiative of the construction*” (OECD, 2003). So construction clients initiate construction projects. Construction clients can be divided roughly into two types: public and private clients (Boyd & Chinyio, 2006). Both types have different values and interests.

According to Kuitert, Volker and Hermans (2016) one of the main professional tasks of the public clients is to ensure public value. The aim is to protect the public goods and ensure benefits for all. Private clients, on the other hand, strive for achieving profit (Boyd & Chinyio, 2006). In infrastructure projects the client is always public of nature (Ten Haaf, 2017, p. 108). Public clients are defined according to the Aanbestedingswet 2012 as contracting authorities (art. 1.1). From now on this term will be used for public authorities. According to the Aanbestedingswet 2012 several types of contracting authorities can be distinguished: the State, a provincial authority, a municipal authority, a water board, a body governed by public law or an association of these government bodies or bodies governed by public law (Aanbestedingswet, 2012, art. 1.1). In the context of this research organisations like Rijkswaterstaat, ProRail or Schiphol are also considered as contracting authorities.

When contracting authorities want to realize an infrastructure project, they prepare a public contract and subsequently look for a party that can offer the best solution. This way of purchasing infrastructure is called procurement. Contracting authorities are not free in selecting and contracting anyone as they wish (Chao-Duivis, Koning, Ubink, & Bruggeman, 2018, p. 147). In order to safeguard fair competition they are obliged to follow the procurement law in which is regulated how they can select parties. This will be explained in the next section.

## 3.2. PROCUREMENT LAW IN GENERAL

In this section the concepts of public procurement will be discussed. First the European Directives are explained and then Dutch procurement legislation is elaborated on, including the procurement procedures.

### 3.2.1. EUROPEAN PROCUREMENT AND DIRECTIVES

In order to create a level playing field for all businesses across Europe, EU law sets out minimum harmonised public procurement rules (European Commission, 2017). The general rules for public procurement and the way public authorities should purchase goods, works and services are laid out in the European Directive 2014/24/EU. This directive is most commonly used for infrastructure projects.

## DEFINITION OF PUBLIC PROCUREMENT

According to the European Directive 2014/24 (art. 1, sub 2) public procurement can be defined as: “the acquisition by means of a public contract of works, supplies or services by one or more contracting authorities from economic operators chosen by those contracting authorities, whether or not the works, supplies or services are intended for a public purpose.” In other words, public procurement refers to the process by which public authorities purchase work, supplies or services from companies (European Commission, 2017). It essentially comes down to “inviting project offers and selecting the most suitable one” (Van Duren & Dorée, 2008). In the context of this research the offers will be submitted by contractors. When contractors are invited to make an offer, the procurement process is called a tender. In short, within a tender multiple contractors are invited to submit offers for the execution of the public contract (Essers & Lombert, 2017, p. 25). The offers are assessed by the contracting authority and the contract is awarded to the contractor with the economically most advantageous offer (Aanbestedingswet 2012, art. 2.114).

## AIM OF EUROPEAN DIRECTIVES

The European Directives are originally drafted to create an internal market within the European Union and to stimulate fair competition (Essers & Lombert, 2017, p.26). The core principles of the European Directives are derived from the fair competition and relate to equal treatment, non-discrimination, proportionality and transparency (Essers & Lombert, 2017, p. 27). These principles have to be honoured in all phases of every tender. The directives aim to make public procurement more effective and efficient (PIANOo, 2018a). They are designed to achieve a procurement market that is competitive, they safeguard against corruption, ensure equality for similar contractors and better value for money for taxpayers (Essers & Lombert, 2017, p. 26). Lastly, the directives can help contracting authorities to achieve strategic and societal goals like innovation or sustainability.

## EUROPEAN THRESHOLD

When public contracts exceed a certain monetary value, contracting authorities have to follow the European Directives on public procurement (European Commission, 2017). This European threshold value depends on the type of public contract and type of contracting authority. Table 1 summarizes the so-called European threshold values for public contracts. Three types of public contracts can be distinguished:

1. **Works:** relate to the execution, or both the design and execution, of a building or civil engineering works taken as a whole (2014/24/EU art. 2.1.6 and 2.1.7).
2. **Supplies:** relate to the purchase, lease, rental or hire-purchase, with or without an option to buy, of products (2014/24/EU art. 2.1.8).
3. **Services:** relate to the provision of services other than works (2014/24/EU art. 2.1.9).

TABLE 1: EUROPEAN THRESHOLD VALUES FOR PUBLIC CONTRACTS. SOURCE: EUROPEAN COMMISSION (2018)

	Central government authorities (State)	Sub-central contracting authorities
Works	€5.548.000	€5.548.000
Supplies	€144.000	€221.000
Services	€144.000	€221.000

In the context of this research, the procurement of works is focussed on, because in the Dutch infrastructure sector most public contracts will consider a work (Moonen, 2016).

For public contracts of a lower value than the European threshold the national rules apply. The European Directives are transposed into national procurement legislation (European

Commission, 2017). In the Netherlands the directives are implemented in the Aanbestedingswet 2012 that came into force on July 1<sup>st</sup> 2016. However, in any case, the national rules also have to respect the general principles of EU law as explained before.

### 3.2.2. DUTCH PROCUREMENT AND LEGISLATION

As mentioned above, the Dutch Aanbestedingswet 2012 interprets the European Directives for public procurement in the Netherlands. Since the 1<sup>st</sup> of July 2016 this law applies to all Dutch tenders and contracting authorities, whether or not contracts exceed the European threshold. The main principles of the Aanbestedingswet 2012 comply with the European ones and have to be honoured throughout the whole procurement process. The principles are: equality, non-discrimination, transparency, and proportionality (2014/24/EU art. 18.1).

- Non-discrimination: a contracting authority treats economic operators in a (...) non-discriminating way (Aanbestedingswet, art. 1.8). This means that it is not allowed to make a distinction based on nationality (Essers & Lombert, 2017, p. 57).
- Equal treatment: a contracting authority treats economic operators in an equal (...) way (Aanbestedingswet, art. 1.8). This means that candidates should never be favoured or disadvantaged in all phases of the tender process.
- Transparency: a contracting authority acts transparently (Aanbestedingswet, art. 1.9). They ensure an appropriate degree of openness of the announcement of the public contract, and the criteria on which the awarding of the contract is based. Furthermore, the awarding of the contract should be motivated.
- Proportionality: a contracting authority sets during the preparation of, and establishment of a public contract (...) only requirements, conditions and criteria (...) that are in reasonable proportion to the object of the contract. (Aanbestedingswet, art. 1.10). This principle is further elaborated in the Dutch “Guide proportionality”. Furthermore, the Aanbestedingswet states that merging of public contracts is not allowed. This should safeguard the participation of small or medium sized companies (Aanbestedingswet, art 1.5 lid 1.a).

### 3.2.3. PROCUREMENT PROCEDURES

According to the Aanbestedingswet (art. 2.2.1.) there are several procedures that can be followed by the contracting authority to execute the procurement process:

- Open procedure
- Restricted procedure
- Negotiated procedure with prior publication of a contract notice
- Negotiated procedure without prior publication of a contract notice
- Competitive dialogue
- Innovation partnership
- Procedure for social and other specific services

In the context of this research only the open and restricted procedure are considered. These procedures can be used in any case (Essers & Lombert, 2017, p. 325). Furthermore, as will become clear later in this research, these two procedures are most compatible with the Best Value approach (chapter 5).

#### *OPEN PROCEDURE*

With the open procedure, all interested contractors are allowed to get insight in the specifications and participate in the tender (Essers & Lombert, 2017, p. 328; Aanbestedingswet art. 1.1.). There is one round in which the candidates can submit their qualifications and offers.

The contracting authority tests if the candidates comply with the exclusion grounds, suitability requirements, and the contract specifications. Then the contracting authority assesses the offers based on the predetermined award criteria (Aanbestedingswet art. 2.26). There is no dialogue between the candidate and the contracting authority, but it is possible to share information through an information note (Dutch: Nota van Inlichtingen) or by organising an information meeting at the beginning of the tender, provided that all candidates are present. The open procedure can be used when it is expected that not that many contractors will participate, otherwise the restricted procedure is more suitable and proportional.

*RESTRICTED PROCEDURE*

In contrast to the open procedure, the restricted procedure is used to assess contractors in two separate rounds. Still, any interested contractor can participate, but the first selection takes place earlier (Essers & Lombert, 2017, p. 338). The aim of this preselection is to limit the amount of contractors that can make an offer to a reasonable amount (if there are enough suitable candidates). For the restricted procedure this amount is at least five (Aanbestedingswet art. 2.99). Just like the open procedure the candidates are tested by the contracting authority on the exclusion grounds and suitability requirements (Aanbestedingswet art. 2.27). Then the contracting authority assesses the candidates based on the predetermined selection criteria. The (at least five) selected candidates are then invited to make an offer which will be tested against the project specifications and assessed based on the predetermined award criteria (Aanbestedingswet art. 2.27). There is also no dialogue between the contracting authorities and tenderers, besides the options presented under the open procedure. The restricted procedure allows contracting authorities to limit the amount of offers that have to be assessed. This mitigates the risk of a large amount of offers, which can be disproportional for both the contracting authority and contractors.

**3.3. THE STEPS OF THE PROCUREMENT PROCESS**

The previous section described the procurement process according to two procedures. Each procedure has several, roughly the same, steps that have to be followed. The specific content and length of each step depends on the type of public contract and the procurement policy of the contracting authority. The tender steps are retrieved from the Aanbestedingswet 2012 art. 2.58-2.131, PIANOo and the book of Essers & Lombert (2017) and visualized below (figure 3). In the next sections, each step will be explained separately.

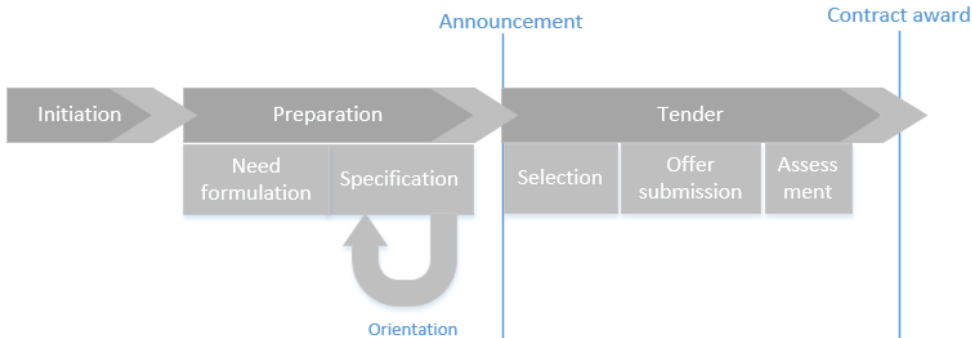


FIGURE 3: PROCUREMENT PROCESS. OWN ILLUSTRATION

**3.3.1. INITIATION OF THE TENDER**

The first step of the procurement process is creating a procurement team (Essers & Lombert, 2017, p. 160). This team consist of several employees of the contracting authority and sometimes external experts. All members should have sufficient knowledge to draft the tender documents, execute the chosen procedure, and assess the offers (Essers & Lombert, 2017, p. 160).

### 3.3.2. PREPARATION OF THE TENDER

The preparation of the tender is very important for contracting authorities. Certain decisions regarding the specifications of the project and the procurement procedure have to be made, which determine the result (and effectiveness) of the tender (Essers & Lombert, 2017, p. 155). The preparation consists of the need formulation, specification and orientation.

#### *NEED FORMULATION*

When the procurement team is established, a need or a wish is formulated that has to be procured. This can be a certain product, service or civil engineering work like a road or bridge (PIANOo, 2018c). The contracting authority determines what the need is, when it should be realized, what the budget will be and what activities need to be outsourced. Besides the actual need for an infrastructural work, it is possible to implement an organisational procurement policy in the formulation of the need. Besides an organisational ambition, also specific project ambitions can be formulated, for example sustainable use of materials or innovation (Antea Group & Metabolic, n.d.; Van Haagen, 2018).

Furthermore a decision for the contract has to be made. A distinction can be made between two contract types: traditional and integrated contracts. In a traditional contract the contracting authority is responsible for all specifications and the contractor only executes the contract (Essers & Lombert, 2017, p. 208). In an integrated contract, the contractor can also be responsible for the design, finances or maintenance of the work (Essers & Lombert, 2017, p. 208-209).

#### *SPECIFICATION*

When the contracting authority has a global idea of its need and what part of it should be outsourced, the need has to be translated into contract specifications. The requirements and wishes that are included in the contract specifications determine how and if the contractor can satisfy the contracting authority's need. The translation from need to requirements can be done by formulating technical specifications (Aanbestedingswet 2012 art. 2.75). It is important that the specifications are transparent, non-discriminating and relate to the object of the contract. They should not unreasonably hamper competition and they must give each contractor equal access to the contract (Aanbestedingswet 2012 art. 2.75 lid 6).

Specifications can be divided in two types of requirements (Aanbestedingswet 2012 art. 2.76):

- Technical: these requirements describe the work in detail. For example, the dimensions, specific properties or necessary EU norms are specified.
- Functional and performance-based: these requirements describe the intended function or performance of the work, supply or service. They are less detailed compared to technical requirements and give contractors more freedom to make use of its expertise, knowledge and inventiveness.

Variants to the specifications can be allowed by the contracting authority to improve competition and innovation (Essers & Lombert, 2017, p. 228), provided that the variant still meets the object of the contract, and the award criteria are still applicable on the variant (Aanbestedingswet 2012, art. 2.83).

#### *ORIENTATION*

In order to draft the right specifications not only the need of the contracting authority is important, it should also be clear what the supply chain can offer (Essers & Lombert, 2017, p. 162). To get a clear view, a market exploration can be held. Through a market consultation the contracting authority can get insight in the creativity, innovativeness, knowledge and experience of the supply chain (Essers & Lombert, 2017, p. 163). Contracting authorities are then able to

identify the market structure and investigate which solutions are available. For example, it can be checked what the current status of technology is. The outcome of the market consultation can help to determine what the best approach is for putting the public contract on the market.

Even though the Aanbestedingswet 2012 does not prescribe how a market consultation should be done, it is important to make sure the procurement principles of transparency, non-discrimination and equality are honoured. The advice from the market consultation may be used, provided that such advice does not have the effect of distorting competition and does not result in a violation of the principles of non-discrimination and transparency (Ten Haaf, 2017; 2014/24/EU art. 40). To make sure no contractors are favoured, the outcome of the consultation has to be shared publicly (PIANOO, 2018f).

### **3.3.3. TENDER PROCESS**

When the preparation phase is completed, the contracting authority can invite contractors to make an offer. The tender phase starts and consists of the announcement of the contract, selection, offer submission, assessment of offers, and contract award.

#### *ANNOUNCEMENT*

When the tender documents are ready, the contracting authority can put the contract on the market. According to the Aanbestedingswet 2012 (art. 2.62) this will be done by an announcement of the public contract. In the Netherlands this is done electronically through the website of TenderNed, the Dutch electronic platform for procurement. This is obliged for contracts above the European threshold (2014/24/EU art. 49) and optional for national contracts. Based on the information presented in the tender documents, contractors can decide whether or not to participate in the tender. If this is the case, they have to request for participation electronically through TenderNed.

#### *SELECTION*

Independent of the procurement procedure, candidates will be selected based on multiple criteria. These criteria all relate to the personal situation of the contractor (Essers & Lombert, 2017, p. 229). First, contractors have to comply with certain criteria in order to participate in the tender, the so-called exclusion grounds and suitability requirements. For the restricted procedure, additional selection criteria can be formulated to limit the total amount of candidates. All criteria and their assessment should be objective (Aanbestedingswet art. 1.4).

- **Exclusion grounds**

A contracting authority is allowed to exclude candidates from the tender process if they do not act integrally or are the subject of a conviction by final judgment for one of the reasons as stated in the Aanbestedingswet 2012 art. 2.86 and 2014/24/EU art. 57. These exclusion grounds are mandatory and the same for every tender. Each candidate has to provide a statement (Dutch: Eigen Verklaring) in which they state that the aforementioned reasons do not apply to them (Essers & Lombert, 2017, p. 232). Besides the mandatory exclusion grounds, also facultative exclusion grounds can be used. These are stated in Aanbestedingswet 2012 (art. 2.87).

- **Suitability requirements**

In contrast to the exclusion grounds, suitability requirements do not relate to the personal circumstances of the contractor, but to its capabilities and competences, based on previously executed projects (Moonen, 2016, p. 149). These requirements concern the financial capability, technical and professional capability, and professional competence of the contractor (Aanbestedingswet 2012 art. 2.90). It is important that the requirements



relate to the object of the contract, are proportional and non-discriminating (Essers & Lombert, 2017, p. 242).

- Selection criteria

The contracting authority can decide to limit the amount of candidates to at least five through additional selection criteria (Aanbestedingswet art. 2.99). The aim of preselection is to reduce the amount of offers that have to be drafted and assessed.

In the tender process, the candidates are first tested against the mandatory, facultative and other exclusion grounds as mentioned in the tender documents. Then, the assessment of the suitability requirements takes place (Aanbestedingswet art. 2.27). Each candidate that does not comply with the exclusion grounds or suitability requirements is rejected directly. In the case of a restricted procedure, the candidates are further assessed and shortlisted by the predetermined selection criteria.

#### *OFFER SUBMISSION*

Depending on the awarding guideline and criterion, a plan has to be made by the candidates how they will realise the need of the contracting authority. During the tender phase, candidates can ask questions with respect to the object of the contract and awarding guideline. These questions can be answered through information sessions with the candidates or the information note and the answers are made available for everyone. The contracting authority determines in advance when the submission deadline for the offers is. This deadline is very strict. Each offer that is handed in too late will not be assessed, because of the equality principle, (PIANOo, 2018d).

#### *ASSESSMENT AND AWARD*

After the offers are submitted, they are assessed based on predefined award criteria. Contracts should be awarded on the basis of objective criteria that honour the principles of transparency, non-discrimination and equal treatment, and that relate to the object of the contract. The criteria should ensure an objective comparison of the offers in order to determine which tender is the economically most advantageous tender (EMAT) (2014/24/EU consideration 90; Aanbestedingswet 2012 art. 2.114). Contracting authorities are obliged to award the contract based on the best price-quality ratio (BPQR) Aanbestedingswet (art. 2.114 sub 3). However, it is also possible to award the contract based on the lowest price or the lowest costs based on cost effectiveness, provided that the contracting authority motivates this choice.

- Lowest price:

The contract is awarded to the candidate that complies with all suitability requirements and offers the lowest price (PIANOo, 2018e). The contracting authority has to motivate when this criterion will be used. For example, it is allowed when it is not possible for candidates to add value within the sub-award criteria (Essers & Lombert, 2017, p. 287).

- Lowest costs based on cost effectiveness like life cycle costs (LCC):

In comparison to the lowest price criteria, not only the investment costs are taken into account, but also the costs related to operation, maintenance and disposal (Aanbestedingswet 2012, art. 115a). Furthermore, costs related to environmental externalities, such as pollution caused by extraction of the raw materials used in the product or caused by the product itself or its manufacturing, provided they can be monetised and be assessed (2014/24/EU consideration 96). The contracting authority has to specify in advance which life cycle cost aspects are assessed and how they are assessed (Essers & Lombert, 2017, p. 287).

- **Best price-quality ratio:**  
The contracting authority specifies, additional to the price, sub-award criteria on which candidates can make a distinguishing offer. These criteria provide a good opportunity to incorporate social, environmental and innovative aspects besides the price (Aanbestedingswet, art. 115 sub 2e). For each sub-award criteria the candidate can get a score which will be settled with the price in the assessment (Aanbestedingswet 2012, art. 115). The contracting authority decides the weighting of the quality criteria, this can vary from a very low percentage to awarding almost 100% on quality. It is important that the quality criteria have a weighting that is high enough to be decisive. Otherwise the contract is still awarded based on the lowest price.

Within BPQR tenders quality is an important aspect in the tender process, but in most tenders the price still plays a role. Instead of inviting the contractor to offer a certain price, a price ceiling can be established to create clarity about the price for the supply chain (van de Rijt, Witteveen, & Santema, 2016). A price ceiling is the maximum price the contracting authority is willing to pay for the infrastructural work. Offers that exceed the price ceiling are declared as unacceptable (Aanbestedingswet art. 2.28 sub 4). The price ceiling is set by the contracting authority based on an estimation of the project costs.

The offers are assessed by the contracting authority based on the technical and functional requirements as stated in the award guideline (Aanbestedingswet 2012, art. 2.113). Because of the principles of non-discrimination and equal treatment, it is important that this assessment is done objectively. The assessment technique and the award criteria should be formulated in such way that it is reasonably clear which award criteria should be fulfilled by the candidate. The offers should be assessed objectively and the contracting authority should motivate the awarding of the contract in such way that it is traceable how the offers are assessed and why a certain score is given (Ten Haaf, 2017, p. 108). Subsequently, the candidate that has the EMAT is awarded with the realisation the contract (PIANOo, 2018b).

#### *AFTER CONTRACT AWARD*

The contract is not awarded immediately to the candidate with the best offer. After the awarding decision, a suspending time of 20 days (Aanbestedingswet 2012 art. 2.127) is used for the other candidates to institute summary proceedings against the award decision. If there are no objections, the contract is officially awarded after these 20 days. The contracting authority is allowed not to enter into the contract, but it cannot contract another candidate. If there is a need for contractual changes or another contractor, the whole tender procedure has to be redone (Chao-Duivis et al., 2018). After the contract award, the procurement process has ended.

### **3.4. SUMMARY**

This chapter has provided an insight in the European and Dutch procurement legislation, and the public procurement process in the Netherlands. In this section the procurement process will be summarized, which provides an answer to the sub question: *What is public procurement in the Netherlands?*

Procurement for Dutch public authorities essentially comes down to “*inviting project offers and selecting the most suitable one*” (Van Duren & Dorée, 2008). The way in which this is done is called a tender and the rules for contracting authorities are laid out in the Aanbestedingswet 2012 and European Directive EU/2014/24. The main principles of public procurement are equality, non-discrimination, transparency, and proportionality in order to create a level playing field. Two procurement procedures are pointed out: the open procedure and restricted

procedure. For both procedures, there are certain steps that have to be followed, which are summarized below in figure 4:

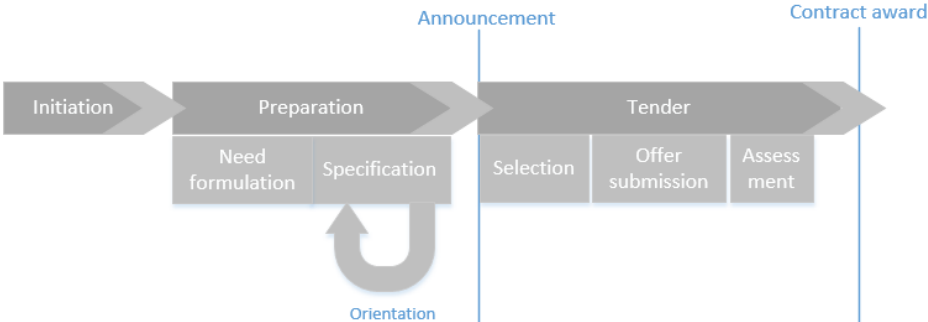


FIGURE 4: PROCUREMENT PROCESS. OWN ILLUSTRATION

Now that the basics of public procurement in the Netherlands are explained, two specific approaches to public procurement are explained in the next chapters. First the details about tenders with circular infrastructure aspects in it are discussed in chapter 4 and then the Best Value approach is elaborated on in chapter 5.

# 4 PROCUREMENT OF CIRCULAR INFRASTRUCTURE

In the previous chapter the public procurement process is described in general. However, with this basic explanation no circular infrastructure will be procured. In order to get this circular infrastructure, the procurement process has to be drafted in such way that the requirements and criteria stimulate contractors to realize circular solutions. This chapter will explain what procurement of circular infrastructure is and what aspects are distinctive compared to the general procurement process as explained in the previous chapter. The following sub-question will be answered: *Where can circular infrastructure aspects be incorporated in the Dutch procurement process?*

First, the circular economy and circular infrastructure will be described in short in section 4.1. Then some aspects of circular procurement will be presented in section 4.2. When these aspects are clear, they will be applied in the procurement process in section 4.3., and lastly, the role of the contracting authority that is required for this procurement approach will be discussed in section 4.4.

It is important to note that circular procurement and circular tenders do not exist. There are no specific procedures or requirements described in the European Directives or Aanbestedingswet 2012 regarding circularity. It is a normal tender, which includes circular aspects. For the readability of this report the term circular procurement will be used from now on, even though it is not entirely correct.

## 4.1. CIRCULAR ECONOMY AND CIRCULAR INFRASTRUCTURE

According to Alhola, Salmenperä, Ryding, & Busch (2017, p. 9) circular procurement refers to procurement that follows the principles of CE. Each phase in the procurement process should give substance to the principles of CE in order to get a circular outcome. This is however not a very clear definition of circular procurement, because it does not mention what these “principles of CE” are exactly. In order to define what the circular principles are that can be incorporated in the procurement process, the concepts of the CE and circular infrastructure should be discussed briefly.

### 4.1.1. CIRCULAR ECONOMY

As mentioned briefly in the introduction of this research, a CE is an economy in which products are no longer disposed at the end of life, but kept in use (Ellen MacArthur Foundation, 2013). As a result, less materials are needed to make new products and less pressure is put on finite resources. Energy and material loops are closed by recovering, restoring, reusing, repairing, remanufacturing, refurbishing or recycling man-made products at their end of life. This process is illustrated below (figure 5).

Since the introduction of the concept of the CE in 2010 by the Ellen MacArthur Foundation it has gained more and more support over the world. It is gaining momentum and a lot of research has been done the last couple of years. It has led to many definitions and interpretations of the CE. For example, Kirchherr, Reike and Hekkert (2017) have investigated a great amount of 114 definitions of the CE. It highly depends on the situation what definition is most suitable and to what extent CE aspects can be applied. Geissdoerfer, Savaget, Bocken and Hultink (2017) have formulated a definition based on many sustainability and circularity concepts. According to

them a CE can be defined as a “regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling” (Geissdoerfer et al., 2017). This definition seems to cover the most important aspects of a CE and will be used as a handhold in this research.

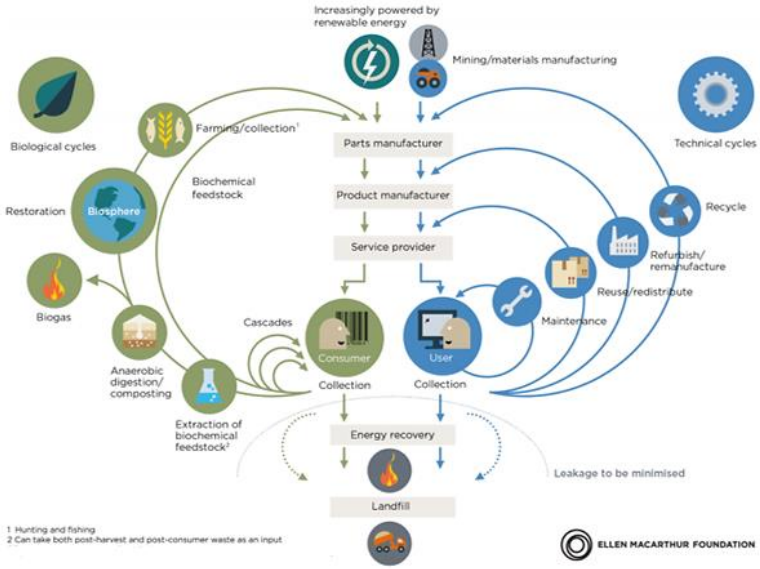


FIGURE 5: CE PRINCIPLE. SOURCE: ELLEN MACARTHUR FOUNDATION (2013)

4.1.2. CIRCULAR INFRASTRUCTURE

The definition of Geissdoerfer et al. (2017) can also be applied to infrastructure works. Circular infrastructure is then infrastructure “in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops.” (Geissdoerfer et al., 2017). Castelein (2018) has found that in the infrastructure sector the main goal of circularity is to minimize waste and consumption of (raw) materials. This entails the sustainable (re)use and production of materials, extending the life span of the work, and the high quality reuse of materials at the end of life. Materials used for the construction of the project should be able to be reused within new infrastructure projects in order to close the material loops. This is underpinned by MVO Nederland (2018b) who define circularity as “the high-quality reuse of resources, materials and components”. More information about the (re)use of materials in circular infrastructure can be found in Appendix A.

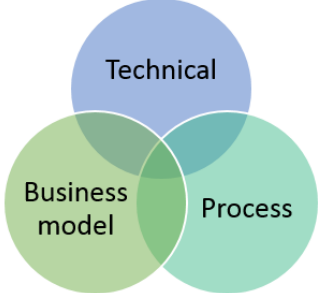


FIGURE 6: ASPECTS OF CE. SOURCE: GREEN DEAL CIRCULAR INKOPEN (2016)

Aforementioned applications of circularity in infrastructure relate mostly to the production and (re)use of materials. Besides these technical aspects, according to the Green Deal Circular Inkopen (2016), also process aspects and business models can be pointed out to reach circularity (figure 6). In short, the process relates to the several phases in the life cycle of an infrastructure project and how circularity can be safeguarded throughout these phases. The business model relates to a new way of financing projects. Because this research focusses on the combination of two procurement approaches and not on circular contracts, the business model aspect is left out. More information about circular contracting can be found in the research of Castelein (2018).

## **4.2. ASPECTS OF CIRCULAR PROCUREMENT**

Now that the concepts of CE and circular infrastructure are clear, the interpretation of these concepts can be linked to the public procurement process. The aspects related to circular procurement will be determined, based on the current literature. Three aspects will be pointed out that define the main thoughts behind circular procurement, which will be discussed one by one in the following sections.

Circular procurement can be seen as a new concept, but on the other hand, it is not entirely new. Before CE gained popularity, sustainability elements were already being used in public procurement. This is called sustainable or green public procurement. Sustainable public procurement is defined by the European Commission as *“a process whereby public authorities seek to procure (...) works with a reduced environmental impact throughout their life cycle when compared to (...) works with the same primary function that would otherwise be procured”* (European Commission, 2017). So, the environmental impact over the life cycle is considered an important aspect of sustainability. This is where sustainability meets circularity, because CE also aims to reduce the environmental impact over the whole life cycle, and additionally minimize waste creation by closing energy and material loops.

### **4.2.1. LIFE CYCLE APPROACH**

So the taking the whole life cycle into account seems important for circular procurement as well. This is underpinned by the European Commission who also formulated a definition of circular procurement: it is *“the process by which public authorities purchase works (...) that seek to contribute to closed energy and material loops within supply chains, whilst minimising, and in the best case avoiding, negative environmental impacts and waste creation across their whole life-cycle”* (European Commission, 2017). This means that contracting authorities should look beyond short-term needs and consider the long-term impacts of each purchase (European Commission, 2017). This includes, for example, questioning whether a purchase should be made at all. If a purchase should be made, the costs over the whole life cycle should be considered instead of the investment costs.

### **4.2.2. COLLABORATION WITH SUPPLY CHAIN**

In the previous definition of circular procurement, nothing is said about how the material and energy loops should be narrowed, slowed or closed. According to MVO Nederland circular procurement is: *“the use of procurement to stimulate the (re)use of circular products and services to boost the CE”* (MVO Nederland, 2018b; Padding et al., 2015). So, according to this definition, (re)use of circular products can contribute to closing the loops. This is in line with the earlier presented definition of Geissdoerfer et al. (2017). Reusing products implies that also agreements about the realisation, use, and end of life phase should be made in order to safeguard circularity over the whole life cycle. This emphasises that, depending on the agreements, not only the contracting authority is responsible but all involved suppliers. This is underpinned by multiple sources who state that circular procurement should strive for collaboration with the supply chain to make circular solutions possible (Adetunji et al., 2008; Nelissen et al., 2018; Padding, Croon, Haastrecht, & Dijkstra, 2015; Pomponi & Moncaster, 2017; Ten Haaf, 2017, p. 110). This collaboration will then subsequently contribute to successful reuse of materials.

