

IMPLEMENTATION FIDELITY OF CIRCULARITY IN PUBLICLY TENDERED CIVIL ENGINEERING PROJECTS

BY OLA TABASHA



GRADUATION THESIS
MSC CME - TU DELFT

Nov 2021



IMPLEMENTATION FIDELITY OF CIRCULARITY IN PUBLICLY TENDERED CIVIL ENGINEERING PROJECTS

By Ola Tabasha

Master thesis document

In partial fulfillment of a MSc of Construction Management and Engineering

At TU Delft

TU Delft Committee:

Chair of the committee

Prof.dr.ir. J.W.F. (Hans) Wamelink

First Supervisor

Dr.ir. L.S.W. (Leonie) Koops

Second Supervisor

Mr. J.M. (Joyce) Kooijman

Company Supervision:

Pro6managers

Mr. Q.R. (Quinten) Niekrake

Preface

I have started this journey seven months ago with the simple premise of finding a graduation topic that interests and challenges me. Both circularity and procurement have been part of my master's journey, and a focus on their combination in my thesis seemed only natural. I am thrilled by the endless potential circularity introduces to our future and how it reframes our perception of what was a given in the sector. While studying procurement satisfies the part of me that needs to understand the technicalities, methods, and politics of any process to get things done.

I can now say that with everything I have learned since I started my thesis, I am ever more engaged in both topics and the research and practice potentials they present. Using the implementation fidelity conceptual framework to navigate the interchangeable spaces of these two topics has challenged me and offered an unparalleled opportunity to expand, with a novel research approach, on the existing body of research on the procurement of circularity.

The journey of this research had challenged me beyond my research skills. Approaching and interacting with people in a new culture, using a newly obtained language, and planning with many uncertainties and surprises along the way have pushed me to work harder at a time, to be more patient with others, and to use a combination of both in most.

I have been very fortunate to have a group of highly supportive and encouraging supervisors throughout the process. Quinten has been my go-to whenever I stumbled, along with the other colleagues at Pro6managers who have been ever more helpful. The continuous academic guidance and support of Leonie from the get-go have been remarkable. Not to mention the feedback and advice of Hans and Joyce, which steered my progress.

I would also like to thank Petra on behalf of the Noord-Holland province, Joost on behalf of the Flevoland province and the Bridge Campus Floriade, and Robert on behalf of municipality' s-Hertogenbosch for their prompt responses and collaboration in conducting the cases. This gratitude extends to all participants and specialists for availing time and sharing their expertise and passion in our interviews.

The past two years have been full of joy and uncertainty in my professional and personal life alike. I have been faced with many hard choices, and I had to go through many changes and new realities in my life. Still, I cannot imagine being anywhere else without my family around, inspiring and empowering me like they always do. My graduation is, undoubtedly, my mothers' achievement almost as much, if not more, as it is mine. I would also like to thank my friends for sharing my road with all its ups and downs.

This thesis, for me, is always going to be a reminder of what is possible when one will it to be. It also reflects how fortunate and blessed I am to be here today and present you all with my thesis.

I wish you all an enjoyable read.

Ola Tabasha

14th of October 2021

Amersfoort, the Netherlands

Executive summary

The transition agenda obligates the construction and infrastructure sector to become progressively more circular to support the objective of making the Netherlands fully circular by 2050 (Rijksoverheid, 2016). Although every construction and infrastructure project offers unique opportunities for circularity, the progress in implementing circularity has been minimal (Rijksvastgoedbedrijf, 2018), and most of this limited progress has been outside the scope of infrastructure (Dijcker, Schepers, & Witteveen+Bos, 2018). The contracting authority must decide what and how to implement circular aspects in procurement, deliver the project's objectives and ambitions, and safeguard the principles of procurement and other policies (Adams, Osmani, Thorpe, & Thornback, 2017; Adams, Osmani, Thorpe, & Hobbs, 2017; Copper8, 2018; De Ridder, 2018; Lenderink, Voordijk, & Halman, 2018; Platform CB'23, 2021; Ten Haaf, 2017). The following problem statement is formulated:

"The implementation of circular ambition through the procurement of civil engineering projects does not meet policymakers' expectations, nor does it approach the theorized potential of circularity in the construction and infrastructure sector. "

To address this, the research examines the efficacy of the methods to include circular aspects in procuring civil engineering projects by using the implementation fidelity framework. Implementation fidelity analyzes how the intervention and its outcome measure up considering the intention and the prescribed results (Blakely et al., 1987; Carroll et al., 2007; E., 2001; JBA, 2009; Mihalic, 2004; Mowbray, Holter, Teague, & Bybee, 2003; Naom, Blase, Friedman, Wallace, & Fixsen, 2005). To answer the main research question:

How to improve the efficacy of the methods to include circularity in the procurement of civil engineering projects at delivering the circular policy ambition?