### **4.2.3. INNOVATION**

The last aspect related to circular procurement is innovation. The European Directives and Aanbestedingswet 2012 underpin the importance of public procurement towards sustainable and innovative solutions: *“It is of utmost importance to fully exploit the potential of public procurement to achieve the objectives of the Europe 2020 strategy for smart, sustainable and*

*inclusive growth*” (2014/24/EU consideration 95). The same consideration states that public procurement is crucial to driving sustainability and innovation. Public authorities are “*social-politically responsible and therefore expected to actively contribute to the innovation and improvement of the construction sector*” (Kuitert et al., 2016). Continuous innovation is needed to achieve greater sustainability (Grandia, Steijn, & Kuipers, 2015). Besides that innovations are needed for sustainability, innovations are also important for circularity. This is underpinned by Ten Haaf (2017, p. 107): “*Innovations on technical, social and organisational levels are inseparably connected to the transition towards a circular economy*”. The focus of this research is mostly on the technical and process aspects of circularity (figure 6), so technical product innovations will be focussed on and not the development of new financial or business models.

### **4.3. CIRCULAR ASPECTS IN THE TENDER PROCESS**

From the previous sections it can be derived that circular procurement is a regular procurement process that incorporates circular aspects in order to procure, realize and safeguard circular infrastructure over its whole life cycle. Now that the aspects (life cycle approach, collaboration with the supply chain, and innovation) of circular procurement are clear, this section will discuss how these aspects can be incorporated in the procurement process. Earlier conducted studies (Chao-Duivis, 2018; Ten Haaf, 2017; Van Haagen, 2018) already dove into the details of the possibilities of circular aspects within the procurement legislation and procurement process. All three conclude that the procurement legislation provides enough room to implement circular aspects and to procure circularly. A short summary of the possibilities will be provided in the next sub-sections. First, the distinguishing aspects of circular procurement will be discussed, then the role of the contracting authority in order to give substance to circular procurement will be described.

#### **4.3.1. PROCUREMENT PROCEDURES**

There are multiple procurement procedures that are suitable to procure circularly. The open procedure, restricted procedure, competitive dialogue and design contest can be used (Ten Haaf, 2017, p. 108). In addition to this, there is the procedure of the innovation partnership which can be used to procure (circular) innovations (Chao-Duivis, 2018, p. 10). Van Haagen (2018) concludes that a procedure with preselection is preferable, because it is desired to only let motivated contractors make an offer. In the context of this research, the restricted procedure seems the most preferable.

#### **4.3.2. INITIATION OF THE TENDER**

When establishing the procurement team, it is possible to involve external experts (Essers & Lombert, 2017, p. 160). If the contracting authority is not experienced with circular procurement, it is possible to involve an expert in that field in the procurement team.

#### **4.3.3. PREPARATION OF THE TENDER**

##### *NEED*

Besides the actual need for an infrastructural work, it is possible to implement an organisational policy in the formulation of the need (section 3.3.2). The Aanbestedingswet 2012 clarifies in which ways organisational policies like sustainability and circularity can be included in public contracts (Essers & Lombert, 2017, p. 52). For example emphasis can be put on sustainability, collaboration, innovation or circularity, depending on the contracting authority and type of project. Specific circular ambitions for the infrastructure project can then be formulated (Antea Group & Metabolic, n.d.; Van Haagen, 2018). The most effective way to ensure that certain circular ambitions are met, is to incorporate them as requirements in the contract (Kuitert, Volker, Hermans, & Steen, 2017).

### *SPECIFICATION*

Circular infrastructure aspects can be incorporated in the technical and functional specifications of a tender (Ten Haaf, 2017, p. 108). As stated by multiple sources, in circular procurement the specifications should be more functional of nature (Chao-Duivis, 2018; Ten Haaf, 2017; Van Haagen, 2018). Furthermore, variants can be used to offer candidates the needed flexibility to develop their own production processes circularly (Ten Haaf, 2017, p. 109). This will provide more flexibility and room for contractors to offer innovative, circular solutions. Not only requirements about the work itself have to be formulated in order to reach circular infrastructure. The whole life cycle of materials needs to be taken into account, so requirements about the production phase, use phase, and end-of-life phase have to be formulated (Padding et al., 2015; Ten Haaf, 2017, p. 109).

### *ORIENTATION*

Because circular procurement is new, holding a market consultation is recommended to check what the supply chain can (not) offer in the field of circularity. It can help to check if the intended specifications or requirements are feasible and, if needed, to adjust them (Chao-Duivis, 2018, p. 9; Ten Haaf, 2017, p. 107).

#### **4.3.4. TENDER PROCESS**

##### *SELECTION*

Circular infrastructure aspects can be incorporated in suitability requirements and/or selection criteria (Ten Haaf, 2017, p. 108).

- **Suitability requirements**  
It is possible to include circularity in the suitability requirements (Ten Haaf, 2017, p. 108). However, Chao-Duivis (2018, p. 12) mentions that there are some limitations to this. Contractors have to prove that they comply with the suitability requirements and especially the technical capability requirements related to circularity can be hard to prove right now. It is therefore not recommended to formulate very strict requirements.
- **Selection criteria**  
Also circular selection criteria can be formulated. For example, a vision on circularity can be asked for, or reference projects with circular aspects (Van Haagen, 2018). Just like the suitability requirements, the selection criteria should not be too strict. This enables “unexperienced”, but motivated contractors to participate in the tender.

##### *ASSESSMENT AND AWARD*

Circular infrastructure aspects can be incorporated in (sub)award criteria as well (Ten Haaf, 2017, p. 108).

- **Lowest costs based on cost effectiveness**  
Circularity becomes evident if the “lowest costs based on cost effectiveness like LCC” are used as an award criterion (Chao-Duivis, 2018, p. 5), because the LCC include all costs related to (environmental) aspects from retrieving raw materials to reusing materials.
- **BPQR**  
Within the BPQR additional sub-award criteria can be formulated related to circularity. These sub-award criteria can relate to, for example, specific environmental requirements (Ten Haaf, 2017, p. 108). Examples are material passports, percentage of recycled materials, disassembly plans, or recyclability of materials. Also the Total Cost of



Ownership (TCO) can be a sub-award criterion. Technical innovations can be incorporated as well. These innovations can be ranked based on their Technology Readiness Level (TRL). This is “a systematic metric/measurement system that supports assessments of the maturity of a particular technology” (Mankins, 1995). It is a scale from 1 (concept) to 9 (proven technology). So, if innovations are offered, this scale can help to assess how innovative the solution is (and how high the contractor scores on this aspect).

The sub-award criteria should be objectively determinable and relate to the object of the contract (Chao-Duivis, 2018, p. 5). Just asking for a circular or innovative solution will not suffice because this too subjective and the relation to the object of the contract becomes vague. Sub-award criteria should proportionally relate to the object of the contract and have to be aligned to what the supply chain can offer.

Important in BPQR tenders is the ratio between price and quality (Chao-Duivis, 2018, p. 13). In order to stimulate the contractors to offer innovative, circular solutions, a large quality ratio (+/- 70%) is recommended to apply (Van Haagen, 2018).

#### **4.3.5. ROLE OF THE CONTRACTING AUTHORITY**

From the previous sections can be concluded that circular infrastructure aspects can be incorporated in almost all preparatory phases of the tender process. This emphasises the importance and the amount of influence contracting authorities have on realizing circular infrastructure. Tenders should be drafted carefully in order to come to stimulate contractors optimally to offer circular infrastructure solutions.

It can be argued that a more open procurement approach is needed because circular procurement is new for most contracting authorities. It is hard to predict the outcome of a circular infrastructure work in advance and maybe innovations are needed. This requires expertise from supply chain parties, because contracting authorities cannot specify the circular work by itself (Copper8, 2016). The development of sustainable and circular applications is fast and the supply chain has the best insight in this. It is thus recommended to provide room for them (Chao-Duivis, 2018, p. 13). This requires an open attitude and faith in the supply chain that they will make a satisfying offer. On the other hand, this does not mean that the contracting authority should lean back and let the contractor come with circular solutions. Even though circular solutions require a more open approach, it is important that the contract is sufficiently determinable and the specifications and criteria relate to the object of the contract (Aanbestedingswet art. 2.75). The transparency principle requires that the object of the contract is clearly described from the beginning of the procurement process (Ten Haaf, 2017, p. 108).

#### **4.4. SUMMARY**

In this chapter the concept of circular procurement is discussed. The answer to the sub-question “Where can circular infrastructure aspects be incorporated in the Dutch procurement process?” can now be formulated. It was found that circular procurement is a regular procurement process that incorporates circular aspects in order to procure, realize and safeguard circular infrastructure over its whole life cycle. One important focus point in circular procurement is that besides ensuring the technical aspects of circularity in the specifications and criteria also collaboration with the supply chain should be sought. A more open approach is required to provide contractors with room to offer innovative circular solutions. Circular specifications and criteria can be incorporated in the following steps of the tender process (table 2):

TABLE 2: OVERVIEW CIRCULAR ASPECTS IN TENDER PROCESS

Where	How
Need formulation	Project goals can contain circular ambitions
Specification	Technical and functional specifications can be related to circularity.
Orientation	Organize a market consultation to see what the supply chain can (not) offer in the field of circularity
Selection, assessment and award	Circular criteria can be taken into account as suitability requirements, selection criteria and award criteria

The circular procurement process is therefore not different from a regular procurement process as described in chapter 3. The parts in which circular aspects can be incorporated are shown in green (figure 7).

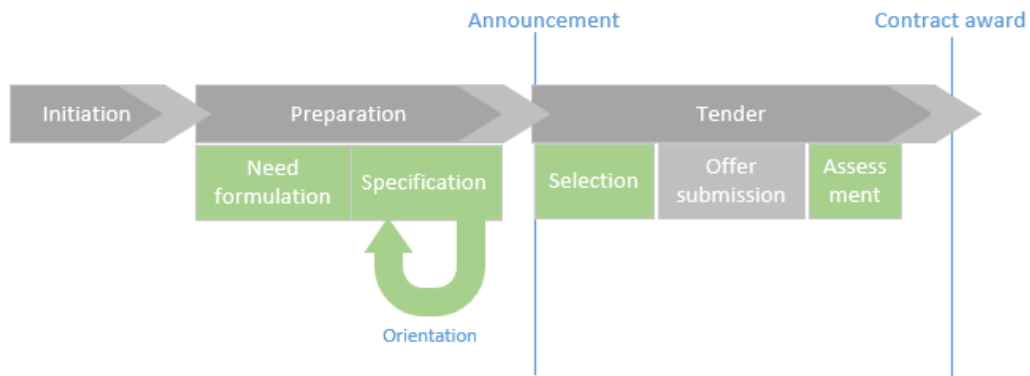


FIGURE 7: CIRCULAR PROCUREMENT PROCESS. OWN ILLUSTRATION

Now that the aspects of public procurement of circular infrastructure are clear, the next chapter will go into the second procurement approach of this research: the BVA.

# 5 THE BEST VALUE APPROACH

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This chapter will provide an overview of the theory behind the Best Value approach (BVA) and how it is applied in Dutch public procurement. Both the philosophy and practical application will be discussed. Focus will be put on what aspects are distinctive compared to the general procurement process as explained before. First, the principles and philosophy behind BVA are presented in 5.1 and applied to the tender process in 5.2. Conditions for successful application of the BVA will be discussed in section 5.3. and the BVA will be placed in perspective in section 5.4. By the end of this chapter the following sub-question is answered in section 5.5.: *What is the Best Value approach and how is it applied in the Dutch procurement process?*

## 5.1. INTRODUCTION TO THE BEST VALUE APPROACH

In short, the BVA is based on an idea by Professor Dean Kashiwagi from the Performance Based Studies Research Group of the Arizona State University. The BVA is a procurement approach that focusses on gaining the best value for the lowest price (Snippert, Witteveen, Boes, & Voordijk, 2015). It aims to identify and utilize experience from the supply chain in order to select the “expert contractor” for executing the contract (PIANOo, 2017). This expert is found based on dominant information (metrics) that proves his qualities. By focussing on the expert, the BVA goes a step further than the BPQR. Not only the EMAT is strived for, but also finding the expert who is aware of the risks and opportunities for the contracting authority and able to mitigate these risk (Rijkswaterstaat, 2013). The starting points of the BVA in procurement are according to Kashiwagi (2017):

- The use of metrics to simplify and minimize risk
- Selection based on level of expertise, risk management and value added in addition to price
- Clarification of scope by the best value contractor
- Use of transparency to track project cost and time deviation and minimize risk

The first point, the use of metrics, is one of the core principles of the BVA that will be explained in the next section. The second, third and fourth point all apply to the tender steps in the procurement process, which will be explained in detail in section 5.2.

### 5.1.1. INFORMATION MEASUREMENT THEORY

In the BVA contractors have to underpin their offers with dominant performance information (van de Rijt & Santema, 2013, p. 67). Dominant information stems from the information measurement theory and can be defined as “*A deductive, logical, and dominant observation / explanation of an event. It includes the use of relative and related data to predict the future outcome of an event.*” (Kashiwagi, 2016). According to van de Rijt & Santema (2013, p. 70) dominant information is information that is verifiable, accurate, measurable, and non-refutable. This is an important starting point because according to the BV philosophy the expert is someone who can explain the problem simply. He is able to show how effective his proposed solution is (Rijkswaterstaat, 2013). An important consequence of mastering this dominant information is that it is easier to predict what is going to happen (Kashiwagi, 2016). In this way uncertainties are eliminated and project risks are reduced (Wenselaar, 2011). Dominant information is captured in so-called “performance metrics” or “metrics” in short, that are easy to understand and enable consensus (Kashiwagi, 2016). It is important to mention that the metrics do not necessarily have to come from the contractor. Also metrics can be retrieved from partner suppliers, which enables collaboration with the whole supply chain (Rijkswaterstaat, 2013).

Below is illustrated how metrics can help to identify the expert contractor (figure 8). Who would you hire for a €3M Design & Construct project?

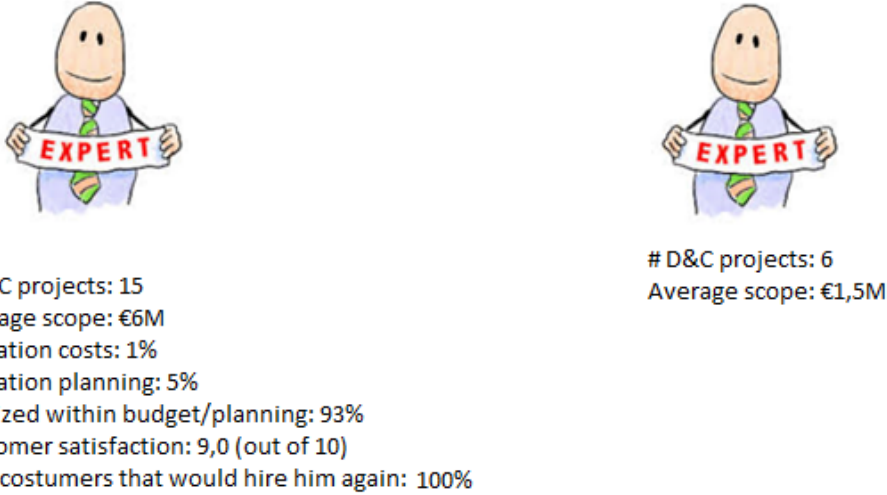


FIGURE 8: WHO IS THE EXPERT? SOURCE: HOUSE OF MINERVA (2012)

**5.2. BEST VALUE APPROACH IN THE TENDER PROCESS**

The previous section described shortly the thought behind the BVA and the use of dominant information and metrics. Continuing on this, the practical application of the BVA in public procurement will be discussed in this section. First, the procurement procedure will be discussed and the distinguishing BVA aspects will be pointed out. Subsequently, the specific conditions for successful application of the BVA will be explained.

According to Kashiwagi (2017, p. 75-77) the BVA is applied in four procurement phases:

1. Pre-qualification phase
2. Selection phase
3. Clarification phase
4. Execution phase

Because the approach of Kashiwagi is based on the American procurement methodology, these procurement phases are slightly different from the phases presented in chapter 3 and 4. The following figure illustrates how the procurement phases relate to each other (figure 9):

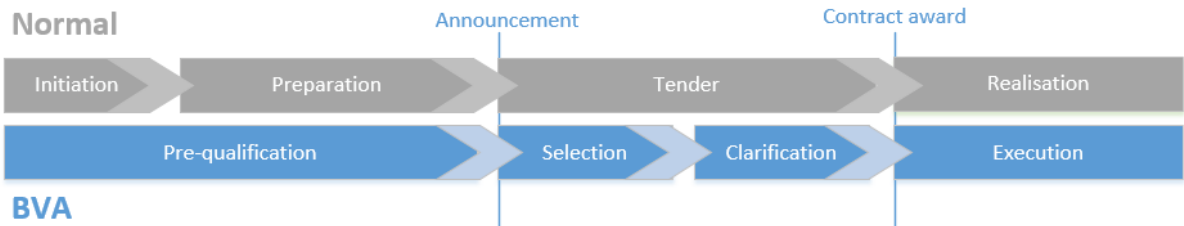


FIGURE 9: DIFFERENCE BETWEEN A NORMAL TENDER AND BVA TENDER. OWN ILLUSTRATION

In order to make the BVA legally applicable in the Netherlands, the approach of Kashiwagi needs to be adjusted to fit within the European and Dutch procurement legislation (Van Duren & Dorée, 2008). This is done in the books “Prestatieinkoop”(van de Rijt & Santema, 2013) and “Best Value stroomt” (van de Rijt et al., 2016) and their interpretation will be used as a guideline in this research. The process is summarized in the figure on the next page (figure 10), and the distinguishing aspects of the BVA will be explained one by one in the next sections.

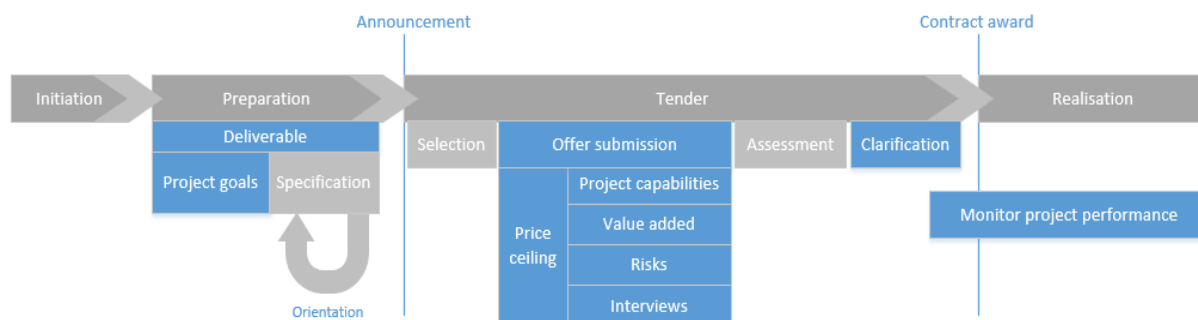


FIGURE 10: BVA PROCUREMENT PROCESS. OWN ILLUSTRATION

### 5.2.1. PROCUREMENT PROCEDURE

First of all, it should be mentioned that BVA is not a procurement procedure in itself. The thinking behind BVA is fit within the standard procurement procedures. In line with the philosophy of BVA, the contractors should be able to determine for themselves if they are capable enough to participate in the tender (van de Rijt & Santema, 2013, p.59). If a contractor is not suited for the project, he will not have the right metrics to support his qualities, and he should not participate in the tender. Therefore, the BVA is generally used in combination with the open procedure (van de Rijt & Santema, 2013, p. 59). However, in line with the proportionality principle, in order to prevent that too many contractors participate in the tender it may be wise to use a restricted procedure. Shortlisting the amount of candidates is possible, but the suitability requirements and selection criteria should be proportional to prevent that the expert is excluded too early.

### 5.2.2. PREPARATION OF THE TENDER

The BVA also starts with the need of the contracting authority, but in the BVA this is called the “deliverable” (van de Rijt et al., 2016, p. 17). The deliverable is described in terms of project goals and requirements. In short, the requirements determine the minimum that should be achieved, and the project goals express the additional ambition that the contracting authority wants to reach. The aim is that the contracting authority specifies **what** the deliverable is, and that it is up to the contractor **how** the deliverable is achieved.

#### *PROJECT GOALS*

The project goals function as the foundation of the assessment framework in the tender phase (van de Rijt et al., 2016, p. 14). The project goals should be formulated in a specific, measurable, achievable, realistic, and time-related (SMART) way and on a high abstraction level, and, preferably, match with the organisational ambitions of the contracting authority. A project goal can be, for example: “reused materials are applied as much as possible.” The project goals can be compared to sub-award criteria that are used in regular BPQR tenders, however contractors cannot directly score on the project goals. The BVA makes use of other sub-award criteria, which will be explained later on.

The philosophy of the BVA is that the project goals should be on an abstract level, because this leaves room for contractors to make an offer that distinguishes themselves from others. If the project goals are formulated more precisely, it becomes a requirement and no room for distinction is left, because everyone needs to fulfil that requirement (van de Rijt et al., 2016, p. 20). However, only formulating abstract project goals is not allowed according to the Aanbestedingswet 2012 (art. 1.10). The description of the deliverable should still relate to the object of the contract. So, at least some requirements or functions of the object should be prescribed by the contracting authority. The deliverable should clearly describe what is expected

of the contractors (van de Rijt et al., 2016, p. 50). This prevents that the tender can be declared invalid.

### REQUIREMENTS

Another part of the deliverable is the project requirements and specifications. The contracting authority defines contract specifications in order to create a minimum level to which the work has to perform and to stimulate contractors to design something that performs above this minimum (van de Rijt & Santema, 2013, p. 36). However, this leads to a paradox. Contractors will see those requirements as something that they have to fulfil, period. The minimum then becomes the maximum. This is illustrated in figure 11. However, the contracting authority has interest in getting the best value for money so, according to the BVA philosophy, he should let go of strict technical specification in order to get the highest performance.

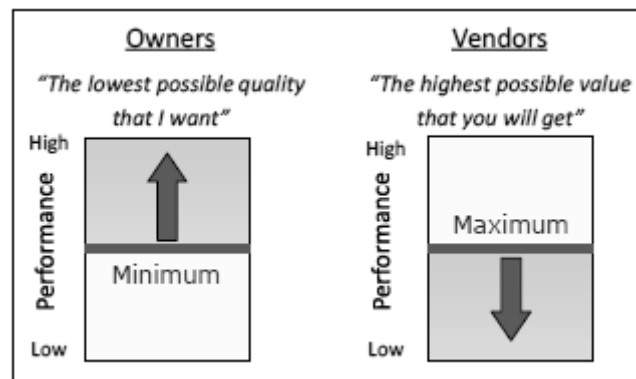


FIGURE 11: THE EFFECT OF MINIMUM REQUIREMENTS. SOURCE: KASHIWAGI (2016)

According to the BVA philosophy, it is recommended to specify as little as possible, but if needed, mostly functionally (van de Rijt et al., 2016, p. 20). As mentioned in section 3.3.2., functional specifications describe the intended function or performance of the work, supply or service. They give the contractor more freedom to make use of its expertise, knowledge and inventiveness. It is not forbidden to use technical specifications in BVA, but the amount should be limited. Within technical requirements no room for distinction is left, because every offer needs to fulfil that requirement (van de Rijt et al., 2016, p. 20). However, just like the project goals, the specifications should still be sufficiently determinable and relate to the object of the contract (Aanbestedingswet 2012, art. 1.10). An optimum has to be found between what should be specified and what can be left open.

### 5.2.3. TENDER PROCESS

#### AWARD CRITERIA

The BVA always makes, with some exceptions, use of the BPQR with predetermined sub-award criteria. The ratio between price and quality is normally around 25% price and 75% quality, but deviations are possible. The sub-award criteria are as follows (van de Rijt et al., 2016, p. 43):

1. Project capabilities: relates to the extent to which the contractor gives substance to the fact that he is able to realize the deliverable and the extent to which he contributes to achieving the project goals (van de Rijt et al., 2016, p. 43). Within this criterion the contractor needs to explain in a few statements that he is capable to execute the infrastructure project. All statements have to be underpinned by dominant information (section 5.1.1.) in order to convince the contracting authority that he is the expert (van de Rijt & Santema, 2013, p. 70).

There is a concern within this criterion: the name and description of the criterion suggest that it relates to the capabilities of the contractor, and therefore it should be seen as a suitability requirement (Aanbestedingswet 2012, art. 2.90). Another concern is that the statements that have to be submitted are comparable to past performance indicators. However, these also seem to relate to the performances of the contractor, and not to the object of the current contract, which, again, makes it a selection criterion, not an award criterion (Essers & Lombert, 2017, p. 237). However, this is not the case. The project capabilities relate to the deliverable which is related to the object of the contract. This is required for award criteria according to the Aanbestedingswet 2012 (art. 2.115 sub 3). So, an award criterion like this can be allowed according to the Aanbestedingswet (art. 2.115), but it should be used with care. There is a certain tension within this criterion if it should be seen as selection or sub-award criterion. The distinction between capabilities of the contractor and the connection to the object of the contract has to be very clear to prevent invalid tenders.

2. Risks: relates to identifying and minimizing the contracting authority's risks (van de Rijt et al., 2016, p. 43). Only risks related to the sphere of influence of contracting authorities can be submitted. Risks related to the technical capabilities of the contractor are not relevant, because they are not present if he is the expert (van de Rijt & Santema, 2013, p. 72). Also the mitigation of the risks should be supported with dominant information. The risks relate to the object of the contract, so this is a valid sub-award criterion within the Aanbestedingswet 2012 (art. 2.115).
3. Value Added: relates to making extra contributions to the project goals, besides fulfilling the deliverable (van de Rijt et al., 2016, p. 43). In other words, within this criterion the contractor can submit extra (innovative) solutions that contribute to the project goals, provided that without these extras the deliverable still has to be fulfilled (van de Rijt & Santema, 2013, p. 76). The contracting authority determines in advance if, and how much extra money is available for the solutions presented in the added value criterion. The value added criterion in relation to the deliverable and project goals is illustrated below (figure 12):

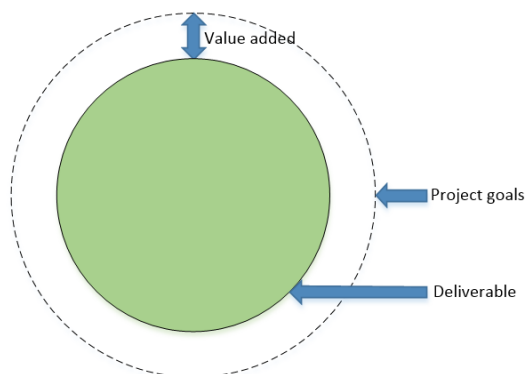


FIGURE 12: INTERPRETATION OF THE VALUE ADDED CRITERION. SOURCE: VAN DE RIJT ET AL. (2016, P. 19).

Within the value added criterion the contracting authority should allow the contractor to propose a (better) variant that meets the deliverable and that contributes more to the project goals. Submitting variants is allowed according to Aanbestedingswet (art. 2.83), provided that the variant still meets the deliverable, and the award criteria are still applicable on the variant. In order to assess the variant objectively, it has to be determined in advance how this will be done (Van Leeuwen, 2011). Another option is that contractor can be allowed to deviate from certain requirements (van de Rijt et al., 2016, p. 20). However, in order to honour the transparency principle, it has to be made clear

which requirements are fixed and which requirements can be optimized (van de Rijt et al., 2016, p. 39).

4. Interview with key personnel: relates to how the experience of key personnel and their role in the organisation contributes to achieving the project goals (van de Rijt et al., 2016). These key persons are asked to elaborate on the project capabilities, risks and value added, and how well they understand the need of the contracting authority.

Also the interviews are harder to place in the Aanbestedingswet 2012. It seems that interviewing the key personnel relates to the contractor and not the object of the contract, which makes the key personnel a selection criterion (Essers & Lombert, 2017, p. 237). However, it can be argued that interviewing key individuals on this specific project predominantly regard the tender itself instead of the contractor (Van Leeuwen, 2011). In order to comply with the fact that the awarding criteria should refer to the object of the contract (Aanbestedingswet art. 1.10) the interviews are used to explain the offer, not to determine the capabilities of the key personnel (van de Rijt & Santema, 2013).

When a contracting authority decides to use interviews as a sub-award criterion, equal treatment and transparency should be ensured by using standard questionnaires. Furthermore, no negotiations about price or the tender that has been turned in can be made. Lastly thorough documentation of the interviews safeguard the transparency principle (Van Leeuwen, 2011).

5. Price: the BVA is often applied in combination with a price ceiling to create clarity about the price for the supply chain (van de Rijt et al., 2016). This creates openness and transparency. The price ceiling contributes to making optimal use of the large quality part in the award criteria. Then within the price ceiling it is possible to determine which contractor is the expert. However, it is up to the contracting authority and the determined project goals what price / quality ratio is appropriate.

It can be concluded that the BVA sub-award criteria require some attention in order to be used within the context of the Dutch procurement legislation. Good understanding of the BVA by both contracting authorities and contractors is required to achieve a successful tender process. Jurisprudence (van de Rijt et al., 2016, p. 47) implies that the approach is difficult to apply legally correct and that there are many misunderstandings about the application. The assessment of project capabilities, value added and interviews have to be determined very clearly by the contracting authority in order to safeguard objectivity, transparency, proportionality and equality. Furthermore, it is very important that the sub-award criteria relate to the object of the contract and not the contractor (Aanbestedingswet art. 1.10).

#### *OFFER SUBMISSION AND ASSESSMENT*

The contractors draft their plan related to the aforementioned sub-award criteria: project capabilities, risks, value added, and price. The important difference in the BVA is that contractors can only submit 2 A4's per sub-award criterion, which is very limited. Therefore, it is not possible to submit a fully detailed design, only the most important aspects, underpinned with dominant information and metrics have to be presented (van de Rijt & Santema, 2013, p. 67). Contractors should be able to explain clearly and briefly that they are the expert.

The final score for each document will be determined after a discussion of all members of the assessment team and in consensus one final score is given for each document. After the assessment of the documents, the candidates are invited for the interview round (van de Rijt &



Santema, 2013, p. 93). Key personnel is interviewed about the offer. However, in contradiction to the three previous documents, the assessment is rather subjective. In order to honour the procurement principles it should be stated clearly in advance how the assessment is done to make it as objectively as possible. Lastly, after the interviews, the envelopes with the submitted price are opened and weighted against the scores of the quality document. Then, the contractor with the BPQR becomes the preliminary winner.

#### *CLARIFICATION PHASE*

In the BVA the preliminary winner is asked to enter in another phase before the contract is officially awarded: the clarification phase. The clarification phase is essentially different compared to the standard procurement process, but it can be fit in an open or restricted procedure. In the clarification phase the preliminary winner is asked to further develop his offer in detail (van de Rijt & Santema, 2013, p. 113). The contractor needs to prove that the submitted dominant information is correct (verification) and also how he will monitor and measure the performance of the intended solution during execution (PIANOo, 2017). The performance can be captured in measureable Key Performance Indicators (KPI's) that relate to the project goals. The contractor drafts these KPI's because, according to the BVA philosophy, he is the expert and knows best how to measure his performances.

In the clarification phase the contractor establishes a detailed planning for the project and the risks, including mitigation measures are further developed (PIANOo, 2017). The contracting authority decides which of the added value options are honoured for the project (van de Rijt et al., 2016, p. 37). If value added options are chosen, the contractor includes them in the solution. It is not allowed for the contracting authority to make use of value added options of a contractor who did not win the tender. Selecting value added options is only allowed according to the Aanbestedingswet 2012 if there is a possibility to change (Dutch: mogelijkheid tot wijziging) included in the tender documents (Aanbestedingswet 2012, art. 2.163c). This is called an option, and the contracting authority has to mention the size and type of the option, the conditions under which the option can be used, and that the object of the contract does not change.

The clarification phase is still part of the tender procedure and therefore the procurement principles of equality, non-discrimination, transparency and proportionality still apply. Also the expert contractor can be eliminated from the process if it becomes evident that:

- He does not fulfil all the requirements. Even though in BVA tenders the contractor gets room to make use of its expertise, he still needs to comply with the requirements of the contracting authority in the first place (van de Rijt et al., 2016, p. 58).
- He exceeds the price ceiling. The clarification phase is not about negotiating new contract terms (PIANOo, 2017; van de Rijt et al., 2016) and therefore the proposed solution should not become more expensive than the price ceiling. Also the EU Directives state that it is not allowed to make substantial changes made in the proposed solution of the contractor when the offer is clarified (2014/24/EU art. 30 sub 6).

When the clarification phase is passed successfully, the contract is awarded to the preliminary winner and the suspending time of 20 days is initiated.

#### *WEEKLY RISK REPORT*

Within the clarification phase the process of the project monitored through so-called weekly risk reports (van de Rijt & Santema, 2013, p.115 ) until the realisation of the object of the contract. This helps keeping the relation between contracting authority and contractor transparent and helps solving contractual disputes related to risks. During execution the progress related to the project goals is measured with respect to the drafted KPIs. The impact of the events during each weekly period have to be determined in terms of money, time and performance.

### **5.3. CONDITIONS FOR SUCCESSFUL APPLICATION OF THE BVA**

Even though the BVA can be used for all sorts of projects, some specific conditions can be established for successful application.

#### **5.3.1. PROJECT CHARACTERISTICS**

The first condition relates to the characteristics of the project that is intended to be procured with the BVA. First of all, the project should be complex enough that contractors can make a distinguishing bid on the risks criterion. Furthermore, the project should be suitable to be captured in functional specifications, the less specifications the better according to the BVA philosophy (Rijkswaterstaat, 2013). So, the project scope should provide enough room for contractors to offer distinctive creative solutions. Moreover, the contracting authority should enable this room. This leads to the second condition.

#### **5.3.2. ROLE OF THE CONTRACTING AUTHORITY**

Even though BVA fits within the Dutch procurement legislation, it requires a certain role of the contracting authority to be successfully applied. Because the contractor is seen as the expert, he should be facilitated to get room to show his expertise. This requires the contracting authority to let go of being in control and become more facilitating (PIANOo, 2017). The winning contractor should be acknowledged as the expert and should be facilitated throughout the execution of the project (Wenselaar, 2011). However, this does not mean that the contracting authority can lean back. In reality, the contracting authority also has a lot of expertise in some fields. It is important that the contracting authority takes the lead in those fields (van de Rijt et al., 2016, p. 18).

#### **5.3.3. ROLE OF THE CONTRACTOR**

It was found that the successful application of the BVA needs sufficient competition on the market, otherwise the expert cannot distinguish himself from others. In the case of a restricted procedure, at least five expert contractors should be available to make an offer. Furthermore, the contractors should be able to show their expertise (through dominant information) and make their performances transparent (Rijkswaterstaat, 2013; PIANOo, 2017).

### **5.4. PLACING THE BVA IN PERSPECTIVE**

The previous sections have provided an overview of the application of the BVA within the Dutch procurement process. The BVA assumes that the contractor is the expert and therefore he should be provided with enough room to make a distinguishing offer. This room can also be facilitated in a regular BPQR tender with few strict requirements and a large quality ratio. On this aspect the BVA does not seem that different from a regular tender, even though the BVA exploits the room for contractors through the project goals and value added criterion.

However, some distinguishing aspects can be found in the approach. First, the way contractors have to underpin their offers. This has to be done with use of dominant information. Even though the contracting authority is free to determine how the sub-award criteria are assessed (Aanbestedingswet 2012, art. 2.112), the quantitative aspect of the BVA is remarkably different. Another distinguishing aspect is the clarification phase in which the expert contractor is asked to elaborate on his submitted offer. This phase is not mentioned in the description of the standard procedures in the Aanbestedingswet 2012, but it is important that the principles of equality, non-discrimination, proportionality, transparency still apply during this phase. Lastly, within the clarification phase transparent monitoring the project performance is already started through the weekly risk report. Normally this happens after the award of the contract.

So, it seems that the BVA is not the only procurement approach that can facilitate the contractor to make optimal use of his expertise, but the approach contains some distinguishing aspects. In the context of this research the distinguishing aspects of dominant information and the clarification phase are important to consider. Also the value added criterion should be paid attention to, since this criterion enables even more room for contractors to offer something extra.

**5.5. SUMMARY**

This chapter discussed the concept of BVA and how it is applied in the Dutch procurement process. The answer to the sub-question “*what is the Best Value Approach and how is applied in the Dutch procurement process?*”, can be answered.

The BVA is an approach to public procurement which focusses on utilizing the experience of the supply chain. This is done by looking for the expert contractor who can prove with dominant information that he understands the need, is able to execute the contract and is able to identify and mitigate risks. The BVA has fixed procurement steps, which can be applied within an open or restricted procedure. The steps are visualized below (figure 13):



FIGURE 13: BVA PROCUREMENT PROCESS. OWN ILLUSTRATION

It can be concluded that the BVA requires some attention in order to be used within the context of the Dutch procurement law. The assessment of project capabilities, value added and interviews have to be determined very clearly by the contracting authority. It is very important that the sub-award criteria relate to the object of the contract and not to the contractor (Aanbestedingswet art. 1.10). Because the BVA can be fit in the standard procedures, it seems plausible that circular aspects can be incorporated in the BVA as well. In the next chapter it will be analysed if BVA can be used to procure circular infrastructure projects.

# 6 BEST VALUE TO PROCURE CIRCULAR INFRASTRUCTURE

The previous chapters have described the aspects of circular procurement and the BVA. Some aspects of both approaches are comparable, like the open need formulation and making use of the knowledge of the supply chain. This indicates that BVA may be suitable to procure circular infrastructure. However, this has to be confirmed first, before the contributions of BVA to more effective circular procurement are researched. The following research question will be answered by the end of this chapter: “*Can the BVA be used to procure circular infrastructure?*”

This chapter consists of a conceptual and procedural analysis of circular procurement and the BVA. The analysis consists of a comparison between the thoughts behind both approaches and if they contradict on a theoretical level. First, the concepts of both procurement approaches are compared in section 6.1, and then the procedural steps are compared in section 6.2. Lastly, a comparison of the role of the contracting authority is discussed in section 6.3.

## 6.1. CONCEPTUAL ANALYSIS

The concepts of circular procurement and the BVA are identified in the previous chapters. They are summarized below and then cross-referred to see if the concepts are contradictory or not. From chapter 4 the following thoughts behind the procurement of circular infrastructure can be extracted:

- Life-cycle approach (section 4.2.1.)  
Circular procurement is about looking beyond short term needs. Agreements about the whole life cycle should be made in order to close energy and material loops.
- Collaboration with whole supply chain (section 4.2.2.)  
In order to safeguard circularity over the life cycle, collaboration with the whole supply chain is needed.
- Innovation (section 4.2.3.)  
Because the procurement of circular infrastructure will require a new way of designing and constructing infrastructure, innovations are needed on technical and organisational aspects.

From Chapter 5 the following thoughts behind the BVA can be extracted:

- Contractor is expert (section 5.1.)  
The BVA assumes that the contractor is the expert and that he should get the freedom to make use of his expertise.
- Use of dominant information and metrics (section 5.1.1.)  
In the BVA metrics have to be used to underpin the offer of the contractor. They help to measure the effectiveness of the solution in relation to the project goals.
- Use of transparency to track results in terms of costs, time and performance (section 5.1.)  
During the clarification phase and realisation, the progress related to budget, planning and performance is measured with respect to the drafted KPI's. This helps keeping the relation between contracting authority and contractor transparent.

The three circular procurement aspects and three BVA aspects are cross-referred to see if the aspects contradict or not. Because this research aims to find the potential opportunities of the

BVA in order to procure circular infrastructure, the approach is one sided. So, it is analysed if BVA aspects contradict with circular procurement aspects, not the other way around. If aspects do not contradict, it is okay. Furthermore, in some cases the BVA can maybe even contribute to circular procurement. The comparison of both approaches can be seen below in table 3. The green fields are possible contributions, white is neutral, and yellow fields are doubtful.

TABLE 3: COMPARISON OF APPROACHES

<b>Legend</b>			
Possible contributions			
Neutral			
Doubtable contribution			
	<b>Contractor is expert</b>	<b>Use of dominant information and metrics</b>	<b>Use of transparency</b>
<b>Life cycle approach</b>	<p>The expert contractor knows about life cycle approach and is able to oversee the whole project. He can identify risks for the contracting authority, which is especially useful in the long term.</p> <p>The expert contractor knows how to make optimal use of materials. He can optimize the design and maintenance approach.</p>	Metrics about the whole life cycle of project can be used.	Use of transparency includes the execution phase. Besides time and costs, performance in terms of circularity can be monitored.
<b>Collaboration with supply chain</b>	The expert contractor takes the lead, but there is no close collaboration between contracting authority and contractor.	Metrics can be retrieved from suppliers, which enhances early contact within the whole supply chain.	Transparency enhances trust between contracting authority and contractor. This is good for collaboration.
<b>Innovation</b>	The expert contractor can determine additional value in relation to the project goals. He can come up with innovations.	Metrics and innovations can be troublesome, because new things do not have metrics yet.	Transparency can be used to measure the performance of the innovation

Because this chapter focusses on whether or not the BVA can be used to procure circular infrastructure, only the yellow areas, that can stand in the way of this, are elaborated on in the next sections.

**6.1.1. COLLABORATION WITH THE SUPPLY CHAIN AND CONTRACTOR IS EXPERT**

First, it is important to mention that the transition towards a circular infrastructure sector is still in its infancy. This means that there are not that many contractors who have expertise in this field. In this early phase more intensive collaboration between contracting authority and contractor is required in order to experiment and gain experience together (Nelissen et al., 2018). The BVA can contribute to the collaboration through the clarification phase (Van Duren & Dorée, 2008), but does not seem to be the best procurement approach to form a collaborative environment. It is about the combined expertise of contracting authorities and the supply chain.

The contractor should get freedom to make use of its expertise, but the contracting authority should also be able to give input. To conclude, the BVA may not result in the right form of collaboration that is required for procuring circular infrastructure.

### **6.1.2. INNOVATION AND METRICS**

The use of metrics can limit the innovativeness of solutions, because new solutions that have not been applied before have no metrics. On the other hand, there are ways to underpin innovations. For example, it is possible to offer an innovation that is applied on a smaller scale or it can be shown that the contractor already successfully implemented innovations before. However, since we are in the beginning of the transition, it is assumed that offering circular (product) innovations in infrastructure projects is not possible for every contractor. There may not be enough metrics available. In order to safeguard the equality and proportionality principle it is questionable if this part of the BVA can contribute to more effective procurement of circular infrastructure.

## **6.2. PROCEDURAL ANALYSIS**

Besides the conceptual aspects, also the procedural aspects should be looked into in order to conclude if the BVA can be used to procure circular infrastructure. In chapters 4 and 5 the tender steps of both approaches are discussed and it was concluded that circular aspects can mainly be found in the need formulation, specification and criteria. When looking at the BVA, the circular aspects can then be incorporated in the deliverable, either in the project goals or specifications. Since the BVA makes use of fixed sub-award criteria no specific circular sub-award criteria can be incorporated. However, the BVA sub-award criteria all relate to the project goals, so indirectly substance can be given to circularity, if it is present as a project goal. So, on a procedural level it can be assumed that the BVA can be used to procure circular infrastructure.

## **6.3. ROLE OF THE CONTRACTING AUTHORITY**

From chapters 4 and 5 can be concluded that both procurement approaches require the contracting authority to let go of their controlling role. On the one hand circular procurement strives for collaboration with the whole supply chain, and on the other hand the BVA strives for finding the expert. Both require more room for the supply chain to come up with innovative circular solutions. This similar role of the contracting authority may be helpful for the BVA to procure circularly.

## **6.4. SUMMARY**

On a conceptual a procedural level was analysed if the BVA can be used to procure circularly. The answer to the sub-question “*can BVA be used to procure circular infrastructure?*”, is that it seems possible to procure circular infrastructure with the BVA. The BVA may be ideal to provide a lot of room for the contractors to come up with circular solutions. Finding the expert and making use of transparency can be helpful to procure circular infrastructure more effectively. However, there are also some elements that may hamper effective application of circular procurement. For example, the underpinning of innovations with metrics and the form of collaboration in BVA. Therefore, right now, the whole BVA may not be suitable to procure circular infrastructure projects. However, the analysis shows the potential of the thought behind the BVA. Even though the whole approach may not be suitable right now, separate elements could make their contribution. These will be analysed in the next, empirical part of this research.



## Empirical exploration

Chapter 7 – Effective procurement of circular infrastructure

# 7 EFFECTIVE PROCUREMENT OF CIRCULAR INFRASTRUCTURE

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In the previous chapters all the theoretical aspect used in this research are defined. It is clear what the procurement of circular infrastructure entails and what the BVA is. The next part of this research focusses on the practical aspects of circular procurement and how effective it is right now in the Netherlands. In this chapter the following sub-questions will be answered: “*What is effective public procurement of circular infrastructure?*” & “*What are the strengths, weaknesses, opportunities and threats of the current practice in the Netherlands?*”

This chapter is divided in a theoretical part and an empirical part. First a definition of effective circular procurement will be formulated based on literature in section 7.1. Subsequently, the factors for this effective circular procurement will be presented based on the explorative and in-depth interviews, which is the start of the empirical part. The method and analysis of these interviews is presented in section 7.2. The result of this (section 7.3.) can be seen as baseline that will be used to test how effective the current practice of public procurement with respect to circularity is. This is presented in the form of a SWOT analysis by the end of this chapter in section 7.4.

## 7.1. DEFINITION OF EFFECTIVE CIRCULAR PROCUREMENT

Effectiveness means that the results of a predetermined goal of a person or organisation are achieved successfully. It is about the achievement of organisational goals by converting specified input to the desired output (Mofokeng & Luke, 2014). With respect to procurement, a project goal is formulated in the initiation phase and the result is achieved after the realization of the object of the contract.

A procurement process can be effective in terms of money, time and quality. In addition to this, with respect to circular procurement, the goal is to select the best available contractor that can realize the circular infrastructure solution according to the predetermined project goals. The circular result can then be determined and compared to the initial goal after the realization of the contract. It is hard to measure effectiveness in terms of how circular the solution is. It is effective when the solution contributes to the transition to a circular infrastructure sector, but this depends on the initial goal of the project. It will be assumed that an effective circular tender is *a tender in which the initial circular project ambitions and goals are met after the realization of the object of the contract*. In the next sections will be described what factors are needed to ensure that these project ambitions are met.

## 7.2. METHOD AND ANALYSIS

In order to answer both sub-questions, two rounds of interviews were conducted (see section 2.2.2). From these interviews is deduced which factors are considered important to procure circular infrastructure effectively. Furthermore, factors are deduced about the current practice. This was an iterative process.

The factors about effectiveness describe how the circular procurement process *should* be. This automatically implies that if this is not the case right now, the factor can be considered as a weakness in the current practice. The relation between effective circular procurement and the current practice is illustrated below (figure 14). As can be seen in the figure, the green dotted



line represents the baseline of effective circular procurement. When this baseline is compared to the current practice, there will be some factors that meet the baseline, which are called strengths. However, also some factors will not meet the baseline, these are called weaknesses (internal) or threats (external). Lastly, there can also be external factors that can increase the effectiveness, these are called opportunities.

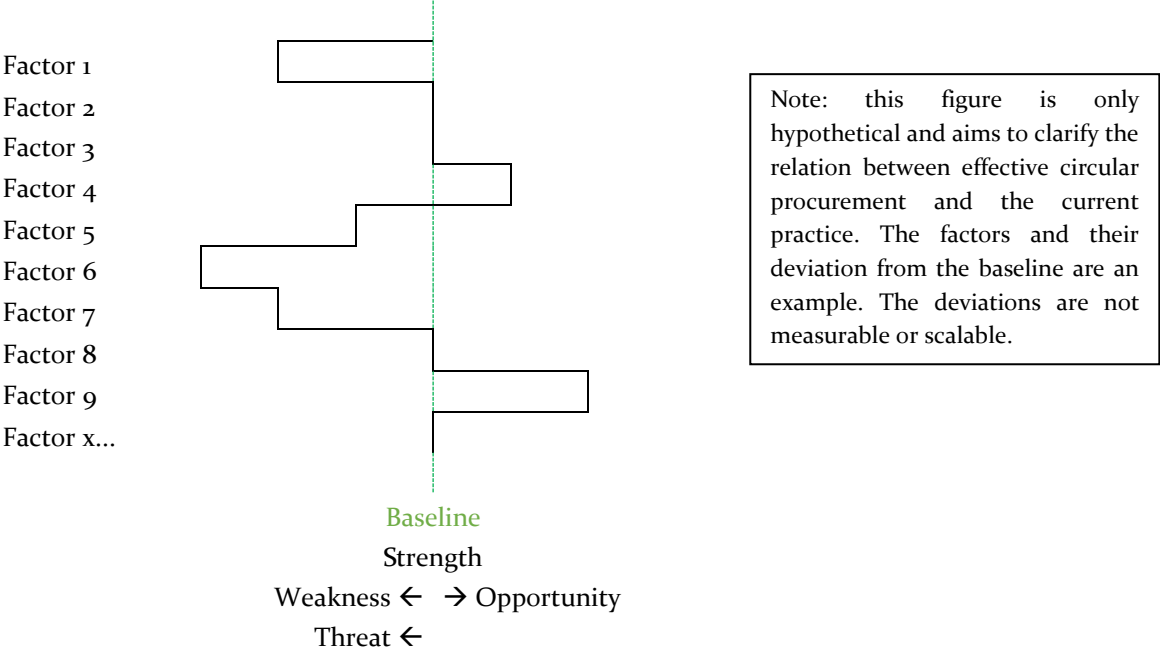


FIGURE 14: RELATION EFFECTIVE PROCUREMENT AND CURRENT PRACTICE

One important difference is that the analysis on effective circular procurement only takes the perspective of the contracting authority into account. The outcomes all relate to what the contracting authority can do to make the procurement process effective. In the SWOT analysis will also be looked at external factors (Chermack & Kasshanna, 2007). In this research external factors refer to legislations or other organisations, which describe the context in which contracting authorities operate. It is important to take these external factors into account to see if the BVA can be of added value.

**7.2.1. SAMPLE GROUP**

The interviews are divided in an explorative and an in-depth round for validation. In order to retrieve the most valuable results, the composition of the sample group of interviewees has to be taken into account. The first group of consisted of multiple types of organisations in order to gather experiences about the procurement of some circular infrastructure projects. The second group consisted of only contracting authorities to reflect on the public procurement process. The characteristics of the groups can be found on the next page (table 4) and in Appendix B.

All of the interviewees had experience with circular procurement, however some of them only had little experience with circular infrastructure. The answers of these interviewees have to be used with care, because they may not be 100% applicable to the infrastructure sector. Furthermore, in the first group were also contractors included. They provided answers about how a contracting authority should draft their tenders ideally, but the answers should be interpreted in such way that their vision is also realistic. The consultancy firms helped on the side of contracting authorities to incorporate circularity in the specifications or requirements. Their answers are therefore valuable, because they have assisted multiple contracting authorities.

TABLE 4: COMPOSITION OF SAMPLE GROUPS

ID's	Round 1	Round 2
	P1-P12	P13-P21
Total	11	9
Contracting Authority	4	9
Consultancy	4	0
Engineering firm	1	0
Contractor	2	0
Experience circular procurement	11	9
Experience infrastructure	8	8
Experience BVA	1	6

### 7.2.2. CODING PROCESS

As mentioned in section 2.2.2, the grounded theory approach is used to retrieve the factors from the interview transcripts. During the analysis, there was no strict distinction between open and axial codes. The process was iterative which resulted in 172 open and 69 axial codes. The axial codes were cross-referenced another time and then 20 selective categories were found that are used to describe the factors needed for effective circular procurement. Because the SWOT analysis takes also the external factors into account, 32 selective categories were found for that part of the analysis. For the selective coding, the quotations connected to the axial code were used to find a general impression whether it concerned a strength or weakness, opportunity or threat. The codes and data structure of both interview rounds can be found in Appendix E.

Because the interviews were semi-structured not every factor was discussed in each interview. Previously mentioned factors were sometimes checked in the next interview, but also new factors appeared. For the definition of effective circular procurement, the minimum amount of interviewees per factor is set at 4 for the first interview round in order to make it as a result. Then after validation with the second interview round, the minimum total was set on 7 interviewees per factor. This led to exclusion of some factors and addition of new ones. For the SWOT analysis there was no strict minimum amount of interviewees used. The SWOT analysis continues on the definition of effective circular procurement, and therefore the connection between the current and desired practice was considered more important.

### 7.3. RESULTS FOR EFFECTIVE CIRCULAR PROCUREMENT

After the creation of the data structure the following six main categories can be pointed out that are needed for effective circular procurement:

- Financial and personal incentive
- Circular ambitions
- Experience & knowledge
- Life cycle approach
- Room for contractor to offer innovations
- Collaboration with supply chain

These categories are used to structure the factors related to the effectiveness of circular procurement. Most of the interviewees have procured circular infrastructure projects and these factors are seen as helpful towards effective circular procurement. There are many different factors per category mentioned. A weighted decision is made per factor and the essence is captured in one sentence. These can be seen below per category (table 5):

TABLE 5: SUMMARY OF FACTORS OF EFFECTIVE CIRCULAR PROCUREMENT

	Factor	Amount of interviewees round 1	Amount of interviewees round 2
<b>Financial and personal incentive</b>	Formulate an economically feasible business case for circular infrastructure solutions	5	1
	Motivate personnel to start with circular procurement	3	3
<b>Circular ambitions</b>	Enthusiastic individuals are needed to pull circular infrastructure projects	5	4
	Formulate SMART circular project ambitions that are in line with your budget and planning	8	8
	Formulate an organisational circular policy	8	8
<b>Experience &amp; knowledge</b>	Educate personnel on circular procurement	6	8
	Start small with circular procurement and implement CE aspects stepwise	9	4
	Evaluate the project and procurement processes	8	4
<b>Life cycle approach</b>	Make agreements about the use phase, maintenance and the end of life of the project	3	4
	Make use of an integrated contract including maintenance	7	6
	Make use of Life Cycle Costs (LCC) as an awarding criterion	4	6
	Ask for a Life Cycle Analysis (LCA)	5	3
	Monitor the project and circular ambitions	3	6
<b>Room for contractor (to offer innovation)</b>	Formulate an open need, and specify functionally (wherever possible)	6	4
	Formulate selection criteria on vision	5	1
	Formulate (sub)award criteria in line with the circular project ambitions	4	5
	Apply a large quality ratio in Best Price Quality Ratio (BPQR) tenders	5	6
	Make use of a price ceiling	6	4
<b>Collaboration with supply chain</b>	Work together with the supply chain	8	7
	Have faith in supply chain to come up with circular solutions	2	6
	Enable contact with the supply chain during the tender	2	2

The analysis and interpretation of each separate factor can be found in Appendix F

### 7.3.1. DISCUSSION OF RESULTS

When looking at the separate factors it stands out that 3 out of the 6 categories do not relate to the procurement process in itself. First, a financial incentive and personal motivation is needed and enough experience and knowledge should be developed in order to start with circular procurement. Furthermore, factors are found that relate to what happens after the tender. For example, the project and ambitions should be monitored after the contract award. The other 3

categories comply with the characteristics of circular procurement, as found in chapter 4. These are: life cycle approach, collaboration with the supply chain and innovation.

Because the interviewees stated what they expect to be effective right now, will not mean that this is the case in the future. It should be noted that many of the initiated projects were still in the preparation phase of the procurement process or were small (pilot). Therefore, the outcomes of the analysis are not proven for common practice yet. The fact the interviewees perceive that more front-end preparations are needed in a circular tender to be effective, underpins the inexperience with circular procurement. This results in factors like drafting organisational policies on circularity, starting with small (pilot) projects with some circular aspects, and evaluating processes. This means that effective circular procurement transcends the tender steps as presented in chapter 3.

As mentioned in section 7.2.2. the total minimum interviewees should be 7 for a factor to be made it as a result. However, some aspects were found to be very important, even if they were only mentioned by less than 7 interviewees. These factors relate to two things: the incentive to start with a circular project and the procurement procedure. The incentives are worth mentioning, because if contracting authorities have no motivation to start with circular procurement, the transition to a CE will never be initiated. Another thing that stands out is that there was no clear answer about the procurement procedure. Different types of procedures are used by the interviewees, and it depends on the project characteristics which one is best applicable. Not every interviewee made use of a selection phase, but the selection criteria “circular vision” was most often used when a selection phase was present. Furthermore, even though not that many interviewees mentioned it, the only common thing is that contact with the supply chain during the procedure is considered important. This seems to eliminate the open and restricted procedure, because there is no dialogue in those procedures, but maybe the clarification phase of BVA can be of use here.

### **7.3.2. DISCUSSION OF DIFFERENCES BETWEEN INTERVIEWEES**

Some differences were found in the answers of the interviewees, depending on their organisation and profession. First of all, some differences between the contractors and contracting authorities stand out. It should be noted that only two contractors were interviewed, so their answers did not influence the results that much. It stands out that the contractors want to be provided with the freedom to offer their own circular solutions. They strongly prefer pilots, because they think that in pilots you get more freedom to experiment. Furthermore, differences were perceived in the professions of interviewees that work for a contracting authority. Strategic advisors focused more on the preparatory factors like circular ambitions and policies, which makes sense from their point of view. Sharing and gaining experience and knowledge is also often mentioned by them, as well as how should be collaborated with the supply chain. Procurers and contract managers focus more on the procurement process itself.

### **7.3.3. SUMMARY OF FINDINGS EFFECTIVE CIRCULAR PROCUREMENT**

The previous sections have provided a definition of effective circular procurement and 20 different factors that contribute to this effectiveness are found. The answer to the sub question *what is effective public procurement of circular infrastructure?*, is: effective circular procurement is procurement where the initial circular project ambitions and goals are met after the realization of the object of the contract.

According to the interviewees, the transition towards a circular infrastructure sector is still in the beginning. Therefore, enough incentives, motivation, ambitions and knowledge should be developed by contracting authorities to start with circular procurement in the first place. Also

factors that safeguard circularity after the tender should be taken into account. Effective circular procurement entails therefore more than just the tender process. This is important to keep in mind.

When looking at the procurement process itself, the three thoughts behind circular procurement appear: life cycle approach, collaboration with supply chain, room for innovation (chapter 4). So, the theory matches with practice on these aspects. Furthermore, it seems that the effectiveness is dependent on the behaviour of the contracting authorities. They should be able to provide room for the supply chain to come up with innovative circular solutions. An open need formulation, functional specifications, a large quality ratio in BPQR tenders, integrated contracts, and having faith in the supply chain all require an open mind-set and a facilitating attitude. The next section will discuss if this is the case for Dutch contracting authorities.

**7.4. RESULTS FOR THE CURRENT PRACTICE OF CIRCULAR PROCUREMENT**

Now that the baseline for effective circular procurement is set with 20 different factors, the relation to the current practice in the Netherlands can be analysed. The same 6 categories are used to structure the SWOT analysis, and one additional category is added: measurability. In this category only external factors were found, that is why the category was not included before.

- Financial and personal incentive to start
- Circular ambitions
- Experience & knowledge
- Life cycle approach
- Room for expertise of contractor
- **Measurability**
- Collaboration with supply chain

These categories are used to structure the strengths, weaknesses, opportunities and threats. Just like in the previous analysis, the factors are perceived by interviewees right now. The outcomes are generalized over the different type of organisations that were interviewed, therefore some outcomes may not be applicable for each organisation. Some contracting authorities will already apply some aspects that are considered as a weakness in this analysis. For them it is already a strength. It was found that there are some front runners in the field of circular procurement, but the majority is still unexperienced. The SWOT analysis is targeted at the latter group. The outcomes should therefore be interpreted with care.

There are many different SWOT's per category mentioned by the interviewees. The connection of the factors between the current and desired practice can be found in Appendix F. Just like the previous analysis a weighted decision is made per factor and the essence is captured in one sentence. These can be seen below per category (table 6).

TABLE 6: SUMMARY OF SWOT ANALYSIS

	Factor	S, W, O, T	Amount of interviewees round 1	Amount of interviewees round 2
<b>Financial and personal incentive</b>	It is hard to formulate a business case and create long term commitment for projects with a long life time	W	9	5
	It is hard to change current, traditional working practices	W	6	5
	Risk-averse mind-set prevents starting	W	7	3

	Rising prices of raw materials can make circularity more financially attractive	O	2	2
	The financial and personal incentive to initiate a circular infrastructure project is low	T	9	5
<b><i>Circular ambitions</i></b>	Management has formulated organisational circular ambitions	S	8	7
	Enthusiastic employee wants to initiate circular infrastructure project	S	4	3
	There is no link between the organisational ambitions and executing personnel	W	9	7
	It is hard to formulate circular project ambitions	W	5	3
	Budget and planning limit circular ambitions	W	5	6
	Political influence and national policies can stimulate incorporating circularity in organisations	O	7	2
	<b><i>Experience &amp; knowledge</i></b>	Experiment with circularity in pilots	S	5
There is a lack of experience with circular procurement		W	6	5
Share experiences between organisations to increase knowledge		O	4	2
It is hard to upscale from pilot to common practice		T	4	1
There are too few projects finished to evaluate circularity		T	3	1
<b><i>Life cycle approach</i></b>	Use of LCA with Dubocalc within award criteria	S	2	3
	Agreements about end of life are not made	W	3	1
	Few integrated contracts (with maintenance) are used	W	3	4
	There are separate budgets for project investments and maintenance	W	5	2
	Monitoring of project ambitions is hardly done	W	3	1
	Circular materials can contradict with regulations or certifications	T	5	2
<b><i>Room for contractor</i></b>	Technical specifications are most often used	W	8	5
	Price is dominant in award criteria	W	4	3

<b>(to offer innovation)</b>	Assessment of functionally specified tenders is perceived hard	W	6	3
	Involve supply chain before announcement of tender	O	7	7
	Stakeholders and legislation always require some technical specifications	T	4	4
<b>Measurability</b>	Online databases for gathering and management of information about materials	O	5	2
	New tools can make circularity in infrastructure projects measurable	O	7	3
<b>Collaboration with supply chain</b>	There is a certain distrust towards the supply chain	W	6	5
	There is little contact with the supply chain during the tender	W	2	3
	Fragmentation of supply chain	T	3	4

The analysis and interpretation of each separate S, W, O, T can be found in Appendix G.