The research is focused on circularity and the methods to include circularity in the tendering process of the public procurement of construction and infrastructure civil engineering projects (In Dutch: Het werkgebied grond-, weg- en waterbouw GWW) in the Netherlands.

Research Methodology

The research adopts a mixed-methods design by employing qualitative and quantitative approaches to better understand the research problems than expected by employing one approach solely (Creswell & Clark, 2006; Schoonenboom & Johnson, 2017). Thus, the research consists of four methods in four research phases. In the first phase, qualitative information is collected through an extensive literature review. Information over the circular ambition, the tendering phase of procurement, and the policy implementation issues are presented through the first phase. Then, in the second phase, a conversion mechanism is devised using the implementation fidelity framework to quantify the qualitative aspects related to the dimensions of implementation fidelity based on the first phase. In the third phase, three case studies are examined and analyzed. Each case study produces quantified data through the Implementation Fidelity Assessment (IFA) and qualitative data through open-ended interviews. In the fourth and final phase, a synthesis takes place where a cross-case analysis is conducted.

Research construct

The proposed construct for implementation fidelity is established based on five dimensions. The moderating dimensions exposure, quality of delivery, and participation are linked to circular policy implementation issues within the procurement process. These issues are categorized as structural

issues, implementation traps, and policy-related. Structural issues of external sources or time and funding impact the entire procurement process and limit the potential of a proactive attitude to the circular ambition. Implementation traps are generated mainly by decisions over the procurement process and its ongoings, which relate to issues of communication, collaboration, or compliance, among others. Lastly, policy-related issues are due to the currently limited knowledge over circularity, inadvertent effects, and the long-term consequences of its implementation in civil engineering projects.

The analysis is designed to assess the implementation fidelity of a tendering process through the differentiated methods to include circularity in tendering. The analysis framework is visualized in Figure 21; the color schemes connect the dimensions with their assessed aspects and potential issues. The construct assumes that the scores of a moderating dimension could be improved by addressing associated issues, reflecting on method efficacy. While adherence, as a bottom-line measurement of implementation fidelity, represents the effective realization, and it is indirectly linked to the moderating dimensions. The arrows in the figure represent this direct and indirect connection.

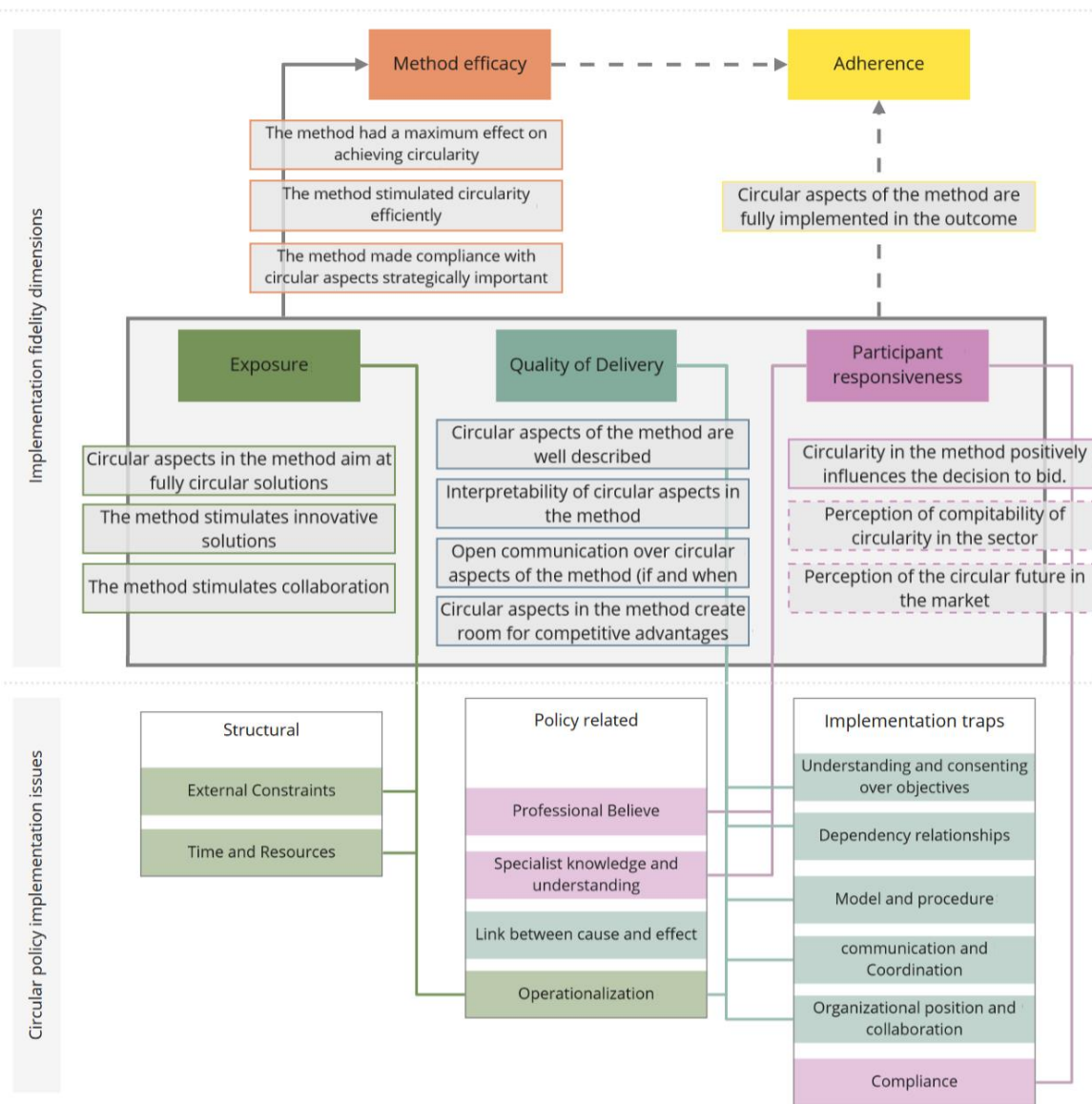


Figure 21 Implementation fidelity analysis framework

Results and recommendations

Along the four research phases, the research devises and uses a framework to assess the fidelity of circularity implementation through the methods to include it in the tendering of civil engineering works. The implementation fidelity framework is used to; create a holistic analysis that captures the many facets impacting the tendering process; determine areas of issues and consequently room for improvements; and finally, differentiate between the methods to include the circular ambition in the process. Through three study cases, the construct of the analysis managed to capture the data between quantitative and qualitative in a consistent and interpretable manner. It creates a consistent link between the fidelity dimensions, the corresponding issue areas, and the methods to include circularity in the tendering process.

The room for improvement follows the three moderating dimensions, exposure, quality of delivery, and participation. The research links the issues impacting the fidelity of circular ambition implementation, in three categories: structural issues, implementation traps, and policy-related, to the three moderating dimensions. The research acknowledges that policy-related issues impact at a sector level as issues inherent to the policy itself. Nonetheless, the research finds that, on an organizational level, removing structural issues and implementation traps raises overall fidelity and reduces the effect of policy-related issues. Increasing this fidelity reflects on the efficacy of the methods to include circularity in tendering, individually and as a group of instruments intended to complement each other.

In conclusion, the research recommends practical use of the implementation fidelity framework, which would feed into the body of expertise within an organization to improve on future tendering processes to include, enable, and produce more circular solutions with more efficacy in the use of the methods. It will also allow aligning perceptions of the contractors and the contracting authority on one hand, and the policy makers and policy implementers on the other hand. Future research wise, examining all five implementation fidelity dimensions for the instruments and processes at the different levels throughout the procurement cycle is most compatible with the circular ambition in the building and infrastructure sector. This could be most beneficial to establish a more vital link between policymakers and policy implementers. Moreover, it would support future efforts to update the circular ambition goals and milestones by presenting a more encompassing image of the policy implementation fidelity in real-world settings.