#### 7.4.1. DISCUSSION OF RESULTS

When looking at the results of the SWOT analysis, few strengths and many weaknesses can be pointed out. This underpins that the transition to a circular infrastructure sector is in the beginning and many contracting authorities have no idea where to start with circular procurement. A financial and personal incentive should be created, knowledge should be developed, life cycle thinking has to become evident, and there should be more faith in the supply chain. All these hurdles have to be overcome in order to start with circular procurement. If contracting authorities have overcome this hurdle, still many weaknesses can be pointed out. Contracting authorities do not seem to be able to formulate their need, specifications and criteria in such way to get circular solutions most effectively.

When looking at the connection of factors between the current and desired practice of circular procurement, it stands out that there is little said about two things: the use of a price ceiling and “circular vision” as an award criterion. The price ceiling can be explained by the fact that the price is still dominant in the award criteria. If less value is attached to quality, then contractors can only distinguish themselves on the price. Making use of a price ceiling does not make sense then. The “circular vision” criterion is not present in the SWOT analysis, simply because it was not possible to establish the current practice of this based on the interview outcomes.

#### 7.4.2. DISCUSSION OF DIFFERENCES BETWEEN INTERVIEWEES

Also in this analysis differences were found in the answers of the interviewees, depending on their organisation and profession. First of all, no differences between the contractors and contracting authorities stand out. Most factors are seen in a similar way. However, there are differences perceived within the different professions. The strategic advisors and consultants thought that circular procurement should not be that hard and had many ideas about how the circular procurement process should be. Especially the consultants were able to reflect on the behaviour of contracting authorities they assisted and they could point out common strengths and weaknesses. On the other hand, the procurers and contract managers were the ones who had to execute the procurement process and faced more difficulties along the way. Lastly, there

are large differences found in how far different contracting authorities are in the transition. Some of them already formulated an open need, but others noted afterwards that they specified too much in advance. This makes it hard to create one overall image of the current practice in the Netherlands.

#### **7.4.3. SUMMARY OF FINDINGS CURRENT PRACTICE**

The previous sections have provided an insight in the current effectiveness of the circular procurement practice in the Netherlands. 32 different aspects were found that are either a strength, weakness, opportunity or threat. The answer to the sub-question “*what are the strengths, weaknesses, opportunities and threats of the current practice in the Netherlands?*”, is extensive. Generally seen, the current practice contains many weaknesses, but there are some strengths that emphasise that contracting authorities want to start with circular procurement. They have formulated circular policies and are experimenting on a small scale in pilot projects. However, the actual execution of circular procurement is not always going so well.

First, the organisational structure of contracting authorities hampers achieving circular ambitions. There is no life cycle thinking and the separate budgets between investment and maintenance of projects limit the realization and safeguarding of circular aspects in projects. The use of LCC and integrated contracts are hampered by this. Furthermore, formulating circular project ambitions and assessing offers based on functional specifications are perceived as hard. When looking at the procurement process itself, contracting authorities tend to be controlling. They make use of many technical specifications, and the price is dominant in the award criteria. They are not able to provide the supply chain with the right conditions to enable room for their expertise. There is a certain distrust towards the supply chain. This attitude of contracting authorities stands in the way of effective circular procurement.

Some outcomes from the SWOT may be strengthened by the BVA. Weaknesses may be improved, opportunities exploited and threats mitigated. This will be analysed in the next chapter.





## Design and validation

Chapter 8 – Best value and circular model

Chapter 9 – Application and discussion of model

# 8 BEST VALUE AND CIRCULAR MODEL

The previous chapters described the definition and current status of effective circular procurement. Apparently, the current practice is not very effective so there may be opportunities for the BVA to contribute to this. This chapter will discuss the analysis of what elements of the BVA can contribute to the current practice to increase the effectiveness of circular procurement and if so, how. The answer to the following sub-question will be found: *“Which elements of the Best Value approach can strengthen the current practice of public procurement of circular infrastructure and under which conditions?”*

From the analysis between circular procurement and the BVA in chapter 6 and the SWOT analysis in chapter 7 became clear that most likely the whole BVA as it is applied right now is not the most optimal solution towards effective circular procurement. However, some single elements of the approach may already be beneficial. These will from now on be referred to as Best Value (BV) elements. In this chapter the possible contribution of each BV element will be discussed step by step. The aim is to design and validate a conceptual model that can be used as a guideline for contracting authorities that want to procure circular infrastructure.

First, the research method for this part is repeated in section 8.1. Then some boundary conditions are determined based on the theory of the BVA and a second round of interviews section 8.2. When the boundary conditions are set the individual BV elements are compared to the outcomes of the SWOT analysis. It will be discussed how they contribute to more effective circular procurement, and under what conditions they are applicable (section 8.3.). This information is visualized in a conceptual model, presented in section 8.4. The conceptual model is then subsequently validated in section 8.5, resulting in a final model in section 8.6., and an answer to the sub-question in section 8.7.

## 8.1. METHOD AND ANALYSIS

In order to answer the sub-question a second round of interviews was conducted. As described in chapter 2, several contracting authorities in the infrastructure sector were interviewed in order to understand how an effective circular tender would look like and, optionally, if BV elements could be helpful for this. Furthermore, the boundary conditions for applying these factors were discussed with the interviewees. The list of interviewees and the interview questions can be found in Appendix B respectively D.

### 8.1.1. SAMPLE GROUP

As mentioned in chapter 2, for this interview round only public authorities were approached. Some of the interviewees had also experience with the BVA. This was considered as an extra, because it helped to link the BVA elements already within the interview. The characteristics of the sample group can be found in table 7.

TABLE 7: CHARACTERISTICS INTERVIEWEES ROUND 2

	Round 2
ID	P13-P21
Total	9
Contracting Authority	9
Experience circular procurement	9
Experience infrastructure	8
Experience BVA	6

## ANALYSIS

After conducting the interviews, the recordings were transcribed and the sections related to the BVA were highlighted. The separate BV elements were listed in an Excel file and these elements were compared to the transcripts (Appendix H). For each interviewee was noted if they said something about a certain BV element. Answers that did not directly related to the BVA were compared by the researcher to the theory on the BVA (chapter 5). Based on this comparison and extra input from the interviewees was established which BV elements may contribute to the current practice of circular procurement and under which conditions. The possible contributions of the BV elements will be discussed in section 8.3.

### 8.2. BOUNDARY CONDITIONS

As mentioned in section 5.3. the BVA is not suitable to use for every contracting authority and for every type of project. In order to determine when BV elements can contribute to the effectiveness of circular procurement, some boundary conditions have to be established. Establishing these boundary conditions was an iterative process. Many different aspects were named by the interviewees (Appendix H). Multiple combinations of boundary conditions were made which resulted in different models. Through discussions with colleagues, fellow graduate students, and the graduation supervisors, the combinations of boundary conditions were iterated in several steps. In order to make the model applicable for different types of contracting authorities and projects, the following boundary conditions are selected: level of control of the contracting authority, and flexibility of the project environment. These two conditions will be used to form two axes of the conceptual model and will be discussed individually below.

#### 8.2.1. LEVEL OF CONTROL OF THE CONTRACTING AUTHORITY

In chapter 5 it was concluded that when making use of the BVA, the contracting authority should let go of control in order to provide room for the supply chain to make a distinguishing offer. However, not every contracting authority behaves like this. From the interviews it became clear that contracting authorities are on different levels when it comes to the ability of letting go and having faith in the supply chain. Some of them are more controlling: *“the majority of the project requirements are prescribed by us”* (P17). And others are have a more facilitating attitude: *“if the contractor promises to realize your ambition, you have to help him the best you can to get him there. And that is what we tried to do”* (P15). It is therefore interesting to identify which BV elements can be used for several attitudes.

The level of control depends on the technical knowledge within the contracting authority (P17, P18, P19), the experience with letting go and functional specifications (P14, P20, P21), and the attitude towards the supply chain (P14, P15, P16, P19, P20, P21). This results in a spectrum of the level of control: from controlling to facilitating. Each attitude determines which BV elements can be used by the contracting authority in the procurement process.

#### CONTROLLING

From the interviews it can be deduced that a controlling contracting authority prefers having influence on the whole project from design until the realisation of the contract. They do not trust the supply chain, and rather not take risks (related to circularity). Most of the time they have a lot of technical knowledge, especially contracting authorities with an internal engineering firm, which leads to the effect of detailed specification in advance.

#### FACILITATING

In contrast to the controlling role, contracting authorities can be facilitating. This means that the contracting authority provides all the conditions for the contractor to realize the (circular)

solutions to their need. A more trusting attitude towards the supply chain comes with this. This does not mean that the contracting authority can lean back and let the contractor do everything. The contracting authority should still be able to determine which expertise is needed from the contractor, and should have enough knowledge to assess the offers correctly.

#### *SUGGESTING*

There are also contracting authorities that are somewhere in between control and facilitate. These contracting authorities have a more suggesting attitude. They do not want to control over everything, but still want to have some sort of influence on the end result.

### **8.2.2. FLEXIBILITY OF THE PROJECT ENVIRONMENT**

As concluded in section 5.3., in order to make use of the BVA, there should be enough freedom within the project environment for contracting authorities to formulate an open need. Multiple projects are discussed during the interviews, which all have a different flexibility in the project environment. *“The project location determines the amount of interests that you have to take into account”* (P20). One of the interviewees stated: *“In the middle of a large city, there are so many interests to take into account. It is simply not possible to say: contractor, we want a road and good luck”* (P19). It is therefore interesting to identify which BV elements can be used for several kinds of projects.

The flexibility of the project environment depends on all kind of factors like stakeholders (P14, P19, P20), legislation, and regulations like land-use plans or track decisions (P19, P20, P21). A spectrum is created from very tight projects environments, to loose project environments. However, the project environment cannot be entirely loose within the Netherlands. Just asking for a “connection from A to B” is almost never feasible, because of the stakeholders, regulations and legislation. The end result still has to be sufficiently determinable, so loose in this case is relative.

#### *TIGHT PROJECT ENVIRONMENT*

Within a project with a tight environment, a lot of requirements and specifications are already determined by aforementioned external factors. There is not a lot of freedom for the contracting authority to formulate an open need and provide room for contractors. Examples are municipal projects in urban areas (P17, P18, P19, P20).

#### *LOOSE PROJECT ENVIRONMENT*

Within a project with a loose environment there is less determined in advance by external factors. The contracting authority is then able to formulate an open need to provide the contractor with more freedom. An example is the Lelystad Airport project, discussed in the second round of interviews (P14).

#### *AVERAGE PROJECT ENVIRONMENT*

Within an average flexible project environment some requirements and specifications are determined by external factors, but there is still some freedom for the contracting authority to formulate an open need. An example is a provincial project, the InnovA58 (P8), discussed in the first round of interviews.

**8.2.3. APPLICATION OF BOUNDARY CONDITIONS TO MODEL**

The previously described boundary conditions are used to shape the model in the form of two axes. This is illustrated below (figure 15). The contracting authority can determine its level of control and the flexibility of the environment of the intended circular project.

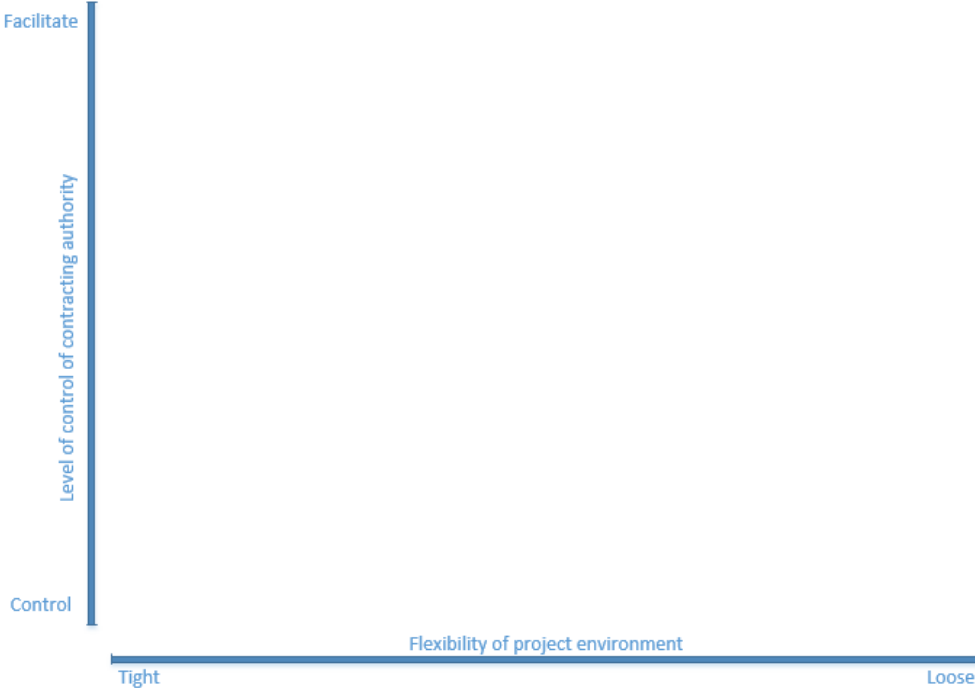


FIGURE 15: APPLICATION OF BOUNDARY CONDITIONS TO MODEL

Based on the intersection of both variables it can be determined which BV elements can be used in the procurement process of corresponding project. These BV elements and their conditions will be discussed in the next section.

**8.3. CONTRIBUTIONS OF BEST VALUE TO CURRENT PRACTICE**

Now that the boundary conditions are set, the separate BV elements as discussed in chapter 5 are listed and compared to the outcome of the in-depth interviews and the SWOT analysis (chapter 7). For each element it was determined if it could contribute to separate factors of the SWOT analysis, especially the weaknesses. The positive relations that were found are presented on the next page (table 8).

As can be seen in the table, a lot of BV elements are assumed to be helpful towards more effective circular procurement. Some elements can contribute to multiple factors of the SWOT analysis. Each BV element and why / how it fits in the model in relation to the two axes (figure 15) will be discussed in the next sections.

TABLE 8: COMPARISON BVA TO OUTCOMES SWOT ANALYSIS

Legend	
Positive relation	
Neutral	

BVA \ SWOT	Financial and personal incentive	Circular ambitions	Life cycle approach	Room for contractor			Measurability	Collaboration with supply chain	
	Risk-averse mind-set prevents starting	It is hard to formulate circular project ambitions	Monitoring of project ambitions is hardly done	Technical specifications are most often used	Assessment of functionally specified tenders is perceived hard	Price is dominant in award criteria	New tools can make circularity in projects measurable	There is a certain distrust towards the supply chain	There is little contact with the supply chain during tender
KPI's									
Value added									
Price ceiling									
Functional specification									
Large P/Q ratio									
Risks									
Project goals									
Project capabilities									
Clarification phase									
Weekly risk report									

### 8.3.1. ELEMENTS THAT ARE ALWAYS APPLICABLE

Out of the BV elements that are presented in table 8, the following three BV elements are considered to be helpful and applicable in any case: KPI's, value added criterion, and price ceiling. These are shown in figure 16. The green plane represents when the elements can be used.



FIGURE 16: APPLICATION OF KPI'S, VALUE ADDED AND PRICE CEILING

#### KPI's

According to the SWOT analysis (section 7.4.), an opportunity to make the circular procurement process more effective is to make circularity measurable. This can be done by drafting KPI's. According to the interviewees making use of KPI's to measure circular performances contributes to the effectiveness (P14, P15, P16, P19, P21). "Make your ambitions specific in terms of KPI's and determine how you are going to measure them" (P21). They contribute to safeguarding the circular project ambitions over the whole process,

because in the realisation phase they are monitored (P13). “With contract management you monitor if the contractor sticks to achieving the KPI’s” (P15). For example, the project ambition “reused materials are applied as much as possible” can be expressed in a % of reused materials. This makes the assessment of offers objective and transparent.

*VALUE ADDED CRITERION*

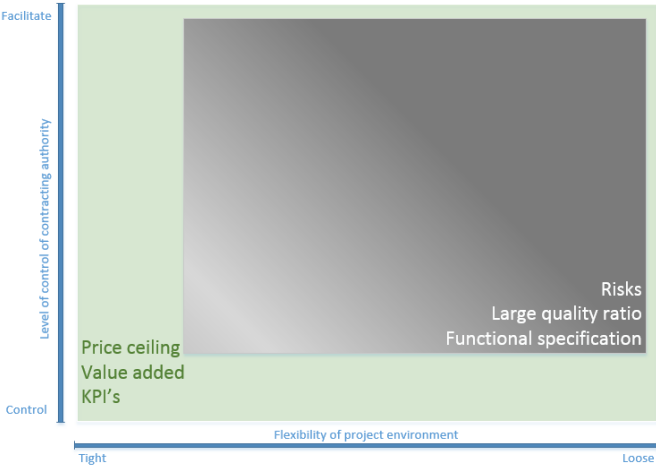
The value added criterion is considered as a good opportunity for circularity (P14, P15, P17). One of the interviewees says that “circularity has to be offered in the value added criterion” (P17). This sub-award criterion provides room for contractors to come up with additional circular solutions that are not included in the scope, but contribute to the project ambitions, provided that the contracting authority allows variants or changes for certain specifications. So if the contracting authority has predefined perhaps too much in advance, it is still possible to offer something extra as a contractor. However, the value added criterion is not a guarantee towards more circular solutions. It is an opportunity for contractors to offer something extra, but there is always a chance that this will not happen. Contractors should therefore be rewarded for offering extras, but not be punished with an insufficient score if they cannot.

*PRICE CEILING*

In the analysis on effective circular procurement it is concluded that a price ceiling can be helpful for effective circular procurement (section 7.3.) (P13, P14, P15, P16). Even though it is not directly mentioned by the interviewees, making use of a price ceiling may also strengthen other aspects from the SWOT analysis. For example, it can help to reduce the risk of cost overruns and provide the supply chain with a certain design freedom within the price ceiling. This can reduce the risk-averse mind-set of contracting authorities and their distrust towards the supply chain.

**8.3.2. LESS CONTROLLING, LESS TIGHT PROJECT ENVIRONMENT**

The following three BV elements require a less controlling attitude and a looser project environment in order to be applicable: functional specifications, large quality ratio and risks criterion. This is shown in figure 17. The grey plane lays on top of the green one and represents the application of these elements.



**FIGURE 17: APPLICATION OF RISKS, LARGE QUALIRTY RATIO AND FUNCTIONAL SPECIFICATION**

*FUNCTIONAL SPECIFICATIONS*

In order to procure circularly, it is recommended to specify functionally wherever possible (P13, P14, P15, P16, P17, P19, P20). However, from the SWOT analysis (section 7.4.) can be concluded that this is often not the case. The BVA can be a solution to this, because within BVA as less as possible is technically specified. This stimulates contracting authorities to specify more functionally. Subsequently, this enables more freedom for the contractor to make a distinguishing circular offer and realizing the circular project ambitions. Specifying functionally requires a less

controlling attitude of contracting authorities. They should be able to let go of only technical specifications. Also looser project environments are more suitable, because tight environments already have a more technical character by definition.

### LARGE QUALITY RATIO IN BPQR

From the SWOT analysis it can be concluded that the price is still dominant within the award criteria. However, a large quality ratio is recommended for achieving circular project ambitions (P13, P14, P16, P19, P20). The BVA can be a solution to this, because within the BVA usually a quality ratio of 75% is used to award the expert on quality (section 5.2.3). The conditions for applying this element are in line with the specifications, the more functional, the more contractors should be awarded on quality. As can be seen in figure 17, there is a change of colour that applies to the functional specifications and the large quality ratio. The colour change represents a slope, the more facilitating and the looser the environment, the more functional specifications should be formulated and the larger the quality ratio should be.

### RISKS CRITERION

In the interviews little is said about the risk criterion. Based on the previous analyses it is assumed that the risks criterion can contribute to the risk-averse mind-set and the distrust towards the supply chain. Contracting authorities do not have that much experience with circular projects and therefore they may have less insight in the corresponding risks. By letting the contractor identifying the risks related to the (circular) project goals, there is a chance that they may be prevented, which makes achieving the circular ambitions more likely. However, a more facilitating attitude is required for this. The contracting authority has to be comfortable with the fact that the contractor identifies the risks for them. Also the project environment has to be looser, because then the contractors have more room to distinguish themselves from others when identifying the risks.

### 8.3.3. MORE FACILITATING, LOOSER PROJECT ENVIRONMENT

The following two BV elements require an even less controlling attitude and looser project environment in order to be applicable: project goals and project capabilities criterion. This is shown in figure 18. The blue plane lays on top of the green and grey ones and represents the application of the project goals and capabilities.

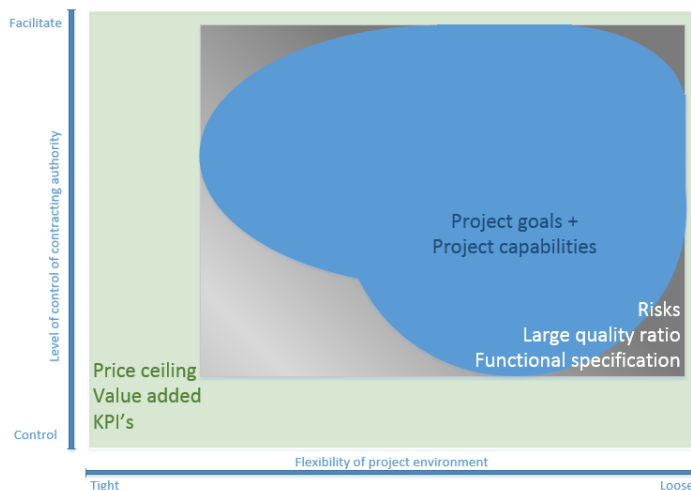


FIGURE 18: APPLICATION OF PROJECT GOALS AND PROJECT CAPABILITIES

assessment of offers. “Translate your ambitions to clear project goals and use them to assess the offers” (P21). Namely, the offers have to be assessed based on what extent they contribute to realizing the project goals.

It is recommended to also make use of the project capabilities criterion if project goals are applied. Within the project capabilities criterion it is possible to describe the solutions that

### PROJECT GOALS AND PROJECT CAPABILITIES CRITERION

Project goals can contribute to formulating SMART organisational ambitions on circularity in projects (P13, P14, P15, P21). “I think project goals can help to highlight circularity and sustainability. It tells contractors what your focus is” (P13). The goals have to be formulated on an abstract level and determine the focus of the project. Because of this a lot of room is provided for contractors to contribute to the project goals with their own creative solution(s). The project goals also provide a handhold for the

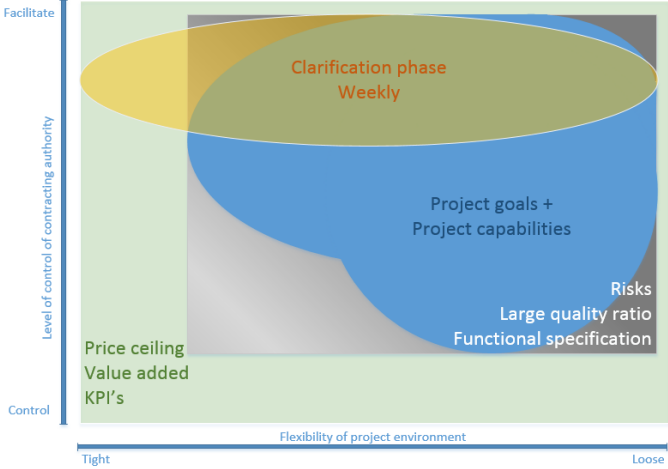


contribute to the project goals on circularity. “What we saw is that all contractors included project capabilities statements about sustainability” (P14). The contractors have to underpin their solutions with metrics, which makes the assessment of the offers more objective. This also contributes to the opportunity to make circularity measurable and it stimulates collaboration within the whole supply chain, because metrics can be obtained from suppliers as well.

Because the project goals are formulated on an abstract level, it is important that the contracting authority has a suggesting or facilitating attitude. Also the project should have an average or loose project environment. Within a tight environment there is not a lot of value added for formulating project goals, because there is not a lot of room for contractors to make a distinguishing offer on the goals. The more the contracting authority specifies functionally, the more important project goals are to provide focus for the contractors. This is why the blue shape covers the darker the grey area in the model. The blue shape within the model is round in order to show that it lies on top of the grey layer. In reality, the two upper and right corners of the grey shape should also be covered by the blue shape.

**8.3.4. ENTIRELY FACILITATING**

The last two BV elements require a completely facilitating attitude of the contracting authority, but the type of project does not matter: clarification phase and weekly risk report. This is shown in figure 19. The yellow plane lays on top of the green plane and sometimes on the grey and blue planes. It represents the application the clarification phase and weekly risk report. Also here the shape is round to show the overlap between layers, but in reality the upper corners should also be covered.



**FIGURE 19: APPLICATION OF CLARIFICATION PHASE AND WEEKLY RISK REPORT**

*CLARIFICATION PHASE*

Interviewees state that the clarification phase is a good opportunity to procure circularly more effectively (P14, P15, P21). From the analysis in chapter 7 it can be concluded that contact with the contractor in the tender phase is required, but that this is not the case right now. The clarification phase can be suitable to facilitate this contact. It can remove the distrust towards the supply chain, because of the early contact and collaboration. “I would always make use of a clarification phase. Just to talk through the whole project with each other before the execution starts. If there are any

*misunderstandings, they can be solved early in the process”* (P15). Furthermore, the submitted offer will be verified, project risks are identified and value added is (optionally) exploited in the clarification phase. It is an extra check if the contractor’s promises are achievable, which contributes to the chance that the circular project ambitions are realized. It is also a good opportunity to check if you understand each other, which contributes to a positive and collaborative working spirit. This is essential within open, functional tenders. The contractor is in the lead in the clarification phase, so facilitating role of the contracting authority is required. It is recommended to include a clarification phase for each type of project. For each project (tight or loose) it can be wise to let the contractor clarify his offer in order to solve uncertainties or disputes early in the process.

## WEEKLY RISK REPORT

The weekly risk report is a tool to monitor the project in relation to time, budget and performance. It can help to monitor and safeguard the circular project ambitions and KPIs. The transparency about time and costs can help with the collaboration between contracting authority and contractor, and mitigate distrust. The weekly risk report can be used in each type of project, but it assumes a facilitating role of the contracting authority, because the contractor drafts the reports. The contracting authority only has to check it.

### 8.4. CONCEPTUAL MODEL

Based on the discussion of all BV elements that can contribute to more effective circular procurement, a conceptual model is created. The model can be used as a guideline by contracting authorities to determine which BV elements can be used in their procurement processes. The conceptual model is designed layer by layer in the previous sections, resulting in the following figure (figure 20). With help of the axes, the contracting authority can determine its level of control and the flexibility of the project environment. Based on the intersection of both variables, the model shows which BV elements are recommended to use in order to procure circular infrastructure more effectively.

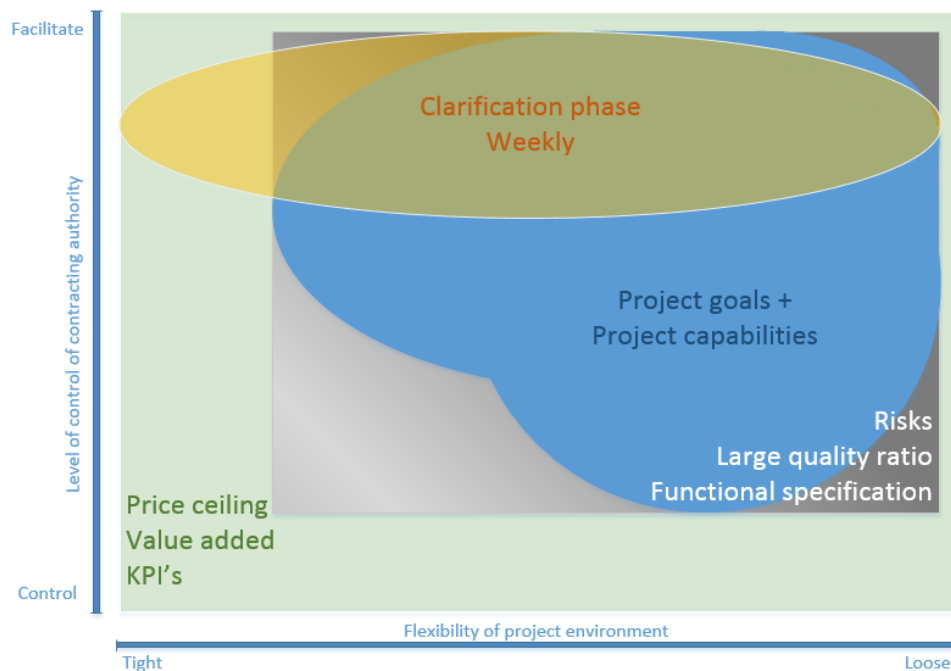


FIGURE 20: CONCEPTUAL MODEL. OWN ILLUSTRATION

As can be seen the more facilitating the contracting authority is and the looser the project environment is, the more BV elements are recommended to apply. This is in line with the theory behind the BVA, because, as mentioned in section 5.3., the successful application of the whole BVA requires a facilitating contracting authority and a looser project environment. However, there are some BV elements that can already be applied when the contracting authority is less facilitating, or in a tight project environment. Before going into detail about the application of the conceptual model, it will be validated first in the next section to come to a final model.

### 8.5. VALIDATION OF MODEL

The model is designed based on a theoretical analysis of the BVA and a couple of interviews with experts in the field of procurement of circular infrastructure. In order to ensure the correctness and applicability of the conceptual model, a separate validation round is held with experts in the field of the BVA.

### 8.5.1. METHOD AND ANALYSIS

The aim of the focus group is to confirm the answers of the interviewees, so if the right BV elements are used in the model under the right conditions. During one afternoon the conceptual model was discussed with a focus group. The participants received the conceptual model (figure 20), including guidance text one week before the meeting to prepare. Furthermore, they were sent some discussion points related to the concerns as presented in chapter 6. These concerns relate to: the required form of collaboration for circular procurement and the BVA, and the use of metrics to procure (circular) innovations.

By getting multiple persons in contact at the same time, a discussion is enabled between experts in the field of circular procurement, and experts in the field of the BVA. As described in chapter 2, during the focus group the model was build up (similarly as in section 8.3.) in a presentation, starting with the boundary conditions and then the BV elements layer by layer. For each BV element it was discussed if it could contribute to effective circular procurement or not. It was also checked if the corresponding conditions were correct. After consensus was reached, the next BV element was discussed. Furthermore, the discussion points were discussed after all of the BV elements were validated. This resulted in a better understanding of applying the BV elements to procure circularly, which will be discussed in chapter 9.

#### *PARTICIPANTS OF THE GROUP*

The focus group consisted of three experts in the field of procuring infrastructure with the BVA. All of them currently work for a public authority (table 9). However, the intention was to also have circular procurement experts present in order to enable a discussion between experts of the two procurement approaches. Since, there were only BVA experts, this resulted in extra effort of the researcher to keep the discussion objective and also related to circular procurement. Luckily, two of the BVA experts had some experience with sustainable or innovative procurement so they were able to reflect on the model from both sides.

In order to validate the conceptual model with input from both expertises, one circular procurement expert was asked to provide a written reflection on the model (last row, table 9). This reflection was compared to the outcomes of the focus group and a weighted decision was made by the researcher which aspects of the model should be changed.

TABLE 9: COMPOSITION FOCUS GROUP

<b>Organisation</b>	<b>Profession</b>
Rijkswaterstaat	Advisor BVA and sustainability
Municipality of Amersfoort	Project manager BVA
Province of Utrecht	BVA procurer
Copper8	Consultant circular procurement

The focus group was relatively small. As mentioned in chapter 2, it is recommended to have at least 6-8 persons present in order to get the best results (Wilkinson, 1998). Because the focus group was held during the summer holidays, not that many experts were available to join the session. The effect is that the validation and final version of the model have to be interpreted with care.