Table of contents

Preface	i
Executive summary	ii
Table of contents	v
List of figures.....	viii
1 Introduction.....	1
1.1 Research design	2
1.1.1 Research gap.....	2
1.1.2 Research goals	2
1.1.3 Research questions	2
1.1.4 Research Scope and context	3
1.1.5 Research Relevance	4
1.2 Research methodology	5
1.2.1 Phase one Literature review	6
1.2.2 Phase two Implementation fidelity framework construct	7
1.2.3 Phase three Case studies.....	8
1.2.4 Phase four The synthesis.....	9
1.3 Validity and reliability	9
1.3.1 Construct validity	9
1.3.2 Internal validity	10
1.3.3 External validity.....	10
1.3.4 Reliability.....	10
2 PHASE ONE Literature review.....	12
2.1 Implementation of circularity	12
2.1.1 Circular ambition.....	12
2.1.2 Circularity in the sector	14
2.2 Procurement of circularity	16
2.2.1 Including circularity.....	16
2.2.2 Public procurement.....	17
2.2.3 Procurement principles.....	21
2.2.4 Circular procurement principles	21
2.2.5 Circularity inclusion in the tendering process.....	22
2.2.6 The bidding process	25
2.3 Issues of circularity implementation.....	27
2.3.1 Issues categorization.....	28

2.3.2	Issues Identification	28
2.4	Phase one summary.....	33
3	PHASE TWO Implementation fidelity framework construct	34
3.1	Conceptual framework of implementation fidelity	34
3.1.1	Definition.....	34
3.1.2	Objectives.....	34
3.1.3	Dimensions.....	36
3.2	Proposed construct.....	38
3.2.1	Proposed assessment framework.....	38
3.2.2	Fidelity dimensions in procurement	38
3.2.3	Assessing the outcome of the procurement.....	39
3.2.4	Assessing implementation moderators	39
3.2.5	Differentiating impact of implementation.....	40
3.2.6	Issues concerning the dimensions	40
3.3	Implementation Fidelity Assessment (IFA)	42
3.3.1	Data collection	42
3.3.2	Data analysis	43
3.4	Phase two summary.....	45
4	PHASE THREE STUDY CASES.....	46
4.1	Study Case 1: De Cruquiusbrug.....	46
4.1.1	Case information.....	46
4.1.2	Participation and Documents	46
4.1.3	Case Results	46
4.1.4	Conclusion.....	48
4.2	Study Case 2: Innovative and circular Floriade bridges	50
4.2.1	Case information.....	50
4.2.2	Participation and Documents	50
4.2.3	Case Results	51
4.2.4	Conclusion.....	52
4.3	Study Case 3: Fietsbrug Groote Wielenplas.....	53
4.3.1	Case information.....	53
4.3.2	Participation and Documents	54
4.3.3	Case Results	54
4.3.4	Conclusion.....	56
4.4	Phase three conclusion.....	57
5	PHASE FOUR Synthesis	58

5.1	Fidelity dimensions	58
5.1.1	Exposure.....	58
5.1.2	Quality of delivery	59
5.1.3	Methods efficacy.....	60
5.1.4	Participant responsiveness	60
5.1.5	Adherence	61
5.2	Methods differentiation.....	62
5.2.1	Need definition	63
5.2.2	Specification.....	63
5.2.3	Pre-selection	64
5.2.4	The awarding framework.....	64
5.3	Between the contracting authority and the contractors.....	64
5.4	Phase four conclusions	65
6	Results and discussion.....	66
6.1	Research results.....	66
6.1.1	Using implementation fidelity.....	66
6.1.2	Higher fidelity: room for improvement	66
6.1.3	Compatibility with circularity implementation	67
6.2	Discussion.....	67
6.2.1	Validity and reliability	68
6.2.2	Limitations.....	69
6.3	Recommendations	70
6.3.1	For Practice	70
6.3.2	For research	70
	References	72
Appendix A	ifa format	81
Appendix B	CASE RESULTS	88
	Case One results.....	88
	Case Two results.....	89
	Case three results.....	89
	Cross-case Results	90

List of figures

Figure 1 Research objectives	2
Figure 2 Research focus within the procurement process	4
Figure 3 Method designs in research phases.....	5
Figure 4 Research phases with associated sub-questions	6
Figure 5 Structure of Phase one.....	7
Figure 6 Structure of Phase two	8
Figure 7 The R Ladder Source: Potting et al. (2017).....	15
Figure 8 Procurement Objectives (self-made)	17
Figure 9 Procurement phases	18
Figure 10 Tendering procedures (Self-made)	20
Figure 11 IPM model source: (Rijkswaterstaat, 2008).....	21
Figure 12 A simple Bid Process based on Nickson (2012).....	26
Figure 13 Potential issues of circularity implementation in the procurement process	29
Figure 14 Objectives of the IFA.....	35
Figure 15 Assessing implementation fidelity of circularity in the tender process.....	39
Figure 16 The combination of principles related to the quality of delivery dimension	40
Figure 17 The main question of the framework assessment areas.....	40
Figure 18 Implementation issues with the moderators of implementation fidelity	41
Figure 19 Assessment form structure	43
Figure 20 Analysis approach	44
Figure 21 Implementation fidelity analysis framework	45
Figure 22 Case one: Implementation fidelity dimensions	47
Figure 23 Case one: differentiated implementation fidelity for the four methods.....	47
Figure 24 Identified issues according to causes and by dimensions.	48
Figure 25 Issues effect on the dimensions.....	49
Figure 26 Case two: Implementation fidelity dimensions	51
Figure 27 Case two: differentiated implementation fidelity for the four methods	51
Figure 28 Case two: Identified issues according to causes and by dimensions.....	52
Figure 29 Issues effect on the dimensions.....	53
Figure 30 Case three: Implementation fidelity Dimensions	54
Figure 31 Case three: differentiated implementation fidelity for the four methods	55
Figure 32 Case three: Identified issues according to causes and by dimensions	55
Figure 33 Case three: Issues effect on the dimensions	57
Figure 34 Cases implementation fidelity scores on all dimensions.....	58
Figure 35 The two indicators of the participation dimension	61
Figure 36 Implementation in the outcome relative to policy ambition in all three cases.....	62
Figure 37 Differentiated implementation fidelity values for the four methods to include circularity.63	



1 Introduction

In the Netherlands, the government has devised a transition agenda to achieve a circular economy by 2050 to reduce CO2 emissions (Rijksoverheid, 2016). The transition agenda obligates the construction and infrastructure sector to become progressively more circular. This ambition is translated into public entities' organizational and procurement policies, which govern the procurement of sector projects. Public procurement is a prominent way to implement circularity in the sector (REBus, 2017). Nonetheless, although every construction and infrastructure project offers unique opportunities for circularity, the progress in implementing circularity has been minimal (Rijksvastgoedbedrijf, 2018), and most of this limited progress has been outside the scope of infrastructure (Dijcker et al., 2018).

Procurement of circularity

The contracting authority must choose and decide which of the available methods to implement circularity in procurement is most impactful to deliver the project's objectives and ambitions and safeguard the principles of procurement and other policies (Adams, Osmani, Thorpe, & Thornback, 2017; Adams, Osmani, Thorpe, & Hobbs, 2017; Copper8, 2018; De Ridder, 2018; Lenderink et al., 2018; Platform CB'23, 2021; Ten Haaf, 2017). Moreover, the client needs to consider the viability of the implementation for the procured product type and the most efficient delivery methods in the tendering process. At the same time, implementing circularity in the sector necessitates high involvement and interest of the contractors (Pomponi & Moncaster, 2017; REBus, 2017; Rijksoverheid, 2016). To win the tender, the contractor seeks competitive advantage by offering distinctive benefits for the clients in terms of technical and financial value (Copper8, 2018; Lewis, 2009). This makes aligning circular ambition and the methods to implement it in procurement with the contractors' need to achieve a competitive advantage in their bids critical to achieving that ambition (Adams, Osmani, Thorpe, & Thornback, 2017; Adams, Osmani, Thorpe, & Hobbs, 2017).

Implementation Fidelity

Implementation and any related aspects such as affecting factors, processes, and the results of the implementation are usually analyzed in highly valued implementation research (Bauer, Damschroder, Hagedorn, Smith, & Kilbourne, 2015; Bhattacharyya, Reeves, & Zwarenstein, 2009; Durlak, 1998, 2015; Durlak & DuPre, 2008). Implementation fidelity examines how the intervention and its outcome measure up considering the intention and the prescribed results (Blakely et al., 1987; Carroll et al., 2007; E., 2001; JBA, 2009; Mihalic, 2004; Mowbray et al., 2003; Naom et al., 2005). An appropriate evaluation of implementation fidelity is the only way to make a viable assessment of the contribution of the intervention to the outcome and its effect on performance (Dobson & Cook, 1980). Otherwise, it will not be possible to determine whether the lack of impact is a result of poor implementation, inherent inadequacies, or in the intervention itself; or whether room for improvements is in the intervention or its inadequate or incomplete implementation (Carroll et al., 2007; Mihalic, 2004).