## ANALYSIS

The focus group session was recorded and transcribed. A summary was sent back to the participants for validation. Then the findings were compared to the conceptual model. The elements that are also by the focus group considered as a contribution to circular procurement are automatically accepted, it is just a confirmation of the previous analyses. However, there are also some elements that are differently seen by the focus group. For each questionable element is determined what the nature of the discussion is in order to determine if a change to the model, initiated by the focus group, can be justified or not. Because the focus group is more experienced with the BVA, the opinion of the participants related to practical application of BV elements was seen as more decisive than the opinion of the interviewees. On the other hand, the discussions related to circular procurement were interpreted with more care. The opinion of the interviewees is then seen as more decisive, because they are more experienced with circular procurement than the participants of the focus group. After the comparison of the results, some adjustments or optimizations were made, resulting in the final model.

### 8.5.2. RESULTS OF FOCUS GROUP

After the analysis of the discussions held during the focus group, for each boundary condition and BV element it is determined if the application in the conceptual model is correct. The following table summarizes the results (table 10). The right column describes if the element used in the conceptual model contributes (green), is questionable (orange) or does not contribute (red). One exception is the interviews criterion. This element was not included in the conceptual model, and also after validation this element will not be included.

TABLE 10: OUTCOMES VALIDATION

	Element	Validation	Legend
<b>Boundary condition</b>	Level of control of contracting authority		Element accepted, no changes made
	Project environment		
<b>BV element</b>	KPI		
	Value added		
	Price ceiling		Element not accepted, changes made
	Risks		
	Functional specification		
	Large quality ratio		Discussion, but no changes made
	Project goals + capabilities		
	Clarification phase		Element accepted, no changes made
	Weekly		
	<i>Interviews</i>		

The red and orange elements will be discussed in the next sections. Green elements will not be further discussed, because no changes related to these elements in the model are made, it is just a confirmation of the previous analyses.

### PRICE CEILING

During the focus group session it was found that the price ceiling in itself does not have a direct connection to achieving circular project ambitions. *“It is just determining what amount of money you want to spend as a contracting authority”*. The price ceiling relates to the project goals and the quality aspects and ratio in BPQR tenders. So if the quality ratio is low, making use of a price ceiling is unnecessary. Therefore, the element does not contribute in itself, but it wise to apply in combination with another BV element *“large quality ratio”*. Therefore, these two elements are combined.

### *RISKS CRITERION*

It was found that also the risks criterion in itself does not have a direct connection to circularity. According to the focus group, most risks related to circularity are risks for the contractor. Besides the usual risks for the contracting authority, the group did not see why the risks criterion contributes to more effective circular procurement. Also with respect to the contractor, circularity should not be seen as a risk, it is an opportunity to be distinguishable. However, the circular procurement expert did think that it was unrealistic to assume that there are no risks related to circularity. Still, the argument that the circular risks consider the supply chain holds up. Furthermore, not much was said about the risks criterion in the interviews (section 8.3.2.), so the opinion of the focus group is decisive. Therefore, the risks criterion as it is used in the BVA is removed from the model.

### *PROJECT GOALS AND CAPABILITIES*

The project goals and capabilities were considered valid by the focus group, but the shape that is used in the conceptual model is changed. According to the focus group the project goals are essential when a large quality ratio is used. The project goals then provide focus for the supply chain. The blue plane is changed from a bulb-shape to a more hollow shape in order to be in line with the grey plane. The darker the grey plane, the more important project goals, so at a certain point they merge into each other.

### *CLARIFICATION PHASE*

The focus group thought that the clarification phase in itself does not contribute to more circularity, because the offers of the contractors are already submitted by then. Applying it will not automatically lead to more effective circular procurement. However, as mentioned in the interviews, it does help with verifying the offer of the contractor and can be a good start of the collaboration between contracting authority and contractor. Because circularity is relatively new and not always measurable, it is recommended to have this extra moment of contact within the tender phase. Therefore, the opinion of the interviewees is decisive and the clarification phase is kept in the model.

### *INTERVIEWS CRITERION*

The interviews criterion was not mentioned often during the second interview round, but it was assumed that it may not contribute to effective circular procurement. It is just an extra check if the contractor understands his submitted offer. Even though it provides contact with the supply chain in the tender phase, the interviews are more one-sided instead of a dialogue. Also according to the focus group the interviews criterion has no direct relationship towards more effective procurement of circular infrastructure. It helps to identify the expert, but it *“has not much to do with realizing circular project ambitions”*. Also the circular procurement expert did not think that the interviews would be helpful. Therefore this element will stay out of the model.

## **8.6. FINAL MODEL**

After the analysis of the outcomes of the focus group, some changes are made to design the final model. To summarize, the following changes are made:

- The price ceiling is included within the “large quality ratio” element
- The risks criterion is removed
- The shape of the project goals + capabilities is changed to illustrate the relation with the functional specifications

Furthermore, the position and shapes of the planes are slightly adjusted (the rectangles have round edges) to make the overlap of the different layers visible. The final model is presented below (figure 21). In reality the grey, blue and yellow planes would stretch to the upper and right side of the model, but this does not benefit the understanding of the cumulative layers and requires extra explanation. However, when applying the model, this should be taken into account. This will be explained in the next chapter.

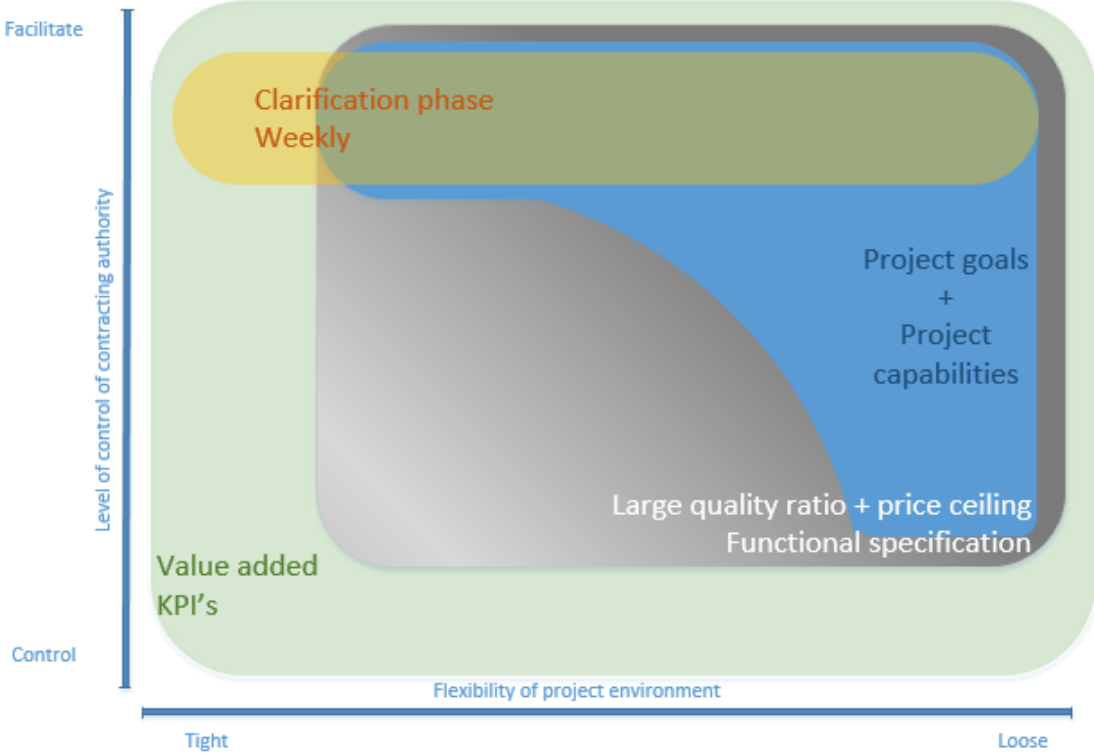


FIGURE 21: FINAL MODEL. OWN ILLUSTRATION

The final model can be used as a guideline for Dutch contracting authorities that want to procure circular infrastructure. It is now time to look closely at the model and discuss how it can be used by contracting authorities in their procurement processes. Furthermore, there are some limitations that have to be taken into account when using this model. In the next chapter the application of the model will be discussed in detail.

**8.7. SUMMARY**

The previous chapter has provided the development and validation of the model that can be used to strengthen the current effectiveness of circular procurement. The answer to the sub-question: “Which elements of the Best Value approach can strengthen the current practice of public procurement of circular infrastructure and under which conditions?”, is answered with the interpretation of the model. All BV elements that are visible in the model can strengthen the current practice of circular procurement. It depends on the level of control of the contracting authority and the flexibility of the project environment when certain BV elements are recommended to use.

# 9 APPLICATION AND DISCUSSION OF MODEL

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In the previous chapter a model is created which shows the BV elements that can contribute to the effectiveness of circular procurement. This chapter will focus on how contracting authorities can make use of the model as a guideline to procure circular infrastructure and which limitations have to be taken into account. First some general factors that have to be incorporated in the procurement process to safeguard circularity will be elaborated on in section 9.1. Then the model and its layers will be discussed in section 9.2. For multiple areas in the model an advice is written for contracting authorities how to make use of the BV elements in the model. The model is reflected on in section 9.3, and some limitations of the model will be discussed on section 9.4. The reflection and limitations result in some practical recommendations for contracting authorities in section 9.5. The chapter ends with a preliminary conclusion in section 9.6.

## 9.1. GENERAL FACTORS TO SAFEGUARD CIRCULARITY

Before going directly to the model, one issue should be addressed: just applying BV elements will not automatically lead to circular infrastructure solutions. Contracting authorities have to establish in advance what their circular need is and if the supply chain is able to realize that need. The BV elements are then used in the procurement process to embed that circular need. Based on the analysis in chapter 7 (section 7.3. & 7.4.), multiple factors are considered important to procure circularly effectively. These factors should be used in every case, independent of the BV elements that are used.

### 9.1.1. PREPARE INTERNAL ORGANISATION

From section 7.4.1. it can be concluded that it is essential for contracting authorities to create personal and financial motivation, to develop knowledge, to stimulate life cycle thinking, and to have faith in the supply chain in order to start with circular procurement in the first place. The internal organisation should be prepared to procure circular infrastructure, otherwise no circular projects will be initiated. This boils down to the following things that have to be taken into account by contracting authorities, *before* the preparation phase of the tender:

- A clear circular policy should be formulated and what this means for the organisation.
- A motivated procurement team should be created with the right circular expertise.

When these factors are in place, a foundation has been laid to procure circular infrastructure effectively.

### 9.1.2. MAKE CIRCULARITY A PART OF THE PROJECT

For an effective circular procurement process, it is important for the contracting authority to formulate its need in such way that contractors will offer circular solutions. Together with the need, the contracting authority should formulate circular project ambitions for the project. In advance should be determined what the ambition level is and what the opportunities for circularity are. As mentioned in section 7.3. the circular project ambitions should not be too vague in order to provide focus for the supply chain.

Besides the circular ambitions, the specifications determine the circular outcome of the tender. Circular specifications and agreements about the whole life cycle should be taken into account, depending on the ambition (section 7.3). It is important to leave room for the supply chain to stimulate them towards offering circular solutions. For example, if you have the ambition to realize a project with mostly secondary materials, it is wise to leave some freedom in the

specifications of the materials. The supply chain is then not limited in what they can offer and stimulated to come up with creative solutions.

### **9.1.3. GET IN TOUCH WITH THE SUPPLY CHAIN**

In section 7.4. the opportunity of involving the supply chain before the announcement of the tender is presented. One way to facilitate this, is to organise a market consultation. It is very useful for the contracting authority to check if the intended circular ambition and specifications comply with what the supply chain can offer. Furthermore, a market consultation can be useful to check if the intended procedure and criteria are suitable for the supply chain to make a satisfying circular offer (especially if BV elements are used).

### **9.1.4. SELECT ON VISION AND AWARD ON QUALITY**

Not much was said about the procurement procedure for effective circular procurement by the interviewees. In section 4.3.1. it was already mentioned that it is recommended for circular procurement to make use of preselection (in this research the restricted procedure). It is considered important that a motivated contractor with a similar circular ambition as the contracting authority is selected to make an offer (section 7.3.). One way to facilitate this is to ask for a vision document on circularity in the selection phase. Then all contractors that have a circular vision and are motivated to contribute to the contracting authority's ambitions can be preselected. After preselection contractors should be awarded on quality in order to be stimulated to offer creative circular solutions (section 7.3.). Also the Aanbestedingswet 2012 (art. 2114 sub 3) states that public contracts should be awarded based on the BPQR. The aspects of circular procurement, related to life cycle approach, collaboration with the supply chain, and innovation can then be incorporated as a sub-award criterion. Based on these findings can be concluded that the model should be used in combination with a restricted procedure and awarding on the BPQR to procure circular infrastructure effectively.

### **9.1.5. SAFEGUARD CIRCULARITY AFTER CONTRACT AWARD**

In order establish if the circular procurement process was effective or not, it is necessary to check if the circular project ambitions are indeed realized after the award of the contract. According to section 7.4. this is hardly done by contracting authorities. One way to monitor the ambitions is to make use of one of the contract management approaches. The weekly risk report that is used within the BVA is one example, but there are also other types like "voortgangsrapportage" and "systeemgerichte contractbeheersing". The exact type of contract management is up to the contracting authority, as long as it monitors the project ambitions.

### **9.1.6. EVALUATION**

Lastly, in order to become more experienced with circular procurement, it is recommended for contracting authorities to evaluate the entire procurement process after the contract award (section 7.3). This increases their knowledge about circular procurement and it can help to make the next projects stepwise more circular than the previous one.

## **9.2. APPLICATION OF BV ELEMENTS**

Now that the general aspects for procuring circular infrastructure are discussed, the application of BV elements in the model will be elaborated on. In this section will be discussed in detail how contracting authorities can procure circular infrastructure with help of the model.

When the contracting authority has initiated a circular infrastructure project the following steps should be taken:



1. Determine the flexibility of the project environment. Is the project situated in the middle of a busy road network (tight), or in a rural area (loose)? Are there many stakeholders that influence the requirements of the project (tight) or is there more freedom (loose)?
2. Determine your own level of control. Are you comfortable with specifying functionally (facilitate) or do you prefer to specify more detailed (control)? What is your relation with potential contractors, do you trust them with more design freedom (facilitate) or not (control)?
3. Look at the model, and determine based on the intersection of step 1 and 2 which BV elements can be used in the procurement of corresponding project.

As can be seen below, the model is subdivided in 5 different zones (figure 22). For each zone an advice is provided for contracting authorities about which BV elements can be used, and also how they can be used.

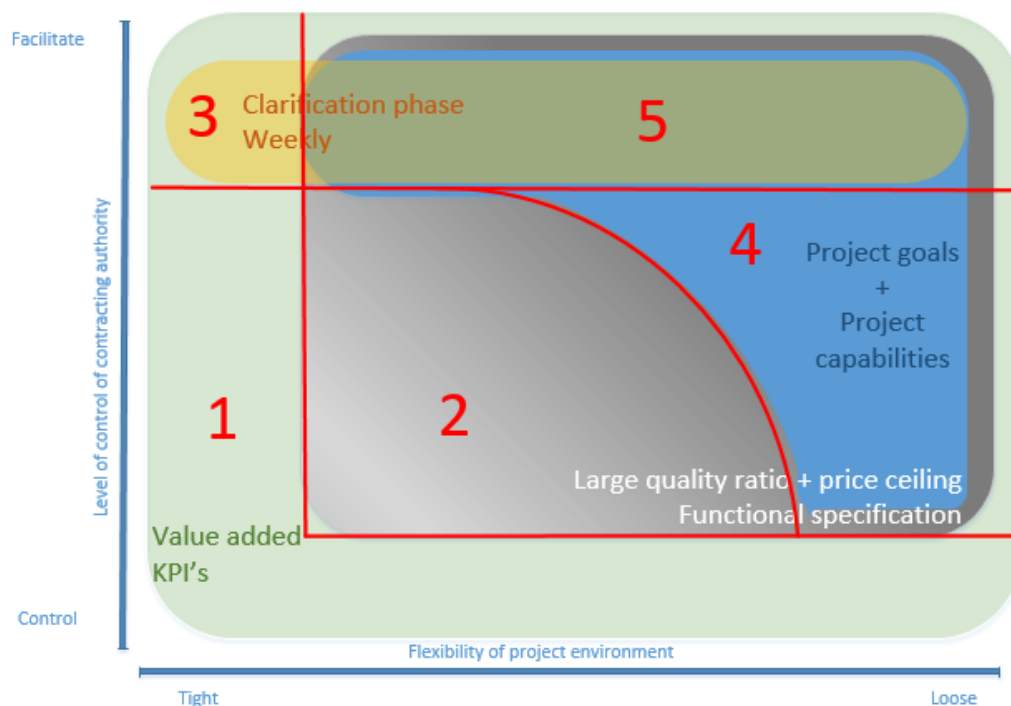


FIGURE 22: DIVISION OF MODEL IN ZONES. OWN ILLUSTRATION

### 9.2.1. ADVICE FOR EACH SCENARIO IN THE MODEL

As mentioned above, the model can be split up in five different zones. Now, for each zone an advice is formulated about which BV elements can be used and especially how they can be used in the circular procurement process. It is important for contracting authorities to explain to the supply chain which approach is used, what the selected BV elements are and how these elements are assessed. The equality, transparency and proportionality principle have to be safeguarded when making use of the separate BV elements.

The BV elements that can be used within each zone, are summarized below (figure 23). This figure functions as a legend for the upcoming sections, the colours correspond with the colours used in the model. One extra layer is visible, these dark green elements represent the circular elements as discussed in section 9.1., which should be applied in any case.

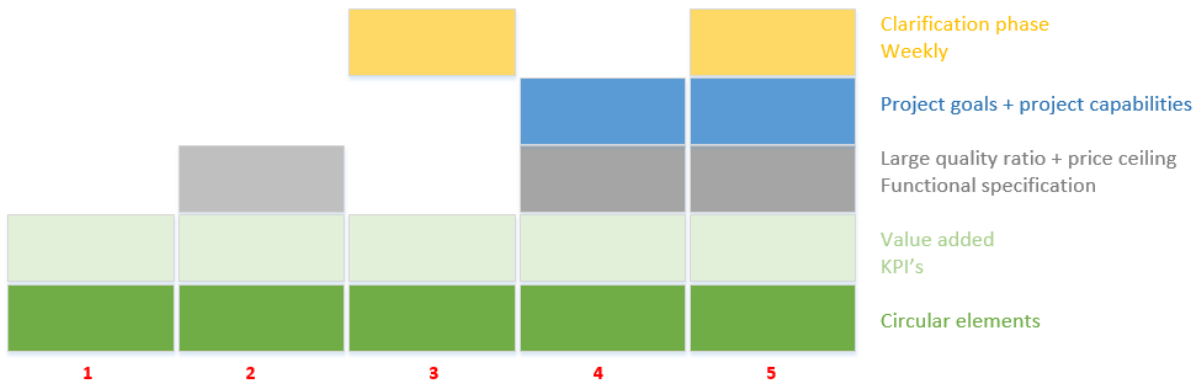


FIGURE 23: BV ELEMENTS FOR EACH ZONE

*ZONE 1: TIGHT AND CONTROL*

Within zone 1 either the attitude of the contracting authority is controlling or the project environment is tight. Both make it very likely that the specifications are technical of nature, which makes it harder to provide room for the contractor and to award on quality. In order to make the procurement process more effective in this scenario two BV elements are recommended to apply: KPI's and the value added criterion. How these are incorporated in the procurement process, is shown below in figure 24.

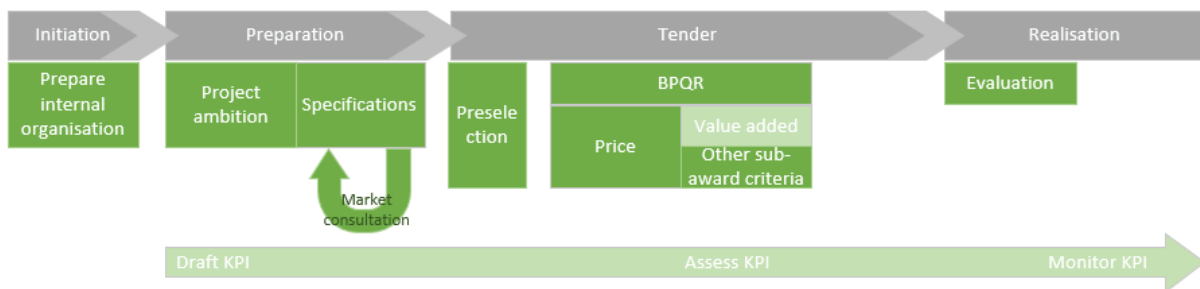


FIGURE 24: PROCUREMENT PROCESS ZONE 1. OWN ILLUSTRATION

The KPI's in this zone are differently used than according to the BVA, because letting the contractor draft the KPI's in the clarification phase requires a facilitating attitude. This is not the case in this zone. Luckily, KPI's can be used by a more controlling contracting authority, but they have to draft the KPI's themselves. For example, the KPI's can relate to the circular project ambitions and can be assessed within the sub-award criteria. An example of a circular KPI is an Environmental Cost Indicator (ECI) obtained by a DuboCalc calculation (P16). The contractor can then be assessed based on this ECI: the better the value the higher his score. After the award of the contract, the project performance can be monitored easily with use of the KPI's.

Besides the KPI's, also the value added criterion is used differently than according to the BVA. It still an award criterion, but it cannot relate to the project goals (according to the BVA), since these are not present in this zone. The value added can relate in this case to either the project ambitions or KPI's. It is important that the contracting authority establishes clearly to which ambitions or KPI's the value added criterion relates and how it is assessed. Otherwise the transparency principle could be violated.

*ZONE 2: LOOSE UP*

Within the second zone the attitude of the contracting authority is less controlling and the project environment is less tight. This enables the use of more functional specifications and awarding on quality. In order to make the procurement process more effective in this scenario

four BV elements are recommended to apply: KPI's, value added criterion, functional specification, and large quality ratio + price ceiling. The procurement process is shown below in figure 25.

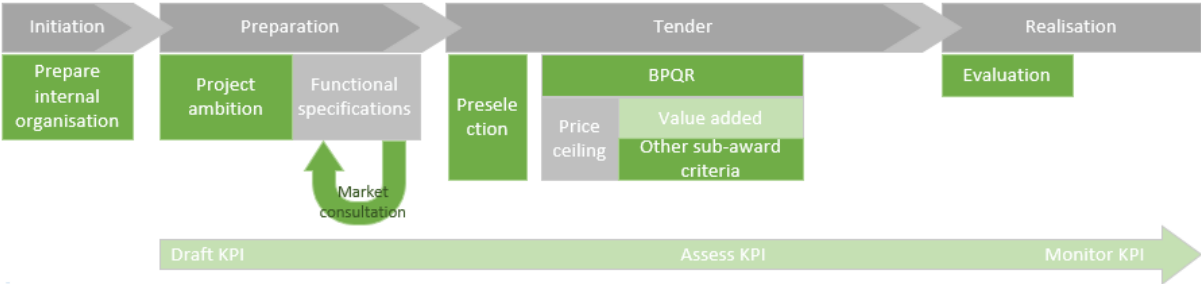


FIGURE 25: PROCUREMENT PROCESS ZONE 2. OWN ILLUSTRATION

The KPI's and value added criterion are applied similarly as in zone 1. In addition to this it is advised to specify more functionally in order to provide room for the contractor to make a distinguishing offer. Also making use of a price ceiling is then recommended to ensure contractors can be awarded on quality without the risks that price will become undesirably high.

*ZONE 3: LETTING GO IN A TIGHT ENVIRONMENT*

The yellow zone is slightly different from the previous two zones. The attitude of the contracting authority is facilitating, which means that they are able to facilitate the supply chain, even though the project environment is tight. This enables the use of the clarification phase and weekly risk report. The KPI's are no longer drafted by the contracting authority, but submitted by the contractor in the clarification phase. This is shown below in figure 26.

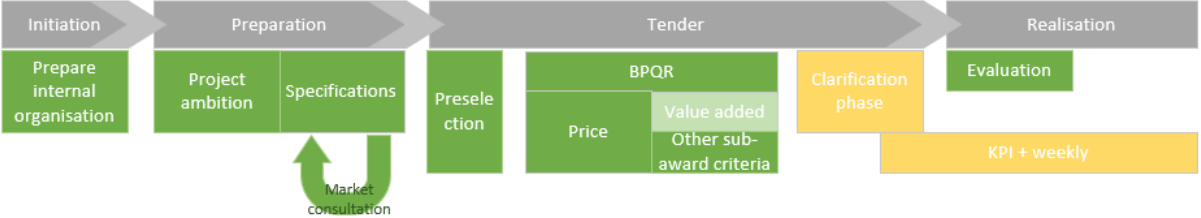


FIGURE 26: PROCUREMENT PROCESS ZONE 3. OWN ILLUSTRATION

In this area the KPI's are used according to the BVA. According to chapter 5, this means that the contractor is in the lead in the clarification phase. The contractor drafts the KPI's, because he has, according to the BVA philosophy, more insight about which KPI's are needed to express and monitor the circular project performance. Furthermore, in the clarification phase will be started with the weekly risk report to monitor the circular performance based on the selected KPI's.

The value added criterion is applied as described in zone 1. However, the value added relates in this case to the project ambitions and not the KPI's, since the KPI's are drafted afterwards in the clarification phase. It is important that the contracting authority establishes clearly to which ambitions the value added criterion relates and how the criterion is assessed.

*ZONE 4: FROM SPECIFICATIONS TO PROJECT GOALS*

Within the blue zone, the project environment is loose or the level of control of the contracting authority is average. This gives the contracting authority the opportunity to provide more room for the supply chain, even though their attitude is not completely facilitating. It is advised to formulate the need, according to the BVA, in the form of a "deliverable" including project goals.

At least one of the project goals should relate to circularity in order to make sure contractors offer circular solutions. The procurement process is shown below (figure 27):

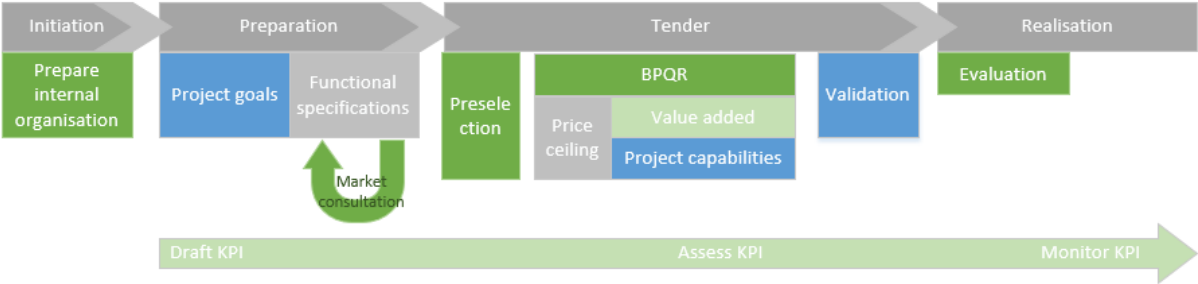


FIGURE 27: PROCUREMENT PROCESS ZONE 4. OWN ILLUSTRATION

The KPI’s are in this zone not applied according to the BVA, since the attitude of the contracting authority is not completely facilitating in this zone. The use of the KPI’s is similar as described in the section of zone 1. However, the value added criterion is used differently than in zone 1. In this zone the value added is an award criterion, applied according to the BVA (section 5.2.3.). The added value options are assessed based on to what extent the offered extras contribute to the project goals.

Furthermore, the project capabilities criterion is used as a sub-award criterion. Contractors have to make use of statements, underpinned with metrics, that ensure that they are capable of realizing the deliverable and contribute to the project goals. However, within the BVA, the offers are validated in the clarification phase, but this is not possible in this zone. Because the offers are limited in size (section 5.2.3.), it may be wise to verify the offer before going to the realisation phase. Therefore, an extra “validation phase” is introduced, which can be seen as a simplified clarification phase. Only the offer of the preliminary winner is validated, before going to the realisation phase.

*ZONE 5: BEST VALUE*

In the last zone the contracting authority has a facilitating attitude and the flexibility of the project environment is average to loose. The last zone is almost similar to the whole BVA. All elements are present, except for the risk criterion and interviews. However, it can be wiser to apply the whole BVA in this case. The members of the focus group mentioned that it is important not to mix up too many different BV elements, because this can be confusing for the supply chain. They are used to either regular BPQR tenders or BVA tenders, and mixing both approaches can result in the wrong interpretation of the need of the contracting authority and the selection / award process. Therefore, it is recommended to make use of the whole BVA in zone 5. The risks and interviews are not considered as a contribution to more effective circular procurement, but they are also not harmful. Together with the circular elements, the process looks as follows (figure 28):

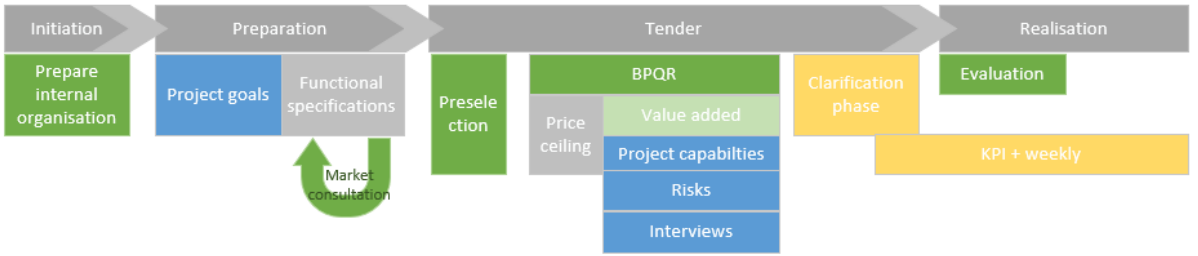


FIGURE 28: PROCUREMENT PROCESS ZONE 5. OWN ILLUSTRATION

### **9.3. REFLECTION ON MODEL APPLICATION**

The previous sections have provided an overview of how contracting authorities can make use of the proposed model in order to procure circular infrastructure. It helps to determine which BV elements can be used for more effective circular procurement. The division of the model in five different zones enables customized advice in different scenarios. This makes the model applicable for a great range of public authorities and projects. In this section will be reflected briefly on the additional application of the model, its contribution to the effectiveness of circular procurement, and what the BV elements in the model mean in relation to the whole BVA.

#### **9.3.1. AWARENESS WITHIN CONTRACTING AUTHORITIES**

Besides the function of selecting the suitable BV elements, the model can also help contracting authorities to raise awareness about their own organisation. For example, a contracting authority wants to procure a circular infrastructure with the whole BVA. It looks at the model and it turns out that its attitude is more controlling than facilitating. In that case the model makes the contracting authority aware that it may not be ready to use the full BVA. Moreover, if this contracting authority still wants to make use of the full BVA, steps have to be taken first to establish a facilitating attitude. This implies that it is possible to make the shift from a controlling to a more facilitating attitude. The value added criterion can play an important role in this shift, because variants have to be allowed (section 5.2.3.). This creates a more open need formulation and requires the contracting authority to be open to the offered value added options. If the value added options are not satisfying, the contracting authority can always decide not to honour them. This is allowed, provided that a possibility to change the contract (option) is included in the tender documents (section 5.2.3.). Furthermore, specifying more and more functionally can help to increase the facilitating attitude of the contracting authority. On the other hand, increasing the flexibility of the project's environment is harder, because it is determined by external factors. This illustrates that certain projects are just not suitable to be procured with the BVA, and a different approach should be followed.