Problem Statement

Based on what has been mentioned, it is argued that the implementation of circular ambition through procurement in practice is yet to deliver its intended objective as prescribed by policymakers, nor is it fulfilling its theorized potential. With the current procurement policy goals, improving and facilitating the implementation of circularity in the tender process is becoming increasingly crucial for both the contracting authority and the contractors. The following problem statement is formulated:

“The implementation of circular ambition through the procurement of civil engineering projects does not meet policymakers’ expectations, nor does it approach the theorized potential of circularity in the construction and infrastructure sector. “

To address this, an assessment of the methods employed to implement circularity is required. This assessment should determine whether the current methods to include circularity in procurement (e. g. need definition, specification, selection criteria, and awarding sub-criteria) effectively and efficiently deliver the circular policy's intended objectives. The assessment should include the different mediators that affect implementation and accordingly examine the efficacy of the methods. The assessment should also differentiate the different methods employed following the perceived impact of the contracting authority and the contractors.

1.1 RESEARCH DESIGN

1.1.1 Research gap

Since the recent re-introduction of circularity and circular economy concepts into the building industry, they have been the topic of new procurements. However, discussions over practicality in the sector are met with conflicting reviews and reactions with each new application. With the current national policy goals to achieve 50% circular procurement by the year 2030 and 100% by the year 2050 (Rijksoverheid, 2016), improving and facilitating the implementation of circularity in the tendering process is becoming increasingly critical for both public entities and contractors.

In this study, the efficacy of the methods to include circular aspects in procuring civil engineering projects is assessed using the implementation fidelity conceptual framework. No research has investigated the fidelity of a particular objective or technical requirement in the tendering process before. Neither a holistic approach has been used to assess the efficacy of implementation in that context either.

1.1.2 Research goals

The research sets the following three objectives as presented in Figure 1:

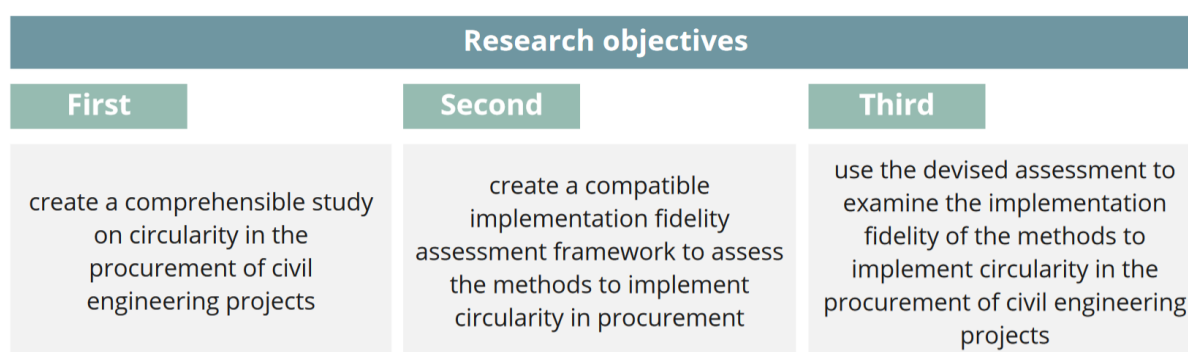


Figure 1 Research objectives

1.1.3 Research questions

To address this gap and achieve its objectives, the research attempts to answer its central question:

How to improve the efficacy of the methods to include circularity in the procurement of civil engineering projects at delivering the circular policy ambition?

The following sub-questions are posed:

- Q1 How is circularity implemented in the procurement of civil engineering projects?
Q2 How is the efficacy of implementation assessed?
Q3 What is implementation fidelity for circularity procurement methods?
Q4 To what extent do the current methods to include circularity in procurement produce the intended results?
Q5 How can the implementation of circularity in procurement be improved?

1.1.4 Research Scope and context

The research is focused on circularity and the methods to include circularity in the tendering process of the public procurement of construction and infrastructure civil engineering projects (In Dutch: Het werkgebied grond-, weg- en waterbouw GWW) in the Netherlands. The research is conducted in the Netherlands and will only focus on Dutch contracting authorities' procurements. To support the efforts of defining the scope of this research, the scope has been one of the topics brought up on the exploratory interviews in the research initiation phase. The exploratory interviews have been conducted with contract managers and consultants at Pro6mangers and with contracting authority personnel concerned with tendering and sustainability ambitions.

Why circularity? With the current procurement policy goals to achieve 50% circularity by the year 2030 and 100% by the year 2050, improving and facilitating the implementation of circularity in the tendering process is becoming increasingly critical for both public entities and contractors.

Why in the tendering process? The tendering process is well-defined; it begins and ends within a limited time frame, allowing for a viable implementation efficacy study.

Why the methods? Narrowing down the scope to focus on differentiating the methods has directly resulted from the insight gained in the explorative interviews. The use and approach to the methods to include circularity in tendering impacts the efficacy of the process significantly. Differentiating between the methods provides practically more targeted insight.

Public Procurement? Public clients in the Netherlands have determined circular goals for their procurements, making it more likely to include circularity in tendering requests explicitly.

Civil engineering projects? The tendering process is relevant to the size and complexity of the project, and the qualitative assessment aspects are more likely to be elaborated in the tendering process of large construction and civil infrastructure projects. Moreover, circularity for these projects is still relatively new and experimental, increasing the need for assessment research.

It is important to note that the tendering phase is officially initiated with the invitation to bid or pre-qualify and ends with the awarded party accepting. However, since this research focuses on the methods to include circularity, which are devised and prescribed in the preparation phase, the research will expand to that phase when relevant. The focus of the research within the procurement process is visualized in Figure 2 Research focus within the procurement process.

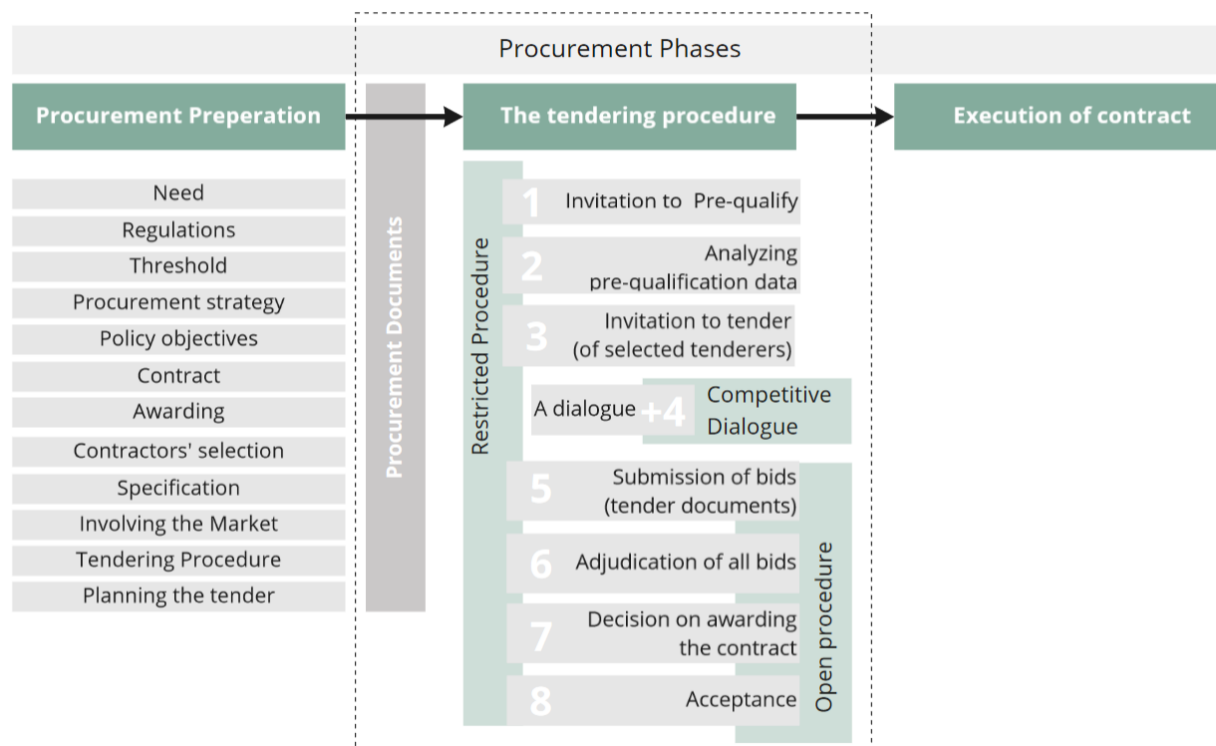


Figure 2 Research focus within the procurement process

1.1.5 Research Relevance

This section discusses the practical and scientific relevance of the research and its broader social relevance.