#### **9.3.2. CONTRIBUTION TO EFFECTIVE CIRCULAR PROCUREMENT**

In section 7.1. effective circular procurement was defined as “procurement where the initial circular project ambitions and goals are met after the realization of the object of the contract”. Subsequently, in chapter 8 the different BV elements were analysed that contribute to this effectiveness of circular procurement, so it can be assumed that each zone in the model can be a contribution to the current practice. The more BV elements are used, the more effective the circular procurement process will be, but only if the contracting authority and the project are compatible with this. The aim of the model is not to force contracting authorities to make use of as many BV elements as possible. If the internal organisation and intended circular project are not suitable for certain BV elements, they should not be used. Contracting authorities should not strive for *the most* effective approach available, but look at which approach suits the organisation and project best. Moreover, if a contracting authority wants to use a certain approach, steps should be taken to reach the right conditions. The model can help to provide insight in this.

As can be seen in table 8, the KPI's contribute to more SWOT factors than any other BV element. It is therefore plausible that the use of KPI's is the biggest contributor to the effectiveness. The KPI's provide the connection between the circular ambitions to the realization of the contract. They help contracting authorities to formulate their circular ambitions, assess the offers objectively and monitor the project performance after the contract award, which increases the likelihood that the initial ambitions are met in the end. If the KPI's are incorporated in the contract, the contractor has to meet them. As mentioned in section 4.3.3., this is the most effective way to ensure that certain circular ambitions (in the form of KPI's) are met.

### **9.3.3. BVA OR NO BVA**

Through the interviews it became clear that making use of the separate BV elements becomes easier when the contracting authority is experienced with the BVA. The specific open mind-set, assessing metrics, and facilitating the expert contractor is different compared to the most common forms of collaboration. Some of the interviewees are not a fan of the BVA and think there are other (better) approaches for procurement. This preference for a certain other procurement approach can be a hurdle to make use of the model. However, since only in zone 5 the whole BVA should be applied, the contracting authorities that are not a large fan of the BVA may still make use of some BV elements in the model.

The members of the focus group pointed out that unless all BV elements are used, making use of separate BV elements results in the fact that the procurement approach cannot longer be called the BVA. One of the members said: *“I’m not a fan of hybrid versions of the BVA”*. As elaborated on in section 9.2., this has no effect on whether or not the BV elements can be used. However, the BV elements are not always applied strictly according to the BVA. The result is that only zone 5 can be seen as a full BVA tender. The rest of the zones should be seen as a regular BPQR tender with derivatives from the BVA in it. It is therefore very important for contracting authorities to explain to the supply chain which approach is used, what the selected BV elements are and how these elements are assessed.

## **9.4. LIMITATIONS OF THE MODEL**

In the previous sections is explained how the model can be used by contracting authorities as a guideline to procure circular infrastructure. Also a reflection on the application of the model is provided. However, as became clear in the interviews and during the focus group, there are some limitations of the model that have to be taken into account. These will be discussed in the following sections.

### **9.4.1. PROCUREMENT PROCEDURE**

The scope of this research is limited to national or European open / restricted procedures and in section 9.1.4. the scope is even further narrowed down by concluding that the restricted procedure is most suitable to procure circular infrastructure. However, other procedures, like national procedures for small projects or procedures like the competitive dialogue are not considered, and therefore the model may not be completely applicable for these other procedures.

Through the interviews it became clear that currently mostly smaller circular projects are initiated with other procedures. Instead of the restricted procedure national procedures for small projects like “enkelvoudig-” or “meervoudig onderhands” are used (P3, P9, P17, P18, P19, P20). This probably excludes many projects that are suitable for applying this model. In order to make use of the model, larger circular projects have to be initiated by contracting authorities.

### **9.4.2. INNOVATIONS**

From the analysis between circular procurement and the BVA (chapter 6) was concluded that the innovation aspect of circular procurement may contradict with the BVA. This possibility is confirmed by the interviewees who state that innovations are hard to underpin by metrics: *“I don’t think that the BVA is a method for very innovative products, because you have to deal with the past performance. And I think that a lot of innovation is needed for circularity”* (P15).

The participants of the focus group did not agree with the statement that it is not possible to procure innovations with the BVA. They believe that there are several ways to provide

information about innovations, strict metrics are not required. The contractor has to prove or make it likely that he is able to successfully realize the proposed innovation. One of the interviewees underpins this: *“I believe we are going to look at what their potential is to apply innovations, so they have to prove that they have successfully introduced innovations in the past”* (P16). Other ways to prove innovations are according to the focus group:

- Teaming up with suppliers that already make use of the innovation.
- Gathering information about all separate parts of the innovation. If you can successfully apply the separate parts, it can be assumed that a (new) combination of these parts will also be successful.

Based on this input of the focus group it may seem possible to procure innovative solutions with the BVA. Furthermore, the teaming up with suppliers can be beneficial for the collaboration with the whole supply chain. However, this does not simply overrule the findings of the second interview round. It seems still hard to make it likely that an innovation will work: *“If it is really innovative, you cannot prove that it works”* (P13). Most of the interviewees who stated that procuring innovations through the BVA can be difficult also had experience with the BVA themselves. So, even between different BV-experts there is no consensus on this matter.

This discussion is considered as a limitation of the model in this research. When looking at the TRL’s (section 4.3.4.) innovations with a low TRL are not suitable to be procured with the BVA, but proven technology can be asked for directly (P16). It depends on the type and the level of the innovation if it can be procured with the BVA in the first place. For example, making use of secondary materials in a road does not require any innovations. The BVA is then very suitable to provide room for contractors to offer innovations, without asking for it directly. If something entirely new needs to be developed, the innovation partnership is maybe a more suitable procedure to apply instead of the BVA.

#### **9.4.3. SUPPLY CHAIN**

The last two limitations of the application of the model relate to the supply chain. First, contractors have to be ready to make a satisfying offer when the BVA is used. Furthermore, they have to be able to take the lead in the clarification and realisation phase.

#### *CIRCULAR METRICS*

In order to ensure fair competition, sufficient circular “experts” should be ready to make a satisfying offer when BV elements are used. In the case of a restricted procedure, at least five experts are needed. These “experts” have to be able to underpin their solutions with metrics. When looking at the model, in each case the value added criterion is recommended, which means that metrics are always a part of the offer. However, it is doubtful if the supply chain has been able to gather enough circular metrics yet. Many pilots and experimental projects are done, but not that many circular projects are already finished. Because of this there are probably not so many metrics available that relate to these projects. On the other hand, the participants of the focus group state that there are already tools that can help to make circularity more measurable, for example DuboCalc and a materials passport. However, the supply chain is still getting used to gathering performance information and measuring their practices.

It is a general opportunity to make circularity more measurable (section 7.4.). However, some of the interviewees (P1, P2, P7, P10, P13, P15, P17) believe that it is not entirely possible and desired to capture circularity only in measurable units. They also think more soft components should be taken into account like vision, motivation and collaboration, especially in the beginning of the transition. It is not just about measurable performances, but also about the motivation to work circularly. Since circular procurement is new, it can be better to make use of more qualitative information to underpin the vision and motivation of the supply chain. This

approach, however, does not fit with the thought behind BVA, because the BVA makes use of dominant information only (section 5.2.). Even though, this is mitigated with the selection on vision (section 9.1.4), this is a big limitation of the model.

#### *FORM OF COLLABORATION*

Besides that the supply chain should be able to make an offer, they should also be able to take the lead in the clarification and realisation phase if the contracting authority provides them with more design freedom (section 5.3.3). If contractors are able to take the lead, then a more open need formulation is possible, and the higher the success chances of the BVA. If not, more guidance and control of the contracting authority is necessary (P13, P14).

Currently, circular infrastructure is also new for contractors. According to the interviewees they have more knowledge and ideas about circularity than most contracting authorities, but still there are not that many circular “experts” present, yet. There are some contractors that stand out, but the majority is not experienced enough to be able to take the lead. The interviewees underpin that a more intensive form of collaboration is needed right now to increase the knowledge and experience of both the contracting authority and supply chain (section 6.1.1., appendix F). It seems that the majority of the supply chain is not mature enough to be provided with a lot of design freedom, which limits optimal application of the model.

### **9.5. PRACTICAL RECOMMENDATIONS**

Besides incorporating circular aspects as mentioned in section 9.1. and applying the model according to section 9.2., some other practical recommendations for Dutch contracting authorities are mentioned in the sections about the reflection on the model and the limitations. They are combined in this section to provide one clear overview about how contracting authorities can make optimally use of the model, and cope with the limitations.

#### **9.5.1. BE SELF-AWARE**

The most important recommendation for contracting authorities is that if they want to make optimal use of the model, they have to be self-aware. As mentioned in section 9.3.1. the model can help to provide insight in the level of control of the contracting authority and the type of project, and which BV elements comply with these conditions. It is important that organisations know what their attitude is and what type of procurement approach is suitable for them. They should be aware of the fact that steps may have to be taken for applying certain elements. In order to get the most satisfying outcome, contracting authorities should not strive for *the most* effective approach available. It is wiser to determine which approach suits the organisation best.

#### *CHECK IF PROJECT IS SUITABLE*

Being self-aware includes a check if the intended circular project is suitable to be procured with help of the model. Consider if the project is large enough and suitable to be procured with the restricted procedure (section 9.4.1.). If, for example, a national procedure for small projects or the competitive dialogue is preferred, the model should not be used. Moreover, contracting authorities should determine, based on their circular ambition, if innovative products should be developed or if the ambition can be reached without innovations. Products with a low TRL are not suitable to be procured with the BVA (section 9.4.2.).

#### **9.5.2. CHECK IF SUPPLY CHAIN IS READY**

It is also important to check if the supply chain is able to make a circular offer underpinned with metrics and if they are experienced enough to be provided with a lot of design freedom (section 9.4.3.). This can be done through, for example, a market consultation. If contractors are not able



to make an offer in metrics, the BV elements that have to be underpinned (value added, project capabilities) are not recommended to use. The other elements are still applicable. Furthermore, the supply chain should be stimulated to monitor and measure their processes in current projects. As a result, they will be able to underpin offers with metrics in the future.

### **9.5.3. COMMUNICATE**

When it is decided which procurement approach will be used, it is recommended to communicate about the circular ambition and the choice of BV elements, both internally and externally. Internal, the tender team should be motivated and trained to draft and assess circular tenders with the selected BV elements, and the use of metrics. External, it is very important for contracting authorities to explain to the supply chain which approach is used, what the circular ambition is, which BV elements are selected and how these elements are assessed (section 9.3.3.).

## **9.6. SUMMARY**

This chapter has provided an overview of how contracting authorities can make use of the model in order to procure circular infrastructure more effectively. First of all, it was found that besides using BV elements it is very important to define a circular ambition and need, otherwise no circular solutions will be offered by the supply chain. These aspects have to be taken into account in every case.

The division of the model in five zones enables a customized advice in different scenarios. This makes the model applicable for a great range of public authorities and projects. Besides the function of selecting the suitable BV elements, the model can also help contracting authorities to raise awareness about their own organisation and if steps need to be taken to use more BV elements. The aim is not to use as many BV elements as possible, but to determine which elements are suitable for the organisation and the intended circular project. Furthermore, it was found that unless all BV elements are used, the approach cannot longer be called the BVA.

However, there are some limitations that have to be taken into account when using the model. Circular procurement is still in an experimental phase. Small (pilot) projects are initiated by contracting authorities, but these projects are too small to be procured with the BVA. Furthermore, few circular infrastructure projects are finished, which makes it hard for contractors to gather metrics to underpin their offers. It is recommended for contracting authorities to be self-aware, and to communicate internally and externally which BV elements are selected for the circular procurement process. But, before the model is used, it is recommended to check if either the project is suitable, and if the supply chain is able to make an offer. If the supply chain is not able to underpin their offers with metrics, they should be stimulated to monitor their processes so that they can use metrics in the future.

The limitations result in few BV elements that can be of use for contracting authorities, if they can be applied at all. Right now it seems that the majority of the contracting authorities, contractors and projects are not ready to make optimal use of the model to procure and realize circular infrastructure more effectively.

Note: this is a generalized image, some contracting authorities and / or contractors are further in the transition, which enables more possibilities to make use of the model.

# Conclusion

Chapter 10 – Conclusion

Chapter 11 – Discussion and recommendations for further research



# 10 CONCLUSION

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The previous chapters have shown the application and limitations of a model that can be used as a guideline by contracting authorities to procure circular infrastructure more effectively. In this chapter the answer to the research question will be formulated: *In what way, if any, can the Best Value approach contribute to the effectiveness of public procurement in order to stimulate the transition towards a circular infrastructure sector in the Netherlands?*

In short, the BVA is a great approach for contracting authorities that want to find the expert contractor who can realize their circular ambition. Circular procurement requires an open procurement approach, which can be facilitated by the BVA. The BVA helps contracting authorities to provide room for contractors through project goals, functional specifications and awarding on quality. Furthermore, within the approach dominant information and metrics are used, which makes the assessment of offers objective and transparent. This is considered helpful to procure circularly more effectively and stimulate the transition towards a circular infrastructure sector. However, the approach seems to be introduced too early. Few circular infrastructure projects are realized, and therefore the majority of the contractors is not ready to make an offer based on metrics. Furthermore, circular solutions seem too innovative, and initiated projects are too small to be procured with the BVA. More and larger circular infrastructure projects should be realized and monitored in order to gather metrics for future projects. The benefits of the BVA cannot be exploited, yet.

## 10.1. EFFECTIVE PROCUREMENT OF CIRCULAR INFRASTRUCTURE

To understand in what way the BVA can contribute to the effectiveness of circular procurement in the Dutch infrastructure sector the current effectiveness is researched. Effective circular procurement is defined as procurement where the initial circular project ambitions and goals are met after the realization of the object of the contract. It was found that the initial circular ambitions are higher than the outcome. The infrastructure sector is considered to be a tough sector to become circular, because of the long life span projects, the traditional working practices and the fragmented supply chain.

It can be concluded that public procurement of circular infrastructure is still in its infancy. Contracting authorities have formulated circular policies and are experimenting on a small scale in pilot projects. However, the life cycle thinking is not always present within organisations. Furthermore, the actual execution of circular procurement is not often going so well. Contracting authorities seem to struggle with providing the supply chain with the right conditions to offer circular infrastructure solutions. They find it hard to formulate circular project ambitions and to assess offers based on functional specifications objectively. Looking at the procurement process itself, contracting authorities tend to be controlling. They have little faith in the supply chain and prefer to make use of many technical specifications and award largely on price instead of quality. Lastly, the circular ambitions are hardly monitored after the award of the contract. This all leads to poor realisation of the circular project ambitions.

## 10.2. CONTRIBUTIONS AND LIMITATIONS OF THE BVA

The BVA may be ideal for public authorities to let go of their controlling role and to provide room for the contractors to come up with circular solutions. However, making use of the BVA will not automatically lead to circular infrastructure solutions. First, public authorities have to prepare their internal organisation towards life cycle thinking, and circularity should become a

part of the project through circular project ambitions and specifications. Moreover, a restricted procedure should be used in order to preselect a contractor with a similar circular vision. Lastly, circularity should be monitored, safeguarded and evaluated after the contract award.

Considering the aforementioned finding, the BVA is split up in separate BV elements and it was found that the following elements have potential to contribute to the effectiveness of the current practice: KPI's, project goals, project capabilities, value added, functional specifications, large quality ratio, price ceiling, clarification phase, and weekly risk report. The contributing BV elements are captured in a model, which is shown below (figure 29). This model can be used by Dutch public authorities as a guideline to determine which BV elements can be used to procure circular infrastructure more effectively. It depends on the level of control of the contracting authority and the flexibility of the project environment when certain BV elements are applicable. Based on the intersection of both variables, the model shows which BV elements are recommended to use in the procurement process.

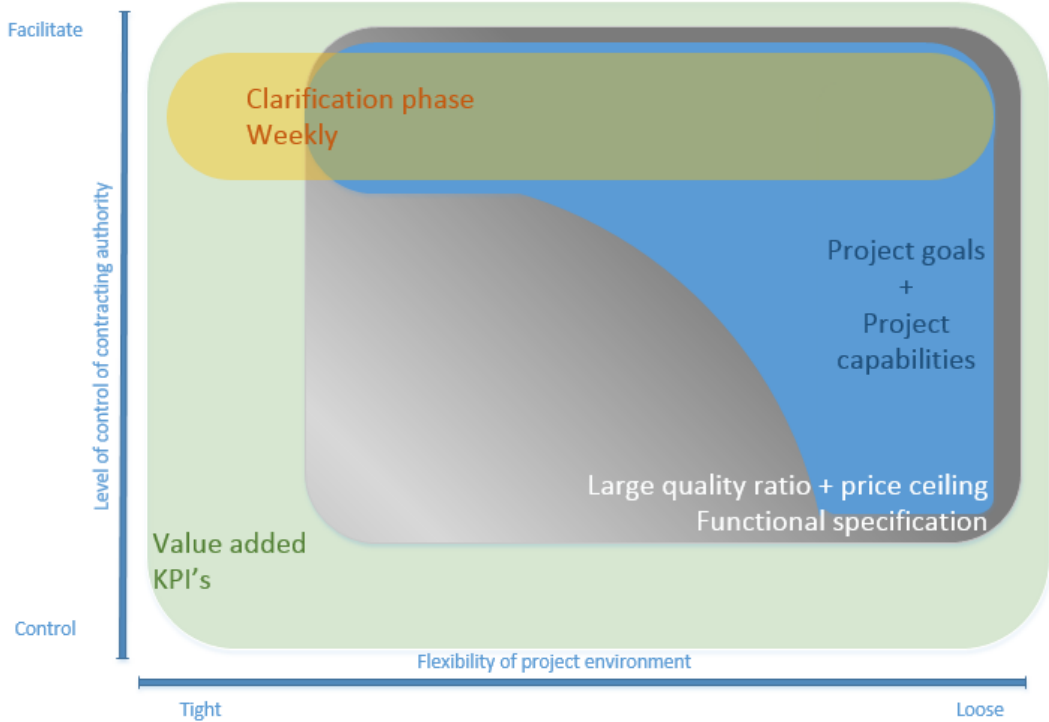


FIGURE 29: CONTRIBUTING BV ELEMENTS FOR EFFECTIVE CIRCULAR PROCUREMENT. OWN ILLUSTRATION

Moreover, the model helps to raise awareness within contracting authorities what their current attitude is, what kind of circular project they have in mind and if these conditions are suitable for making use of the BVA. If desired, steps can be taken to become more facilitating, or a different circular project should be considered. It can be assumed that each area in the model can be a contribution to the current practice. The more BV elements are used, the more effective the circular procurement process will be. However, the aim of the model is not to force contracting authorities to make use of as many BV elements as possible. If the internal organisation and intended project are not suitable for certain BV elements, they should not be used. Contracting authorities should not strive for *the most* effective approach available, but look at which approach suits the organisation and project best.

**10.2.1. GREAT POTENTIAL OF THE BVA TO PROCURE CIRCULAR INFRASTRUCTURE**

It can be concluded that the BVA has great potential to contribute to the current effectiveness of circular procurement and achieving the circular project ambitions. As can be seen in the

model (figure 29), many BV elements can be beneficial, only the risks criterion and interviews are not present. The BV elements aim to provide freedom for the supply chain to make use of their expertise and to offer satisfying circular solutions. This stimulates contracting authorities to take on a more facilitating attitude. The use of KPI's helps contracting authorities to formulate their circular ambitions, assess the offers objectively and monitor the project performance after the contract award. Furthermore, the value added criterion is a great opportunity for the supply chain to offer additional solutions that are not included in the project scope, but contribute to realizing the circular ambitions. Lastly, the clarification phase facilitates contact between the contracting authority and contractor, before the realisation of the project has started. This contributes to a positive and collaborative working spirit, which is essential within open, functional tenders.

The offers of the contractors have to be underpinned with metrics. Collecting these metrics stimulates contractors to get in touch early with the suppliers, which enhances collaboration within the whole supply chain. This is considered necessary for reaching circular infrastructure solutions.

#### **10.2.2. LIMITATIONS OF THE BVA TO PROCURE CIRCULAR INFRASTRUCTURE**

However, there are some limitations that have to be taken into account. Circular procurement still has an experimental status in the infrastructure sector. Small (pilot) projects are initiated by contracting authorities, but such pilots are most of the time procured with national procedures for small projects, and not suitable to be procured with the BVA. Furthermore, some contracting authorities are not experienced with the BVA or have a preference for other procurement approaches. This can be a disadvantage for the use of the model. There are also issues seen in the procurement of innovative circular solutions with the BVA. It is hard for contractors to underpin innovations with metrics, since innovative circular solutions are not proven yet. Moreover, few circular infrastructure projects are finished, which makes it hard for contractors to gather metrics to support their offers. These limitations result in few BV elements that can be of use for the majority of the contracting authorities, if they can be applied at all.

To conclude, the BVA is not the most suitable approach right now to procure circular infrastructure effectively. It can help contracting authorities to formulate an open circular need, but the supply chain is in most cases not able to make an offer underpinned with metrics. This research has provided insight in the potential of the BVA, and some elements, like KPI's, can already be of great use, but more circular infrastructure projects should be realized first in order to make optimal use of the potential of the BVA.

# 11 DISCUSSION & RECOMMENDATIONS FOR FURTHER RESEARCH

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This chapter the research will be discussed with a critical view. First the scientific and practical relevance of the research will be reflected on in section 11.1. Then the reliability and validity of the research will be discussed in section 11.2. Lastly, the limitations of the research are listed and related to some recommendations for further research in section 11.3.

## 11.1. RELEVANCE OF THE RESEARCH

The aim of this research was to fill the knowledge gap about the relationship between the BVA and public procurement of circular infrastructure projects in the Netherlands and to provide public authorities with a guideline on how to do this. Now that the research is finished, it can be reflected on how this research has contributed to the knowledge gap.

### 11.1.1. SCIENTIFIC

From a scientific point of view this research has made several contributions. In the theoretical part of this research, the BVA was placed within the Dutch procurement legislation. Even though there were some articles written on this (Van Duren & Dorée, 2008; Van Leeuwen, 2011) and the books of van de Rijt & Santema (2013) and van de Rijt et al. (2016) also explained the BVA in a legal context, it remained on an abstract level. Based on the broad explanation of the Dutch procurement process in chapter 3, it was attempted to place the BVA in a legal context. This contributes to the scientific value of the, more practically oriented, BVA.

Furthermore, this research contributes to the scientific context of procurement of circular infrastructure works. The theory on this is mainly based on reports drafted by public authorities, construction firms or knowledge platforms like Green Deal Circulair Inkopen which contains experiences and best practices. Furthermore, most reports focussed on other sectors like facility management (Green Deal Circulair Inkopen, 2016). This underpinned the need for an open, empirical research approach to analyse what the current practice in the infrastructure sector is. The outcomes of the empirical part, resulting in the definition of effective public procurement and the SWOT analysis contribute to the scientific understanding of procurement of circular infrastructure.

Lastly, this research has proved its scientific value by proposing the use of BV elements to procure circular infrastructure. Also by the end of the research no scientific literature describes this combination. This means that the knowledge gap between the two procurement approaches, despite the limited contribution of the BVA, is touched upon. Recommendations to further dive into this knowledge gap are provided in section 11.3.

### 11.1.2. PRACTICAL AND SOCIETAL

Besides the scientific relevance, this research also has a practical relevance. As mentioned in the introduction, the Province of Noord-Brabant is already experimenting with the BVA to procure circular infrastructure, but the project is still in the preparation phase. Furthermore, it was discovered through the interviews that Lelystad Airport was also procured with the BVA and the sustainable / circular ambition was definitely achieved. This underpins the opportunities of the BVA, and therefore this research can be a recommendation for other contracting authorities to also make use of this approach, if the conditions are right. As described in chapter 9, the

outcome of this research provides a part of a solution towards the transition to more circular solutions in infrastructure projects.

**11.2. RESEARCH RELIABILITY AND VALIDITY**

The results of the research are based on a methodological framework as presented in chapter 2. Now that the research is finished, the reliability and validity of the research should be reflected on. As can be seen below (figure 30), the reliability relates to the accuracy of the outcomes of the research and if it is replicable. The validity shows whether the outcomes relate to the objective of the research.

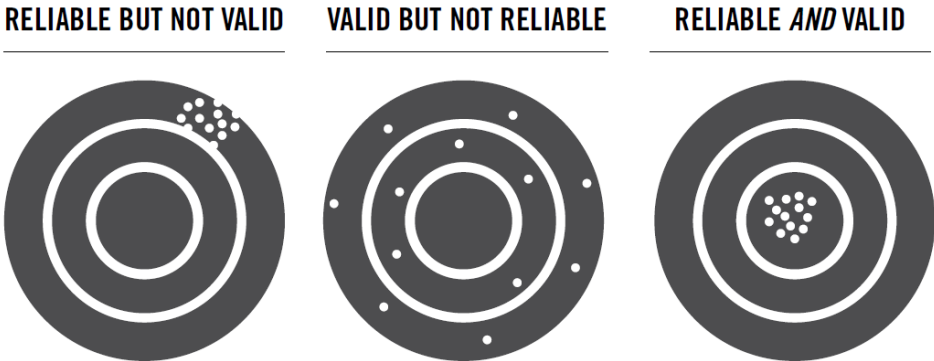


FIGURE 30: DIFFERENCE BETWEEN RELIABILITY AND VALIDITY. SOURCE: MENTIS (2017)

**11.2.1. RELIABILITY**

The reliability of the research relates to the extent to which the research is controllable and replicable (Lucassen & olde Hartman, 2006). In qualitative research the reliability can be limited, because of the more open approach and semi structured interviews. A different researcher could get different outcomes even if the same topics are used for the interviews. The reliability of this research is increased by recording and transcribing of the interviews. Also the coding process of the transcripts is described, which enables a different researcher to retrieve similar results. The planning, conduction and analysis of the interviews were thoroughly discussed with the graduation supervisors to improve the reliability of the process. Another measure to increase reliability was that the second round of interviews was structured by the seven circular procurement categories, together with the tender steps as presented in Chapter 3. This creates a more fixed approach in the semi structured interviews. According to Lucassen & olde Hartman (2006) the reliability of qualitative research is improved by a systematic approach for multiple interviews. Based on these measures that were taken to improve the reliability, the outcomes of the research are considered reliable and replicable. I believe that a different researcher would retrieve similar results.

**11.2.2. EXTERNAL VALIDITY**

The external validity relates to the extent to which this research can be generalised and applied in other situations (Lucassen & olde Hartman, 2006). According to them, this is harder within qualitative research, because the sample group is smaller and more selective. The external validity of the research is split up in two parts: the effective circular procurement and current practice, and the BV model.

*VALIDITY OF EFFECTIVE PUBLIC PROCUREMENT AND CURRENT PRACTICE*

This research focussed on public procurement in the Dutch infrastructure sector and the interviewees were also selected based on this. It was discovered that there is not much experience with circular infrastructure in the Netherlands, only a few projects were procured

and realized. It was therefore hard to find interviewees with all the required knowledge and/or experience. In order to come to a reasonable amount of interviewees, not every interviewees had experience in the infrastructure sector. Three of them were experienced in more mature sectors like facility management. This resulted in a small sample group of 20 interviewees, with partly the required expertise. Even though the amount of interviewees is not always related to the validity of the research, in this case more interviews could have been held to get the most complete image. After 20 interviews still new topics came up, which indicates that this research topic is very broad and there is no clear idea what is the most effective. This limits the generalizability of the results of this part of the research for the infrastructure sector.

#### *VALIDITY OF BV MODEL*

The selection of interviewees of the in-depth interviews also influenced the validity of the BV model. Not all of the interviewees had experience with the BVA, which resulted in limited input for the conceptual model. Furthermore, the focus group consisted of only three BVA experts. More participants, with other expertise, could have led to a more generalised outcome. It is therefore very hard to generalize the outcomes of this research for contracting authorities in the Dutch infrastructure sector.

#### **11.2.3. INTERNAL VALIDITY**

The internal validity relates to the selected research methods and how they help to answer the research question (Lucassen & olde Hartman, 2006). Does this report contain the research that was intended to be researched? An important aspect of internal validity is the attitude of the researcher and the objective analysis of the data. This research is qualitative of nature, which can introduce some subjectivity during the interviews and focus group. In order to reduce the amount of subjectivity the interviews were recorded and transcribed entirely. This prevents that the researcher can make her own (subjective) notes about what she thinks is important. The transcripts were send back to the interviewees for an extra check on the correctness of the answers. Also the second round of interviews was used to validate the definition of effective circular procurement and the outcomes of the SWOT analysis. Lastly, the planning, conduction and analysis of the interviews were thoroughly discussed with the graduation supervisors to reduce the subjectivity of the researcher.

Furthermore, an additional focus group was held to improve the internal validity of the research. It was found that both concepts, circular procurement and the BVA, are subjective and it depends on the experiences of the interviewee if they are positive or negative about the approaches. For the focus group experts on both concepts were asked to reflect on the proposed model. However, experts on the circular procurement field were missing on that day, which makes this research less valid than intended. Even though two of the BVA experts had experience with sustainable and innovative procurement, they were mainly experts in the field of BVA. In order to complement the findings of the focus group with circular procurement expertise, one expert provided his comments separately. However, this occurrence results in the fact that the final model presented in this research may not completely valid. The internal validity would have been increased if they were able to discuss it with each other.



### **11.3. LIMITATIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH**

In order to complete the research within the given amount of time, not all aspects of the topic could be taken into account and concessions had to be made. The research was scoped down to create focus and draft precise conclusions. This initiated some limitations that have to be mentioned. Based on these limitations some recommendations for further research can be made.

#### **11.3.1. INFRASTRUCTURE SECTOR**

The scope of the research was narrowed down by focussing on the Dutch infrastructure sector. As became clear through the first round of interviews, the infrastructure is considered a tough sector to make circular, because of the long life span of the projects, the traditional working practices and fragmented supply chain. Most of the contracting authorities have the ambition to start procuring circular infrastructure, but not that many projects were finished when this research was conducted. Perhaps after a couple of years, the practice of circular procurement is more common and more organisations have conducted projects. This results in more and more experienced interviewees and the ability to conduct case studies. Then it can be researched if the BVA as a whole is of added value. This leads to the first two recommendations for further research:

- 1. Conduct a similar research 3-5 years from now, when circular procurement in the infrastructure sector is more common, with a larger and more experienced sample group.*

Furthermore, circularity can be applied in many other sectors, and some sectors like furniture or carpeting are a lot further in the transition. Even though the products are different, the public procurement process is similar for each sector and lessons can be learned cross-sectoral. The outcomes of this research may already be applicable in those sectors. This leads to the second recommendation for further research:

- 2. Look at the application of the model in other sectors, for example the building industry, carpeting or facility management.*

#### **11.3.2. RESEARCH APPROACH**

In chapter 2 the intervention cycle is mentioned for a practice-oriented research. This research only focussed on the diagnosis and design step, and the cycle was not completed. This is a limitation, because the design is not implemented and evaluated. There were not that many projects finished yet, so it was not possible to evaluate specific cases. Therefore, the outcomes of this research are only on a conceptual level. It is not proven yet if they work. In order to evaluate the model, it should be implemented by a contracting authority, if this is possible in the future. This leads to the third recommendation for further research:

- 3. Close the intervention cycle. This research remains on a conceptual level, the next step is to implement and evaluate the model.*

#### **11.3.3. CONTRACTING AUTHORITIES**

This research focussed on the perspective of the public authorities and how they perceived how they should procure circular infrastructure. Even though two contractors were interviewed, this amount is not representative. The point of view of the supply chain is also important in procurement. Switching to their perspective can lead to new insights about how they would prefer contracting authorities to draft circular tenders. This leads to the fourth recommendation for further research:

- 4. Switch the perspective on circular procurement from contracting authorities to the supply chain.*

#### 11.3.4. THE BVA

The focus of the research was to find out if the BVA could contribute to the effectiveness of circular procurement, not to create the most effective circular procurement process. This resulted in the fact that many not BV related elements are slightly considered in the research. In the analysis of effective circular procurement, many aspects are found, but not all of them could be connected to the BVA. This leads to the fifth recommendation for further research:

5. *Look at the other factors in the analysis of effective circular procurement that could not be influenced by the BVA. For example:*
  - *How can circular infrastructure become financially attractive?*
  - *How can circular materials comply with regulations or certifications?*
  - *The application of life cycle costs or integrated contracts in infrastructure projects.*
  - *The use of DuboCalc and the effects on circular solutions.*

Because there are so many different aspects mentioned by the interviewees, it can be assumed that there is not one proven approach for effective procurement of circular infrastructure. With respect to this research, only the open and restricted procurement procedures are highlighted. However, also other procedures like the competitive dialogue and the innovation partnership can be suitable to procure circular infrastructure. Furthermore, Early Contractor Involvement (Dutch: bouwteam) and Rapid Circular Contracting are mentioned as forms of collaboration to intensify the contact between contracting authority and contractor in order to design circular solutions together. This leads to the sixth, and final recommendation for further research:

6. *Look at (and compare) other procedures / approaches to procure circular infrastructure. For example Early Contractor Involvement (Dutch: bouwteam) or Rapid Circular Contracting.*

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The images used on the front page and at the beginning of each research phase are retrieved from: <https://unsplash.com>



# Appendices

Appendix A – Circular infrastructure

Appendix B – List of interviewees

Appendix C – Interview questions round 1

Appendix D – Interview questions round 2

Appendix E – Data structure chapter 7

Appendix F – Effective circular procurement

Appendix G – Current practice

Appendix H – Data structure chapter 8

# APPENDIX A – CIRCULAR INFRASTRUCTURE

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As mentioned in the introduction the construction industry is one of the most polluting industries in the Netherlands and therefore a lot of progress can be made towards a more sustainable world. Another reason that illustrates the need for more circular infrastructure is the excessive use of materials like concrete, steel and asphalt, CO<sub>2</sub> emissions through cement production, and harmful substances like tar in asphalt (Arcadis, 2010). Materials like steel and concrete are already being recycled, but these materials are of low quality and still a lot of progress can be made.

The aim of this research is to make a contribution to the transition towards a circular infrastructure sector. This appendix contains an extensive description of what is meant with circular infrastructure.

## CIRCULAR ECONOMY APPLIED TO INFRASTRUCTURE

Circular building is used to define a construction that is designed, planned, built, operated, maintained, and deconstructed in a manner consistent with CE principles (Pomponi & Moncaster, 2017). As mentioned in the introduction, this means that infrastructure should be realized *“in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops.”* (Geissdoerfer et al., 2017). So the materials and processes during the whole life cycle of the infrastructure should be considered in order to achieve this.

An important note is that public authorities do not want a circular infrastructure in itself, they want a road that complies with a certain (circular) performance (Castelein, 2018). The infrastructure still has to perform its main function: provide a connection from A to B. It has to facilitate a capacity for a certain amount of cars and it still has to be accessible and safe to use. The main function of the infrastructure always has to be safeguarded.

According to the approach of Duurzaam GWW circular infrastructure should entail sustainable use and production of materials.

1. Sustainable use of materials (Duurzaam GWW, n.d.): renewable and generally available raw materials should be used as much as possible. Raw materials are optimally used and reused, without any risks for health and the environment. Primary raw materials are, if needed, sparingly used and retrieved in a sustainable way. This includes:
  - a. Closing material loops, use of reusable and recycled materials
  - b. Minimize material use
  - c. Minimize environmental impact and harmful emissions
  - d. Maintainability and durability of materials
2. Sustainable production of materials and construction (Duurzaam GWW, n.d.)
  - a. Minimize CO<sub>2</sub> emissions during production process and transport of materials
  - b. Use of local materials

There are two frameworks that can be used to define CE in the infrastructure sector. The first one is the 9R Framework and the second one is the Value Hill. Both are explained below.

## 9R FRAMEWORK

The definition of circular infrastructure as mentioned above is still on an abstract level. It is not clear yet how resource input, waste and energy use are minimised. According to the same

authors circular infrastructure “can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling” (Geissdoerfer et al., 2017).

So there are several levels on which materials can be reused. Multiple researches are conducted on the levels of reuse, starting from the Waste Hierarchy of Lansink in 1979 which consisted of 6 levels. However, this hierarchy includes also the option of disposal, which is not applicable in the context of a CE. The most recent categorization is developed by Kirchherr, Reike, & Hekkert (2017) and consists of 9 levels, without disposal. This is called the 9R framework and the several levels are explained below (table 11)

TABLE 11: 9R FRAMEWORK. SOURCE: KIRCHHERR, REIKE, & HEKKERT (2017)

Smarter product use and manufacture	R0 Refuse	Make product redundant by abandoning its function or by offering the same function with a radically different product
	R1 Rethink	Make product use more intensive (e.g. by sharing product)
	R2 Reduce	Increase efficiency in product manufacture or use by consuming fewer natural resources and materials
Extend lifespan of product and its parts	R3 Reuse	Reuse by other consumer of discarded product which is still in good condition and fulfils its original function
	R4 Repair	Repair and maintenance of defective product so it can be used with its original function
	R5 Refurbish	Restore an old product and bring it up to date
	R6 Remanufacture	Use parts of discarded product in a new product with the same function
	R7 Repurpose	Use discarded product or its parts in a new product with a different function
Useful application of materials	R8 Recycle	Process materials to obtain the same (high grade) or lower (low grade) quality
	R9 Recover	Incineration of material with energy recovery

So for each material that is used in an infrastructure project can be determined to what extent it can be reused. The higher the level the better.

**THE VALUE HILL**

Besides focusing on the technical aspects of circular infrastructure, other aspects have to be taken into account as well. Materials can be reused on a higher level in the 9R framework if their value is maintained over the project life time. This requires certain decisions in the design phase of the project. The principle of how value is added to materials before use, how this value is maintained during use, and how this value is retained after use, is captured in the Value Hill (figure 22).

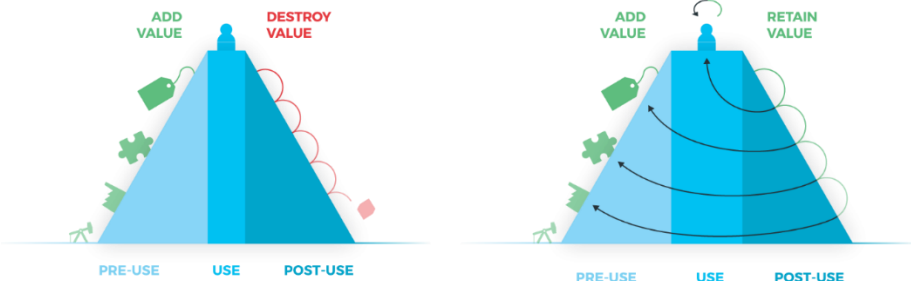


FIGURE 31: VALUE HILL. SOURCE: CIRCLE ECONOMY (2016)

Retaining value is done by slowing, closing and narrowing material loops, depending on the reuse level (9R model). This is an important aspect for circular infrastructure projects in order to reduce the use of new materials and to eliminate demolition waste. Practically seen this can



be achieved by optimizing the material flows between similar projects. The Duurzaam GWW approach, 9R model and Value Hill are combined in one figure (figure 23). The optimizing of material flows can be done in several ways:

1. Plan and design (pre-use): make use of materials that are already “in the loop”, either from the infrastructure that is already there or from other projects.
2. Operation and maintenance (use): extend the life span of the infrastructure by making use of more durable materials. Optimize the maintenance strategy to maintain the value of materials.
3. Demolition (post-use): make sure that at the end of the life the construction can be decomposed and materials can be reused either in the next project or in other projects. It can be determined with help from the 9R model which materials can be reused to which extent.

In the ideal situation, in CE, no materials are disposed and no raw materials are used. However, right now it is not possible to reuse every material from the infrastructure that is already there, because it was simply not designed for reuse. Therefore, as many materials as possible should be taken from the current infrastructure and some new raw materials will be added. The aim is to design the new infrastructure in such way that all materials are reusable and no new materials are needed in future projects.

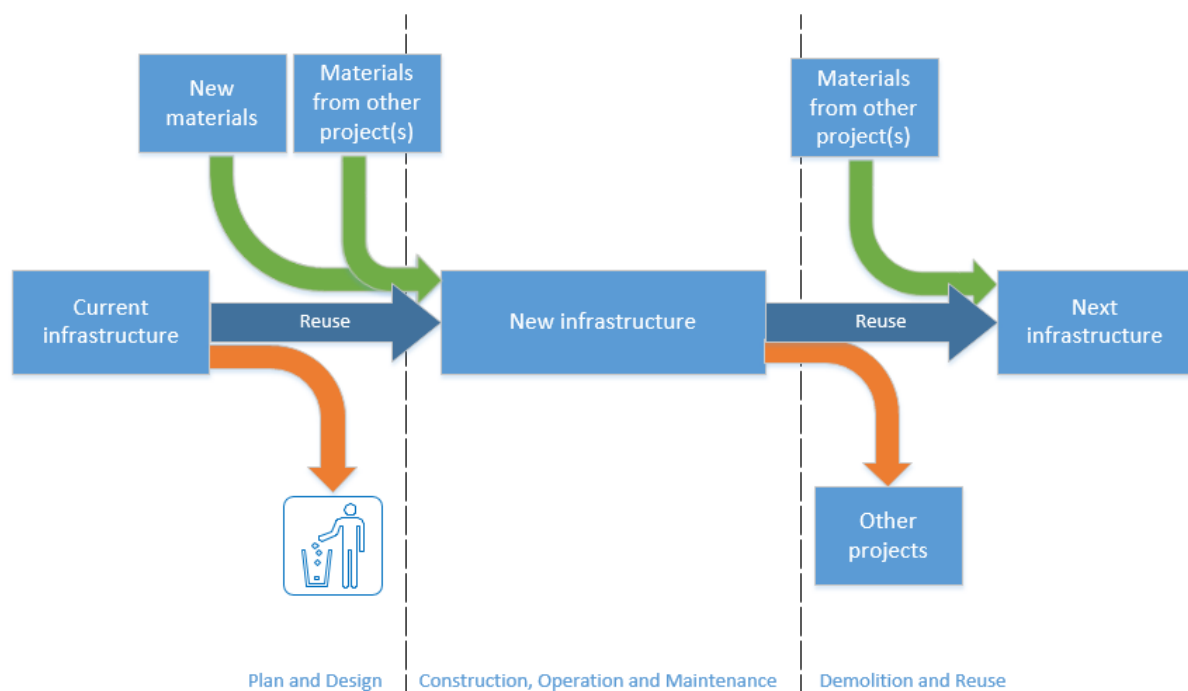


FIGURE 32: MATERIAL FLOW THROUGH MULTIPLE PROJECTS. OWN ILLUSTRATION

To summarize: circular use of materials, circular design and safeguarding circularity in the future are important aspects of the technical part of circular infrastructure (Loppies, 2015). Especially safeguarding circularity in the future is important, but most focus is put now on using materials from already existing projects. This is linked to other aspects of implementing CE in infrastructure projects. This will be explained in the next section.

## OTHER ASPECTS OF CIRCULAR INFRASTRUCTURE

Not only the choice of materials, and optimal material flows determine if infrastructure is circular. As mentioned before the collaboration between the contracting authority and supply chain is also important in order to realize and safeguard circular infrastructure. In the

Netherlands the main public authorities for infrastructure projects are the State, provinces, municipalities, water boards, or other bodies governed by public law like Rijkswaterstaat, ProRail and Schiphol. The supply chain consists of engineering firms, contractors and suppliers. These parties will be focused on in this research.

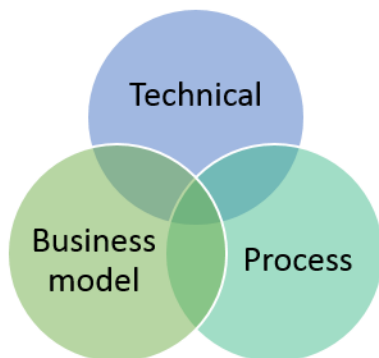


FIGURE 33: ASPECTS OF CIRCULARITY. SOURCE: GREEN DEAL CIRCULAIR INKOPEN (2016)

Besides the technical aspect of circular infrastructure the Green Deal Circulair Inkopen distinguishes two other aspects for circularity: process, and business model (figure 24) (Green Deal Circulair Inkopen, 2016). The combination of the three aspects enlarge the chances of a successful circular project. The technical aspect is already discussed and now the other two aspects will be elaborated on below.

### PROCESS ASPECTS

The process relates to the several phases in the life cycle of an infrastructure project and how throughout these phases circularity can be safeguarded. According to Van Oppen (2017) the process aspect means that collaboration between public authority, contractor and all other supply chain partners needs to be stimulated in order to lay a foundation for CE. This is underpinned by multiple sources who state that collaboration is needed throughout the whole supply chain to make circular solutions possible (Adetunji et al., 2008; Nelissen et al., 2018; Padding et al., 2015; Pomponi & Moncaster, 2017).

In order to safeguard circularity at the end-of-life, agreements have to be made in the first phases. Examples of such agreements can be circular maintenance contracts with the supply chain or agreements that safeguard the reverse logistics of materials (Green Deal Circulair Inkopen, 2016). This should eliminate the risk that a perfectly circular work is still demolished at the end-of-life.

### BUSINESS MODEL ASPECTS

New business models can function as an incentive towards the supply chain in order to safeguard circularity (Van Oppen, 2017). This is connected to a new way of financing projects. The aim is to safeguard the residual value of the project on the long term, because after the end-of-life the materials can still have a certain value. This is crucial because then profitable business cases can be formulated, which is essential to make the transition towards a CE. If circularity is still more costly over the whole life cycle than a traditional approach, this transition will not be made easily (Van Haagen, 2018). Another reason that circularity is not widely adopted yet in the construction industry is because of the “*absence of incentives to design products and buildings for disassembly and reuse at their end of life*” (Adams, Osmani, Thorpe, & Thornback, 2017). According to them, a greater implementation of CE throughout the supply chain is encouraged by a clear economic case.

An example of a new business model is that products can be offered as a service, leased or repurchased after use (Green Deal Circulair Inkopen, 2016; MVO Nederland, 2018b). This may stimulate the reverse logistics of materials in the supply chain. However the question arises then who will be the owner of the materials and how exactly circularity is stimulated? Until now there is not a clear answer yet to what can be a good business model for infrastructure projects. Therefore, this aspect will not be incorporated in this research in detail besides the fact that the procurement process should provide room for development of other business and financial models (Padding et al., 2015).

## **SUMMARY**

Because of the amount of materials and waste involved in the infrastructure sector the need for more circular solutions becomes evident. In this chapter was found that realizing these solutions is dependent on three different aspects: technical, process and business model.

Circular infrastructure is infrastructure *“in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops.”* (Geissdoerfer et al., 2017). Material flows should be optimized in order to keep them in the loop. This entails the sustainable (re)use and production of materials, extending the life span, the high quality reuse (9R's) of materials at the end of life.

## APPENDIX B – LIST OF INTERVIEWEES

### EXPLORATIVE INTERVIEWS

TABLE 12: INTERVIEWEES EXPLORATIVE

ID	Organisation	Profession	Project
P1	Copper8	Consultant circular procurement	Alliander Duiven
P2	Phi Factory	Consultant circular economy	Verkeersleidingspost Barendrecht
P3	NTP Groep	Director	Circulair fietspad Zevenaar
P4	Antea Group	Consultant circular procurement	Gebiedsontwikkeling Oostelijke Langstraat
P5	Rijkswaterstaat	Strategic advisor circular procurement	-
P7	Province of Overijssel	Advisor circular economy	De Parken Apeldoorn
P8	Rijkswaterstaat	Advisor circular economy Contract manager	InnovA58 Noord-Brabant
P9	Municipality of Utrecht	Tactical procurer of works	Croeselaan Utrecht
P10	K plus V	Consultant circular economy	De Parken Apeldoorn
P11	Delta Development Group	System thinker	Park 20 20
P12	Roelofs Groep	Project leader circular economy	De Parken Apeldoorn

### IN-DEPTH INTERVIEWS

TABLE 13: INTERVIEWEES IN-DEPTH

ID	Organisation	Profession	Project
P13	Rijkswaterstaat	Contract manager	-
P14	Schiphol	Procurement and contract manager	Lelystad Airport
P15	ProRail	Tender manager	Verkeersleidingspost Barendrecht
P16	Province of Noord-Brabant	Procurement advisor	Gebiedsontwikkeling Oostelijke Langstraat
P17	Municipality of Rotterdam	Strategic advisor circular economy	-
P18	Municipality of The Hague	Strategic advisor circular economy	-
P19	Municipality of Amsterdam	Procurement advisor	-
P20	Procurement bureau of Middle Netherlands	Procurement manager	-
P21	Twinkel	Independent procurer	-

## APPENDIX C – INTERVIEW QUESTIONS ROUND 1

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### *Algemeen/Introductie*

1. Kan je je kort even voorstellen? Wat is je functie? Hoe ben je bij [organisatie] gekomen?
2. Dit interview zal in het teken staan van circulair inkopen door publieke opdrachtgevers (in de infrasector). Kan je iets vertellen over jouw ervaringen met (aspecten van) circulair inkopen? Heb je een of meerdere voorbeelden, bijvoorbeeld een project?

### *Inhoudelijk*

3. Wat is de aanleiding geweest om (dit project) circulair in te kopen?
4. Hoe zag het aanbestedingstraject voor het project eruit?
  - a. Wat voor procedure? Met/zonder voorselectie?
  - b. Wat voor contract/samenwerkingsvorm?
  - c. Op basis van welke criteria zijn aanbieders geselecteerd en is de aanbesteding gegund (en wat was de prijs/kwaliteit verhouding)?
  - d. Waarom deze?
  - e. Wat zou je weer op deze manier doen? En wat zou je anders aanpakken?
5. In hoeverre is de markt betrokken geweest bij het formuleren van de aanbesteding?
6. Is het inkooptraject (niet) succesvol ervaren? En waarom precies? Welke dingen gingen soepel en zaten er ook nog moeilijkheden in het traject? Kan je hier iets meer over vertellen?
7. Was het project uiteindelijk gerealiseerd naar verwachting? Hoe kwam dat?

### *Algemeen*

Om het circulaire inkoopproces in kaart te brengen heb ik al de nodige literatuur en documentatie gelezen en ik zou graag een aantal bevindingen willen bespreken.

8. Er wordt veel genoemd dat er veel expertise in de markt zit en dat deze meer vrijheid moet krijgen om met circulaire oplossingen te komen. Ben je het hiermee eens? Krijgt dit ook binnen [organisatie] vorm tijdens de aanbesteding? Waarom (niet)?
9. Er wordt veel genoemd dat aanbestedende diensten het niet aandurven om circulair aan te besteden en veelal de oplossing gedetailleerd in technische specificaties vastleggen. Is dit herkenbaar? En waarom wordt dit (niet) zo gedaan?
10. Hierop voortbordurend, er wordt gezegd dat functionele uitvragen geschikt zijn voor circulair inkopen. Hoe ga je hier als opdrachtgever mee om?

Aanvullend op voorgaande bevindingen, losstaand van het project:

11. Je ziet steeds meer circulaire projecten, waaronder circulair kantoormeubilair en gebouwen, maar nog niet zoveel infrastructuur. Waardoor zou dat kunnen komen?
12. Wat zijn voor [organisatie] momenteel de belangrijkste knelpunten met circulair inkopen? Waarom denk je dat? En hoe zou je die kunnen oplossen?
13. Zijn er ook bepaalde succesfactoren aan te wijzen? Of kansen die benut kunnen worden?
14. Wat zijn de belangrijkste risico's die gepaard gaan met circulair inkopen?

15. Wordt nu gewaarborgd dat aan het einde van de levensduur het product weer terug in de materialenketen komt en niet alsnog gesloopt wordt? Is het wenselijk om dit vanuit de uitvraag al beïnvloeden? Waarom (niet)? En hoe zou je dat dan kunnen doen?

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***Overig/afsluitend***

16. Hoe denk je dat circulair inkopen er over 3 tot 5 jaar uit ziet?  
17. Denk je dat er tegen die tijd ook meer circulaire infrastructuur is?

## APPENDIX D – INTERVIEW QUESTIONS ROUND 2

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### *Algemeen/Introductie*

1. Kan je je kort even voorstellen?
2. In hoeverre werk je met circulair aanbesteden / best value vanuit je functie?
3. Wat versta jij onder circulair inkopen?
4. Wat zie jij als een effectieve circulaire aanbesteding? (Onder effectief aanbesteden versta ik dat ambities die aan de voorkant geformuleerd zijn, ook aan de achterkant gerealiseerd zijn. Zie jij dit ook zo?)

---

### *Thema's*

Redeneer vanuit eigen werkpraktijken:

1. Motivatie om te beginnen  
Werknemers en organisaties hebben een bepaalde motivatie nodig om te beginnen met circulair inkopen. Dit kan financieel van aard zijn (circulair goedkoper dan traditioneel) of persoonlijk (huidige werkprocessen willen doorbreken).
2. Circulaire ambities  
Sommige organisaties hebben ambities geformuleerd op het gebied van circulair inkopen. Zowel algemeen, als project specifiek.
3. Ruimte voor aannemer  
Circulair aanbesteden vraagt om expertise van de markt en dat die optimaal benut wordt. Markt kan met innovaties komen en moeten hiervoor de ruimte krijgen.
4. Levenscyclus benadering  
Op verschillende manieren kan de waarde van materialen behouden worden over de hele levenscyclus van het project.
5. Ervaring & kennis  
Over circulaire economie, maar ook aanbesteden. Er worden er ook steeds meer pilots gestart.
6. Ketensamenwerking  
Samenwerken wordt als één van de belangrijkste punten gezien en met name het meenemen van de hele keten, dus ook de leveranciers.
7. Meetbaarheid  
Een van de meest genoemde kansen voor circulair inkopen is meetbaarheid, dus het opslaan en monitoren van informatie over materialen en het meten van de impact van oplossingen.

Per thema vragen:

Vind u dat (onderdelen van) dit thema belangrijk zijn voor het bereiken van circulaire oplossingen? Welke dan? En waarom? Op wat voor manieren denkt u dat dit (niet) bijdraagt aan circulaire oplossingen?

Op wat voor manier zouden onderdelen kunnen bijdragen aan effectief aanbesteden?

Waar en hoe zou dit terug kunnen komen in het aanbestedingsproces? En waarom?

Denkt u dat (elementen van) best value hieraan bij kunnen dragen? Bijvoorbeeld:

1. Abstracte projectdoelstellingen

2. Gunningscriteria (projectbekwaamheid, risicodossier, kansendossier, interviews)  
Groot aandeel kwaliteit
3. Op “concept” gunnen en dan later uitwerken → Concretiseringsfase
4. **Meetbare prestatie informatie**
5. **Aannemer is de expert**
6. **Beheersing tijd, kosten, KPIs door weekly risk report en transparantie**

Waarom wel/niet?

Zelf zat ik te denken dat vanuit één van bovenstaande elementen het ook zo en zo kan, dit noemt u niet, maar hoe denkt u daarover?

Onder wat voor voorwaarden zou dit wel/niet kunnen bijdragen?

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### *Afsluitend*

1. Samen het model samenvattend doorlopen
2. Zijn er thema's/onderdelen die niet besproken zijn, maar die wel zouden kunnen bijdragen aan meer circulaire oplossingen?



# APPENDIX E – DATA STRUCTURE CHAPTER 7

## AXIAL CODES AND THEIR FAMILIES

The following table will provide an overview of the coding structure that was established for the analysis of effective circular procurement and the SWOT analysis (table 14).

TABLE 14: CODING STRUCTURE

Family	Codes
Need formulation	Ambition Question
Specification	Functional Combination External requirements Optimization
Orientation	Market consultation Other
Procedure	Several types Contact
Contract	Integrated contract
Criteria	Award examples Award on quality LCC Price ceiling Selection on vision Selection on collaboration No guarantee circular outcome
Assessment	Concept Consistent
After tender	Example project Safeguard circularity
Behaviour of contracting authority now	Applying circularity Culture Enthusiastic procurer Lack of experience Maintenance service No action No incentive No internal support Separation of budgets
Behaviour of contracting authority required	Change culture Individual motivation Start
Finances	Circularity cheaper Price of resources
Collaboration	Collaboration Bouwteam Early Combination of expertise Team
Infrastructure sector	Materials Long life time Slow processes Supply chain

Experiment	Pilot Upscale
Knowledge	Awareness Contracting authority Supply chain Internal knowledge development External knowledge share Expertise
Laws & regulations	Level playing field Public procurement Regulations Transition-agenda
Measurability	Asset management Circularity Materials passport Information system LCA+ECI Monitor
Trade-off	Costs + CE Planning + CE Quality of secondary materials Regulations + CE
Transparency	Assessment Execution

The quotations that are linked to the right column were used to create a data structure to base the factors for effective circular procurement and the current practice on.

## DATA STRUCTURE

The following data structure is created with help of the article of Gioia, Corley, & Hamilton (2013). First the 1<sup>st</sup> order concepts were retrieved from the quotations, highlighted in the interview transcripts and summarized in one sentence. Then these concepts were clustered, based on commonalities to come to 2<sup>nd</sup> order themes that are used to make the categories. Then these themes are transferred to aggregate dimensions that contribute to answering the research questions (table 15).

The data structure was created initially for the first round of interviews. Then after the second round some elements were deleted and some new elements were added, resulting in the data structure as presented below. The 2<sup>nd</sup> order themes and aggregate dimensions stayed the same after the first round.

TABLE 15: DATA STRUCTURE

1 <sup>st</sup> Order Concepts	2 <sup>nd</sup> Order Themes	Aggregate Dimensions
There should be an inherent, personal motivation to start with circular procurement	<b>Contracting authorities have to be motivated to procure circularly</b>	Role of contracting authorities
Long term commitment should be created		
Circularity can be implemented in organisational policy		
Enthusiastic individuals have to pull circular infrastructure projects		

Political influence and national policies can stimulate incorporating circularity in organisations		
Knowledge and experience about CE and procurement have to be gained	<b>Contracting authorities have to gain experience and knowledge to procure circularly</b>	
Evaluate the project and procurement processes		
Organisations are experimenting with circularity in pilot projects		
Knowledge can be shared between organisations through, for example platforms like Green Deal Circulair Inkopen		
Supply chain has expertise in field of CE		
The supply chain is fragmented in the Netherlands	<b>Contracting authorities have to be open to collaboration with whole supply chain</b>	
Contact with contractors during the tender		
Formulate SMART circular project ambitions that are in line with your budget and planning		
Start small with circular procurement and implement CE aspects stepwise. Maybe even start outside your core business.	<b>Initiate an infrastructure project with circular ambitions</b>	Aspects of circular procurement
Make use of LCC as an awarding criterion		
Conduct a LCA	<b>Make use of Life Cycle aspects in procurement</b>	
Formulate an open need. Do not already limit the amount of circular solutions by your own need		
Specify functionally (wherever possible) and be able to assess this	<b>Provide room for contractor to make a distinguishable circular offer</b>	
Formulate selection criteria on vision/collaboration		
Formulate (sub)award criteria in line with the circular project ambitions		
Apply a large quality ratio in BPQR		
Make use of a price ceiling		
Infrastructure projects have a long life span		Aspects of infrastructure projects
Infrastructure contains mostly low value materials like concrete and asphalt		
Infrastructure projects are bound to strict safety rules and other regulations		
Traditional working practices dominate in infrastructure projects	Aspects of processes in infrastructure projects	
Processes in infrastructure projects are generally slow		
There are many different stakeholders involved in infrastructure projects		
Make agreements about the use phase, maintenance and the end of life of the project	Process aspects of CE	Aspects of circular economy
Monitor the projects and circular ambitions		
Make use of an integrated contract (including maintenance)		

Materials can have a residual value at the end of life	Financial aspects of CE	
Circular practices should be cheaper than linear practices		
Online databases can be used for gathering and management of information about materials	Measurability of CE	
New tools can make circularity in infrastructure projects measurable		

The data structure is used to create the categories for effective circular procurement and the SWOT analysis. All aggregate dimensions contribute to answering the questions:

*What is effective circular procurement? & What are the strengths and weaknesses of the current circular procurement practice in the Netherlands?*

The seven categories are highlighted in the middle column, 2<sup>nd</sup> order themes. They are:

1. Financial and personal incentive
2. Circular ambitions
3. Experience & knowledge
4. Life cycle approach
5. Room for expertise of contractor
6. Measurability
7. Collaboration with supply chain

The themes that are not highlighted are used to fine tune the factors presented under each category. For example the “financial aspects of CE” and “aspects of infrastructure projects” used to get the factor for effective circular procurement “*formulate an economically feasible business case for circular infrastructure solutions*” (first item table 16).

The data structure is used in two ways. The found 1<sup>st</sup> order concepts either relate to the definition of effective public procurement or the current practice of circular procurement. Some concepts are formulated with “should”, this indicates that this should be in place for effective public procurement. On the other hand it can mean, that this is not the case right now, and therefore a weakness of the current practice. For each quotation the context is analysed to determine what type of factor it is. The relation between effective circular procurement and the current practice can be seen in the following table (table 16).

TABLE 16: COMBINATION EFFECTIVE - SWOT

Effective	Current
Formulate an economically feasible business case for circular infrastructure solutions	It is hard to formulate a business case and create long term commitment for projects with a long life time
	Rising prices of raw materials can make circularity more financially attractive
	The financial and personal incentive to initiate a circular infrastructure project is low
Personnel should have an inherent, personal motivation to start with circular procurement	It is hard to change current, traditional working practices
	Risk-averse mind-set prevents starting
You need enthusiastic individuals to pull circular infrastructure projects	Enthusiastic employee wants to initiate circular infrastructure project

	There is no link between the organisational ambitions and executing personnel
Formulate SMART circular project ambitions that are in line with your budget and planning	It is hard to formulate circular project ambitions Budget and planning limit circular ambitions
Formulate an organisational circular policy	Management has formulated organisational circular ambitions Political influence and national policies can stimulate incorporating circularity in organisations
Educate personnel on circular procurement	There is a lack of experience with circular procurement Share experiences between organisations to increase knowledge
Start small with circular procurement and implement CE aspects stepwise	Experiment with circularity in pilots It is hard to upscale from pilot to common practice Start with circular procurement outside core business
Evaluate the project and procurement processes	There are too few projects finished to evaluate circularity
Make agreements about the use phase, maintenance and the end of life of the project	Agreements about end of life are not made
Make use of an integrated contract (including maintenance)	Few integrated contracts (with maintenance) are used
Make use of LCC as an awarding criterion	There are separate budgets for project investments and maintenance
Conduct a LCA	Use of Dubocalc within award criteria Circular materials can contradict with regulations or certifications
Monitor the projects and circular ambitions	Monitoring of project ambitions is hardly done
Formulate an open need, and specify functionally (wherever possible)	Technical specifications are most often used Assessment of functionally specified tenders is perceived hard Stakeholders and legislation always require some technical specifications
Formulate selection criteria on vision	
Formulate (sub)award criteria in line with the circular project ambitions	Price is dominant in award criteria
Apply a large quality ratio in BPQR	
Make use of a price ceiling	
Have faith in supply chain to come up with circular solutions	Involve supply chain before announcement of tender There is a certain distrust towards the supply chain Fragmentation of supply chain
Enable contact with contractors during the tender	There is little contact with the supply chain during the tender
	Online databases for gathering and management of information about materials
	New tools can make circularity in infrastructure projects measurable, for example materials passport

# APPENDIX F – EFFECTIVE CIRCULAR PROCUREMENT

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## FINANCIAL AND PERSONAL INCENTIVE TO START

Contracting authorities should have a certain incentive to start with a circular infrastructure project. According to the interviewees this incentive can be financial or personal. A financial incentive means that there should be an economically feasible business case for circular solutions (P8, P9, P11). Both the contracting authority as the supply chain (P3) should benefit from it, otherwise no contractors are willing to make an offer.

CE is about the whole life cycle of projects and at the end of life the used materials can still have a residual value (P1, P11, P21). This life cycle approach should make CE more attractive in the long run. It should therefore become clear that circularity is worth the (possible) higher investment (P11). Circular practices should be cheaper than traditional, linear practices (P8), otherwise no investments in circular projects will be made.

There can also be a personal motivation to start with procuring differently (P4). If procurers have no intention to procure circularly, they will not do it. The interviewees state that embracing CE aspects has to come from your own beliefs (P1, P11, P14), it is about inherent motivation of persons in organisations to apply CE aspects (P1, P11, P18, P20). So applying circular procurement will not work if persons are forced to, they have to be willing to do it themselves.

## CIRCULAR AMBITIONS

According to the interviewees circularity can be translated to concrete ambitions. This will help organisations to gain focus on what they want to achieve. The ambitions can be formulated in the form of organisational policy, but also specific ambitions for a certain project can be drafted. This contributes to effectiveness because this stimulates all employees to realize circular solutions. This increases the likelihood that the project ambitions are achieved in the end, because employees are motivated to achieve those ambitions. Furthermore, it can help to check if the initial need was realized and how effective the procurement process was in the end.

### *CIRCULARITY IN PUBLIC ORGANISATIONS*

Circularity needs to become incorporated in the entire organisation (P1, P2, P7, P12, P14, P15, P16, P18) (van Kruisbergen, 2016). This can be done top down by formulating circular ambitions in the organisational policy by the management (P1, P2, P3, P4, P5, P8, P9, P12, P13, P14, P15, P16, P18, P19, P20, P21). It is important to be specific in what circularity means for the organisation. This policy should motivate all employees towards circular behaviour (P13, P16). The policy should be consequent for the whole organisation and there should be no contradictions with other policy goals.

In addition to the management of an organisation, all the individual employees, especially procurers, project managers and contract managers need to be guided towards circular behaviour (P3, P4, P7, P10, P15, P16, P19, P21). This individual behaviour is very important, because they decide in the end whether or not to fully use the potential of circular procurement. In order to get there you need a “puller”, someone who is open minded (P2, P15, P16, P21), enthusiastic and is strong enough to face the rest of the organisation if they are not supportive (P2). He needs to have the guts to start (P3, P7, P12). Van Kuisbergen (2016) and Bossink (2004) also conclude that you need enthusiastic employees that are strong enough to overcome hurdles to drive innovative, circular ideas.

### *PROJECT AMBITIONS*

Project ambitions related to circularity are formulated in advance. It is important that the ambitions are in line with the object of the contract and are feasible. The interviewees state that good circular ambitions contain the following:

- a. Explain why you want CE as an ambition (P1, P2, P7).
- b. Be clear and specific in what CE means for the project, what goals do you want to achieve (P1, P2, P4, P5, P8, P9, P12, P14, P15, P16, P17, P19, P21). Using container terms like circularity and sustainability are too vague (P2, P4, P5, P8).
- c. Chose a certain focus (P1, P2, P5, P12, P13, P15, P18, P19, P21). This can vary for each organization and type of project, so be clear about what is important and feasible for you as a contracting authority (P1, P2, P21). This makes it easier for the supply chain to interpret your need and make a satisfying offer (P2, P13, P21).
- d. Make ambitions measurable, or include KPI's (P2, P4, P13, P14, P15, P16, P21).

To conclude, SMART project ambitions.

The need also consists of determining the budget and planning. In order to be effective, these two should be in line with the ambitions. If the budget or planning are too tight, the circular solutions the supply chain can offer can be limited (P3, P4, P7, P12, P15, P16, P18) and therefore the ambitions might not be reached. A good balance should be found to get the best value for money.

### **EXPERIENCE AND KNOWLEDGE**

In order to get the most out of projects and to avoid pitfalls, you need knowledge of- and experience with circular procurement to be effective.

Procurers need to be equipped with the right skills and knowledge to procure (circularly) (P5, P3, P13, P16, P17). Procurers should be involved early in the project (P16, P18, P21). This can be done by educating your own personnel (P2, P13, P14, P15, P18, P21) and by knowledge sharing (P2, P20). Raise awareness about circularity (P1, P2, P3, P9, P10, P13, P14, P19, P20). Therefore, clear definitions of CE and circular procurement are needed to make sure everyone knows what you are talking about (P8, P9, P12, P14, P20).

If there is not a lot of knowledge within the organisation, it is possible to hire someone that can help you with this (P1, P2, P15). Also knowledge institutions, consultancies, or universities can help (P3, P8, P16, P18).

### *PILOTS*

You can start getting experience and knowledge by doing (P1, P3). The best way is just to start (P1, P9, P10, P11, P16, P19). Just do it, start small and then stepwise implementation of CE principles (P1, P2, P7, P8, P9, P11, P12, P15, P16, P19). Experiment (P1, P2, P5, P8, P10, P15). And accept that during this transition phase to a CE not everything will go right (P3, P19).

For example, a pilot is perceived to be good by the interviewees, because according to the interviewed contractors, in a pilot you get more freedom to experiment (P3, P12). If these pilots turn out to be successful lessons can be learnt and evaluated for the next project (P2), also for contracting authorities. Successful examples can boost the implementation of CE aspects in the organisation and application in future projects (P14, P15, P16).

## *EVALUATION*

To increase the effectiveness for the next tenders, the process has to be evaluated afterwards (P1, P2, P3, P4, P7, P9, P13, P14, P15, P20). Learn from mistakes and best practices and implement findings for new projects (P3, P8, P11, P13, P15). Both the project and the tender process should be evaluated.

## **LIFE CYCLE APPROACH**

An important aspect of CE is looking at the whole life cycle of an object. This should be included already in the procurement process and contributes to achieving the ambitions on circularity.

## *CONTRACT*

The contract is a good place to ensure agreements about use phase, maintenance phase and end of life of the project. These agreements have to be made in advance in order to safeguard circularity (and contribute to project ambitions) (P1, P5, P14, P17, P20, P21). If the project is still demolished at the end of life, these ambitions are not reached.

Integrated contracts (Bossink, 2004)(Bossink, 2004)(Bossink, 2004)(Bossink, 2004)(Bossink, 2004)(Bossink, 2004)(Bossink, 2004)are often mentioned (P1, P2, P3, P4, P9, P10, P12, P13, P14, P15, P16, P19, P21), based on the UAC-ic (P14, P15, P16, P19, P20). They enable the use of knowledge of the contractor in both the design and construction (and maintenance). It is recommended to include also the maintenance in the contract. However, it depends on the project size and context if this is possible (P9, P12, P19, P21).

Commitment after award, keep on implementing new innovations and developing together (P1, P10). This requires a flexible contract (P10, P13, P17).

## *LIFE CYCLE COSTS*

Another approach to look at the whole life cycle is to finance projects over their whole life cycle. For circularity it is better to award on the Total Cost of Ownership (TCO) or Life Cycle Costs (LCC) (P1, P9, P11, P12) instead of the investment costs (P13, P15, P16, P19, P20, P21). This is key towards circular infrastructure because it includes all aspects from raw materials to reuse. LCC recommended in Design & Construct contracts, but in Design, Build, Maintenance contracts it is less interesting, because then the maintenance costs are already included (P13).

Another way of determining the costs of circularity is by doing a life cycle analysis (LCA). A LCA can measure the environmental impact of a infrastructure solution, based on a so-called environmental cost indicator (ECI). The use of LCA and ECI is mentioned by the interviewees (P3, P4, P8, P9, P12) and it can be assessed by for example DuboCalc (P4, P12, P13, P16, P19). Doing a LCA is only recommended when there is enough room to optimize these environmental costs. If, for example, all the materials are already determined, there is no room for distinction for contractors within the LCA (P12).

## *MONITOR*

In order to check if the project ambitions are being achieved it is recommended to monitor projects to measure the impact the solution on the ambitions (P2, P4, P8, P13, P14, P15, P16). Check that contractor meets the promised ambitions (P16). Contract management can facilitate this (P13, P14, P15, P16, P19, P21).

## **ROOM FOR EXPERTISE OF CONTRACTOR**

In the interviews became clear that the supply chain is further with circularity than contracting authorities. Therefore it is recommended to make use of this extra expertise. In order to give



optimally give substance to the project goals a more open question is needed (P2, P3, P5, P10, P15), because you do not know in advance what you will get (P1, P5). Do not let your question restrict the supply chain to come with circular solutions (P1, P9). They will not offer a different kind of material or solution if you do not ask for it (P1, P8, P19). Be clear about what you want and leave the “how” to the supply chain (P1, P2, P10, P14, P15, P18).

### *SPECIFICATIONS*

Almost all interviewees state that functional specifications are most suitable for circular procurement (P1, P2, P3, P4, P5, P7, P8, P9, P10, P11, P12, P13, P14, P15, P16, P17, P19, P20, P21). Functional specification enables room for contractors to innovate and to contribute to your project ambitions and realizing them effectively. Also if the contracting authority wants to give more room to the contractor, it can be allowed that the contractor is able to optimize the technical specifications (P1, P2, P4, P8). Or submitting variants can be allowed.

The specifications should be in line with what the supply chain can offer. They have to be demanding enough to stimulate contractors to innovate (P10, P14, P18), but not too demanding, because otherwise no one can realize them. By making the specifications more and more demanding over the time, the supply chain has to innovate to satisfy these specifications (P14, P16). It is important to communicate this to the supply chain so they know what to expect (P5, P14).

Lastly, it is also important to not only define requirements for the design of the work. Requirements about the whole life cycle, so the production phase, use phase, and end-of-life phase have to be formulated (P12). Include specifications about maintenance if the contract is only Design & Construct (P9, P13). This triggers contractors to think about it, even though they are not responsible for it in the end.

### *CRITERIA*

The criteria should also leave room for the contractor to make use of his knowledge and expertise. They should be able to make a distinguishing offer (P3, P7, P12, P14).

- a. Exclusion grounds and suitability requirements:  
Some suitability requirements can be included (P13), but the threshold to participate should not be too high (P2). This enables the opportunity for new / less experienced, but enthusiastic contractors to participate.
- b. Selection criteria:  
Selection based on vision on circular economy is recommended (P1, P2, P7, P10, P12, P20). This eliminates contractors that are not motivated to realize the best circular solution. But the interpretation of “vision” depends on the exact project.
- c. Award criteria:  
Include an award criterion based on your predefined circular ambitions (P1, P2, P7, P9, P12, P13, P15, P19, P20, P21). If you do not award on circularity, you will not get it. Think about what your ambitions are, and draft (sub)awarding criteria that are consistent with this ambition (P1, P13, P19).

It is important to award based on a large quality component (up to 100%) (Van Haagen, 2018) (P1, P7, P9, P11, P12, P13, P14, P15, P16, P19, P20). Increase proportion of quality in best price/quality tenders in order to award contractors for creative, circular solutions (P9, P12, P14, P15, P19).

It is recommended to make use of a price ceiling (P1, P2, P3, P7, P9, P12, P13, P14, P15, P16). In this way, every candidate can submit an idea within the same conditions, which also makes the assessment fair.

## **COLLABORATION WITH SUPPLY CHAIN**

Multiple interviewees state that collaboration is the key to circular infrastructure projects (P1, P3, P5, P7, P8, P10, P11, P12, P19, P20). As became clear earlier, contractors have a lot of knowledge on circular infrastructure and therefore they should get a lot of design freedom. Make use of the expertise that is not within your own organisation and work together in order to get the best circular solution. Collaboration means creating team and in order to be effective the team has to be connected based on vision (P5, P20). Look for parties with a similar ambition (P5, P10, P11, P13, P14, P20), that understand what you need (P1, P7).

Involve the supply chain as early as possible in order to make the best use of the knowledge of the contractor (P7, P10, P11, P12, P16). The contractor is experienced and is better able to identify risks (P7, P10).

Stimulate collaboration in the whole supply chain (P5, P10, P11, P14, P15, P17, P20, P21). For example, the architect and demolisher should collaborate (P15, P18). They can form a consortium, together with a contractor, and participate as one party in the tender (P2, P8, P10, P12, P15). Develop together (P17).

However, public authorities can also have specific knowledge about the project (P2, P9, P10, P12, P15, P16, P17, P19). It is about combining the expertise of the contracting authority and the contractor. Share knowledge between all involved parties (P14, P15, P19, P20). Look within your own organisation what kind of expertise you already have, and then look for the expertise in the supply chain that you are missing (P2, P5).

Transparency in collaboration is mentioned as important. Open books (P12), honesty (P1) and transparency (P3, P5, P7, P18) are required between parties. Especially about the costs (P3, P4, P11). Share knowledge and expertise between involved parties in the project (P14, P19, P20). Talk about risks and divide/share them properly (P14, P15, P19, P20)

This new form of collaboration requires a specific attitude from contracting authorities. Contracting authorities should have faith in the supply chain and their capabilities (P1, P3, P14, P15, P16, P19, P20). An open mind-set towards the supply chain is needed in order to give them the opportunity to create something circular (P2, P15, P16, P19, P20, P21). The contracting authority should facilitate the supply chain to achieve the project ambitions (P14, P19, P20).

## *PROCEDURE*

There is not a certain procurement procedure mentioned by the interviewees that contributes mostly to the effectiveness. Different types of procedures are used, depending on the project characteristics. One common thing is that contact with the supply chain during the procedure is considered important (P1, P10, P15, P20).

# APPENDIX G – CURRENT PRACTICE

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## FINANCIAL AND PERSONAL INCENTIVE

For effective circular procurement there should be an incentive to start. However, according to the interviewees the incentive to initiate a circular infrastructure project is currently low for most contracting authorities. This is one of the biggest threats towards effective circular procurement, because if no contracting authorities have an incentive to do it, no circular projects will be initiated. There are several reasons why this incentive is low.

### *FORMULATING A BUSINESS CASE*

Right now, CE is perceived more expensive, because it new and it is hard to obtain the right secondary materials (P18). As long as there is this perception that circularity is more expensive (P7, P11, P18), or traditional practices are less expensive, these will be asked for (P1, P5, P8, P9, P11, P18).

According to interviewees the main reason behind this low financial incentive is the long life time of infrastructure projects (P1, P2, P4, P5, P8, P9, P10, P11, P12, P17, P19, P20, P21). It is hard to formulate a business case for projects with a long life cycle, because it is hard to determine the residual value of materials at the end of life. *“Generally seen, it is hard to finance something for a long period of time”* (P8). It is also questionable if infrastructure is reusable on component level after decades (P3, P19). Furthermore, a lot of materials (P3, P5, P12, P17), and especially low value materials like ground, concrete, steel, asphalt are used in the infrastructure industry. There is no incentive to keep this value high by reusing (P4, P5, P12), even though the impact can be high because of the large scale.

There is also an uncertainty about the future use of infrastructure. Innovations like automated driving are rising, and travelling by car is already under pressure. This may result in the fact that not so much infrastructure is needed in the future or a different type of infrastructure (P3, P8, P11, P16). Because of the long life time and future uncertainties, it is not known if the initial investments will pay off in the end (P1, P4, P5, P9, P11, P14, P16, P20).

### *LONG TERM COMMITMENT*

There is also a lack of a personal incentive to start. Most people who are involved in the project right now, will probably not be involved anymore in 60-80 years (P5, P4, P14). There is no long term commitment.

### *RISING PRICES OF RAW MATERIALS*

This is a future opportunity for circular procurement. Currently, new materials are cheaper than recycled materials (P18). However, at a certain point LE materials will become scarce and therefore more expensive. This creates an incentive to reuse current materials (P1, P2, P18). LE is for investment cheaper, but in the long run CE is cheaper, because the raw materials will become scarce and therefore expensive. Schiphol experienced that reducing the amount of materials in the construction also effectively lowers the costs (P14).

### *TRADITIONAL WORKING PRACTICES*

A different, more collaborative way of working is required for reaching circular infrastructure solutions effectively. But contracting authorities are used to a certain, traditional way of working (P2, P4, P12, P14, P16, P19, P20, P21). They perceive that their current way of working is still good, so why change this (P5, P7, P18, P20)? *“Most people have done their job for 20 years now and now they have to change their practice suddenly because of something called the circular economy. This*

*feels like a disqualification of what you have been doing so far” (P5). They also believe that the infrastructure sector is traditional and therefore not innovative (P10, P11). Infrastructure projects from the initiation to the design to the construction take a lot of time (P2, P10), the procedures are slow (P9). This makes it hard to change products or apply innovations (P9).*

#### *RISK-AVERSE MIND-SET*

The interviewees state that contracting authorities are afraid to start because of public responsibility. Their mind-set is predominantly risk-averse (P4, P19, P21). Contracting authorities are responsible for the functioning of the infrastructure and if it does not work, they have a problem (P4). There is a certain fear for making mistakes (P7, P10, P18, P21). Large amounts of public money is invested in infrastructure projects (P1, P5, P8, P9, P12) and this money should be spend wisely to safeguard the taxpayers’ value for money.

### **CIRCULAR AMBITIONS**

#### *CIRCULARITY IN PUBLIC ORGANISATIONS*

Circularity is already (partly) incorporated in public organisations. The management has formulated circular ambitions in the organisational policy (P1, P2, P3, P4, P5, P8, P9, P12, P13, P14, P15, P16, P18, P19, P20). However, is perceived that it generally stagnates after this. The management keeps talking about how we should apply the ambitions, but no actual action is undertaken (P1, P3, P5, P8, P12, P17, P20, P21). Or the rest of the organisation has no idea how or no intention to work with this circular policy and therefore nothing happens (P2, P3, P12, P15, P19, P21).

On the other hand, there are some enthusiastic procurers or project managers that want to start with circular procurement (P3, P4, P7, P10, P15, P20, P21). However, if the rest of the organisation does not support this, still nothing happens (P3, P4, P7, P9, P14, P18, P20). If the management of organisations do not embrace circularity, it is hard as a procurer or project manager to make the circular procurement process successful. The connection between policy and execution is missing (P20, P21).

#### *PROJECT AMBITIONS*

Contracting authorities struggle with formulating good circular ambitions for the project (P2, P8, P9, P12, P19, P20, P21). It is hard to translate general policy to specific project ambitions (P20). Consultancy’s are hired to help several organisations. Even though this is not a bad thing, apparently contracting authorities cannot do it themselves (P2, P4). Furthermore, too much (or wrong) focus points are chosen so there is no opportunity for contractors to make a distinguishing bid (P2, P9, P19). *“They told me that they wanted a sustainable solution and I think: well congratulations, but then the supply chain has no idea. What do you want within sustainability?” (P2).*

#### *BUDGET AND PLANNING LIMIT AMBITIONS*

Costs and time influence the quality (circularity) of the project and therefore the height of the ambitions. Costs are named by (P3, P4, P7, P8, P12, P15, P16, P18, P19, P20, P21) and mean that the project budget determines what kind of circular solutions can be realized. The CE is still in an infancy and some solutions and/or innovations that are more costly, are not implemented because of the budget (P7, P8, P15). The preparation is now more intensive and expensive because it is new (P2, P7, P9). Implementing circular procurement is more time consuming than normal procurement, because it is a new concept and contracting authorities have to get used to it. The intention to start it present, but no additional money is provided to experiment (P15, P18).

Planning is named by (P3, P7, P8, P15, P16, P18, P19, P21) and means that projects have to be ready within a certain amount of time. This limits the time that is needed to brainstorm and come up with new circular solutions. It also limits applying innovative procurement strategies (P16, P21).

#### *INFLUENCE OF GOVERNMENT*

Political influence (P12, P18, P20) can be an opportunity to stimulate initiating sustainable and circular projects. For example, the transition agendas or national policies on sustainability. Most of the interviewees mention the transition-agenda or the national goal to reach a circular economy in the Netherlands (P2, P4, P5, P8, P10, P11, P12). They believe that national policies boost contracting authorities to start with incorporating circularity in their organisations.

#### **EXPERIENCE AND KNOWLEDGE**

From the interviews was found that there is not that much experience with (P1, P10, P12, P15, P16, P18, P19) and knowledge of (P2, P3, P9, P17) circular procurement in the infrastructure sector, yet. There are just a few circular infrastructure projects procured and even less are realized. This results in the fact that the procurers do not perceive it as normal practice (P3, P5), they are not familiar with it yet. Furthermore it is perceived that contracting authorities do not know what CE is (P3) or what circular procurement is (P9). Circular procurement is new and both contracting authorities and contractors have to give substance to the concept.

This lack of experience leads to perception that organisations are not ready to start (P1, P2, P21). And if they are ready, they do not know where to start (P1, P12, P13, P15, P18, P19, P21).

#### *EXPERIMENT IN PILOTS*

Contracting authorities who have overcome the fear to start, are experimenting with circular procurement in pilots (P2, P3, P5, P8, P12, P14, P15). The Green Deal Circular Inkopen is signed by more and more organisations.

#### *SHARE EXPERIENCES AND KNOWLEDGE*

An opportunity is to share knowledge between organisations. Since most public authorities are struggling with CE principles, it is important that lessons within the organisation and from other organisations is shared. This can be done through knowledge platforms (Bossink, 2004)(Bossink, 2004)(Bossink, 2004)(Bossink, 2004)(Bossink, 2004)(Bossink, 2004) (P2, P5, P10, P12, P15, P20) like DuurzaamGWW, Green Deal Circulair Inkopen, Circular Valley, etc. Important is that these knowledge platforms are connected in some way (P2, P18) in order to prevent that several initiatives are all doing the same thing.

#### *UPSCALING*

We are now in an experimenting phase and larger projects are needed to have the opportunity to fully exploit CE aspects and to learn from them (P9, P10). Doing a pilot first can be good to experiment, but large scale implementation is needed to make the transition to a CE (P9). A pitfall from piloting is that it is hard to upscale after the pilot when the normal rules apply. In pilots there is a certain extra budget or room to experiment (P3, P12), but in order to make circular procurement common practice, the projects still need to be economically feasible. By the interviewees it is also perceived hard to go from a pilot to common practice (P3, P9, P10, P20).

### *EVALUATION AND MONITORING*

There are not that many projects realized yet, so it is not possible to evaluate yet. Monitoring (P2, P7, P8, P13) and evaluating is not done right now because there are not many projects realized yet. Furthermore, infrastructure projects have a long life span, so the impact of circular aspects will take a long time to show.

### **LIFE CYCLE APPROACH**

When the awarding criterion of lowest costs based on cost effectiveness is used, one method to assess these costs is to make use of DuboCalc (P16, P19). This is already being done by several contracting authorities. Also (P4, P12, P13, P19) mention that they already use DuboCalc and state that Rijkswaterstaat is also using it and that more public authorities make use of it.

### *AGREEMENTS WHOLE LIFE CYCLE*

Agreements about the end of life are forgotten easily because the procurer is no longer involved after the award of the contract (P1, P5, P9, P15). P1 names an example of a project that was demolished even though it was designed for deconstruction. Mainly because there were no agreements made in advance about the end of life of the construction.

### *SEPARATE BUDGETS FOR INVESTMENT AND MAINTENANCE*

Contracting authorities have separate budgets for investment and maintenance, which hampers the applicability of life cycle costing (P1, P2, P3, P7, P9, P20, P21). This leads to the fact that most projects that are put on the market are still based on investment costs. The applicability of LCC as an award criterion is hampered by this.

### *CONTRACT*

In relation to the small projects that are initiated and the fact that investment and maintenance budgets are separated, not that many integrated contracts with maintenance component are used. It namely depends on project size if this is economically attractive (P9, P12, P16). Small, routine project could also be procured based on technical specifications (Dutch: RAW) (P17, P18). The projects that are currently executed are small and usually maintained by the municipal/provincial maintenance service (P9, P7, P12, P16, P21).

Also if small projects are procured with maintenance, there will be many separate contracts to manage for the contracting authority (P9, P16, P21). This is not desired.

### *THE USE OF SECONDARY MATERIALS*

The level of circularity can also be influenced by other factors than time and costs (P2, P3, P5, P8, P12). Infrastructure works are bound to certain rules, legislation or certifications to secure safety or comfort for the users of the infrastructure (P2, P8, P12, P16, P20, P21). The quality can be lower if secondary materials are used or the certification is not granted.

### **ROOM FOR EXPERTISE OF CONTRACTOR**

#### *SPECIFICATIONS*

Even though some contracting authorities specify more and more functionally, technical specifications are still most often used by contracting authorities (P1, P3, P4, P5, P7, P8, P10, P12, P16, P17, P18, P19, P20). They are hesitant to specify functionally, because contracting authorities are not used to do that (P1, P5, P11, P20) or afraid to lose grip on the end result (P7, P9, P12). They want to be sure that they get what they have asked for (P2, P3, P16). However, this limits the amount of circular solutions the supply chain can generate (P1, P2, P8, P9).

Specifications are also drafted very specific in order to avoid discussions about responsibilities, risks (P1, P10, P12). A lot of studies and design is already done in advance in infrastructure projects, which leaves almost no room for innovation and circularity (P10, P16, P19).

However, fully functional specification in infrastructure projects is almost not feasible. Because of stakeholders, regulations and track decisions, some requirements are already set. This leads to a combination of technical and functional requirements (P2, P4, P8, P9, P15, P16, P19, P20).

#### *CIRCULARITY IN AWARD CRITERIA*

Contracting authorities largely award contracts to the contractor who offers the lowest price (P1, P10, P11, P17, P18, P20) or best price quality ratio with small quality aspect (P12, P18). Circularity is often a small aspect within the award criteria (P12, P18).

#### *ASSESSMENT*

The assessment of functionally specified tenders is perceived hard (P1, P2, P5, P7, P9, P12, P13, P15, P21). It is not always stated how the assessment takes place. It is not always in line with project ambitions (P2). How do you determine which circular solution is the best?

#### *INVOLVE SUPPLY CHAIN IN PREPARATION PHASE*

An opportunity is to involve the supply chain already in the preparation phase of the tender. The supply chain is further than contracting authorities (P3, P8, P18) when it comes to application of CE principles. They have more knowledge and ideas about circular solutions. The interviewees state that it is possible to consult the supply chain before the contract is put out for tender. Different market parties can be approached:

- Engineering firm. In the infrastructure sector it is common that an engineering firm is hired to help during the planning and development phase before the track decision (P4, P8, P10). This engineering firm can also help to make the first design circular (P4, P8).
- Consultancy firm. Public authorities can also hire consultants in the field of CE in order to help them with formulating ambitions or specifications (P1, P2, P3, P10, P15, P21).
- Market consultation (P1, P2, P4, P7, P9, P10, P12, P13, P14, P15, P16, P17, P18, P20). The supply chain can be consulted to check what they can realize, and thus what is realistic to ask for (P1, P9, P13, P14). In this way the need of the contracting authority can be aligned to the capabilities of the supply chain (P5, P9). This leads to a realistic need formulation (P5). They can help you to formulate your need so that they can realize what you want (P5, P9, P10, P14). It is important as a contracting authority to express your expectations for now, but also for the future. In this way contractors can invest in innovations for future projects (P4, P5, P16).

## **MEASURABILITY**

#### *ONLINE DATABASES*

Online information platforms where contractors can store information about materials and when they become available again. Madaster is mentioned for the building sector (P2, P3, P11, P12, P18). Something similar could be created for the infrastructure sector, but then it should be open for everyone (P3, P7, P11, P12). BIM is mentioned often (P3, P7, P11, P12), even though this is more an opportunity for contractors.

Another way to get insight in the materials used in the project is asset management (P4, P8, P9, P11, P12, P13, P18). Optimal asset management and material flows are good opportunity to reach continuously circular infrastructure solutions. For example, look at materials that are already

there on the construction site, especially with renovation or maintenance projects (P4, P9, P12, P17, P18). Together with a disassembly plan (P2, P4, P11) this can enhance circularity at the end of life.

#### *MEASURE CIRCULARITY*

There is a need for an accessible, reliable measuring instrument for circular building. This is also seen by (P2, P3, P5, P9) who want to make circularity more measurable. However, it can be hard to make circularity measurable (P15, P18). One way to get more insight in the level of circularity is a materials passport. It is a tool to measure materials and resources in a project (P4, P5, P7, P8, P12, P14, P15, P18). In such a passport can be determined for each object what materials are needed to construct it and what can be done with the materials at the end of life (P4, P8).

#### **COLLABORATION WITH SUPPLY CHAIN**

For effective circular procurement contracting authorities should have faith in the supply chain and their capabilities. An open mind-set is needed in order to give them the freedom to create circular infrastructure solutions. This requires that they should let go of their controlling role. However, from the interviews can be concluded that this is not the case right now. One of the most mentioned weaknesses is the traditional way of working of contracting authorities in the infrastructure sector.

#### *DISTRUST*

According to the interviewees there is still a certain distrust between contracting authorities and the supply chain in the infrastructure sector (P1, P2, P10, P12, P14, P18, P19). This distrust lead to the fact that contracting authorities are afraid of giving too much freedom to the contractor, because they do not want to lose grip on the end result (P7, P9, P12). *“There is a certain distrust and it is always about money. So, yeah, they are always busy with prescribing everything, also legally, in order to prevent conflicts later”* (P1). The form of collaboration is against each other, not with each other (P16, P20). This distrust stands in the way of the desired collaboration.

#### *CONTACT DURING TENDER*

All kind of procedures are used to procure circular infrastructure. However, since most of the projects are small, most of them are “*onderhands*” (P3, P8, P17, P18, P20) and there is no contact with the supply chain during the tender then.

#### *FRAGMENTED SUPPLY CHAIN*

The many layers between the contracting authorities, the contractor and the underlying supply chain can be a threat to realizing circular infrastructure (P5, P9, P15, P18, P19). There is no sight on the supply chain from a contracting authority’s point of view (P15, P20). Especially if the supply chain cannot realize circular solutions with a profit (P3).



## APPENDIX H – DATA STRUCTURE CHAPTER 8

BV aspects	P13	P14	P15	P16	P17	P18	P19	P20	P21	Legend
Project goals	Help with assessment	Stimulate, not force								Contributing
Project capabilities										Doubtable
KPI										Not contributing
Added value		Offers room for solutions outside of scope								
Functional specification										
Weekly										
Price ceiling							Can hamper	Does not work		
Risks					CE is about opportunities, not risks					
Clarification phase										
Large P/Q ratio										
Interviews										
Open procedure	We use restricted in BV									

Boundary conditions	P13	P14	P15	P16	P17	P18	P19	P20	P21
Innovation (not able to capture in metrics)		Provided it is applied before							
Make circularity measurable (this is hard)				Good, but may hamper innovation					
Collaboration in general									
Role of contracting authority (let go, have faith in supply chain)									
Project environment (few design freedom because of urban environment)								Spatial planning regulations	Spatial planning regulations