1.1.5.1 Practical Relevance

Provide recommendations for contracting authority and consultants to procure circular products more efficiently and effectively.

This study provides insight into the different methods to implement circularity in the procurement of construction and infrastructure civil engineering projects. The results help the contracting authority determine if the implementation is negatively affecting the circularity of the procurement outcome and the potential areas of improvement. Moreover, by differentiating the efficacy of the different methods to include circularity in procurement, the results help improve those methods' making, delivery, and employment to maximize their efficacy in procuring circularly.

Provide recommendations for the contracting authority to optimize circular procurement to motivate the participation of contractors in circular procurement.

Insight over the perception of contractors over the fidelity of the methods to implement circularity in practice will help the contracting authority select and optimize these methods to produce more attractive and effective procurements. More so by providing insight particular to each method.

The Implementation Fidelity Assessment (IFA) in sector procurements

The research is novel. The use of implementation fidelity studies in this context has not been attempted before. The assessment framework provides practically applicable evaluations to feed into an assessment cycle that builds upon itself to optimize the implementation of circularity in

procurement. Besides, the approach used to improve other social and environmental policy implementations through procurements.

1.1.5.2 Scientific Relevance

The research contributes to science by providing information on the viability of the implementation fidelity analysis in the context of procurement. It also provides differentiated insight into the different methods to implement circularity in procurement and their perceived efficacy in the procurement of civil engineering projects. The novel use of the analysis and the differentiated insights over the impact of the methods also provides future research recommendations regarding circularity implementation and the types of issues it navigates.

1.2 RESEARCH METHODOLOGY

The research adopts a mixed-methods design by employing qualitative and quantitative approaches to produce better answers to the research questions. The purpose of using mixed methods is to provide a better understanding of the research problems than what would be expected by employing one approach solely (Creswell & Clark, 2006; Schoonenboom & Johnson, 2017). Thus, the research consists of four methods in four research phases; check Figure 3, illustrating the method designs employed throughout the four phases. In the first phase, qualitative information is collected through an extensive literature review. The first phase aims to collect theoretical insight into the methods to include circularity in the procurement process of civil engineering projects and related implementation aspects. Then, in the second phase, a conversion mechanism is devised using the implementation fidelity framework to quantify the qualitative aspects related to the dimensions of implementation fidelity. In this phase, the theoretical insight gained is employed to construct an IFA framework to implement circularity in the procurement process around the four methods to include circularity in the procurement process.

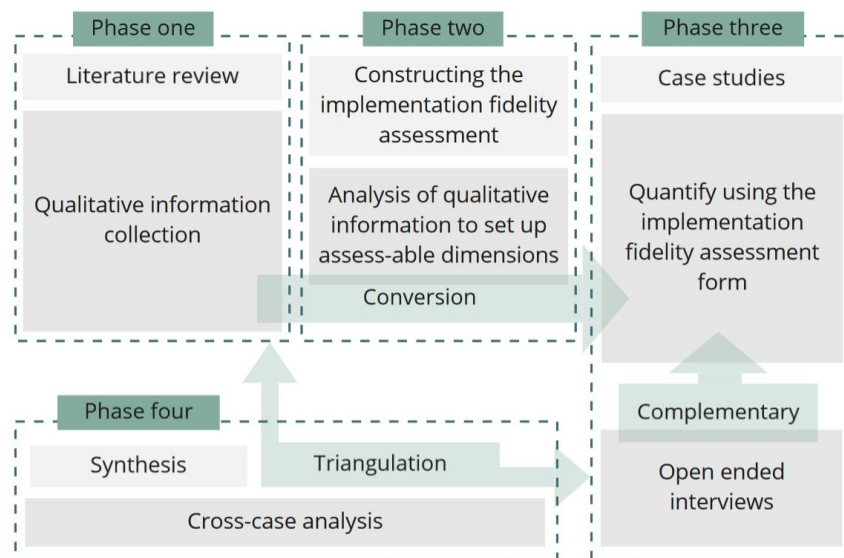


Figure 3 Method designs in research phases

In the third phase, case studies are examined and analyzed. Each case study produces quantified data through the IFA and qualitative data through open-ended interviews. This complementarity method aims to increase the interpretability, meaningfulness, and validity of the research construct (Greene, Caracelli, & Graham, 1989). In the fourth and final phase, a synthesis takes place where a cross-case analysis is conducted. The quantified and qualitative data collected in the previous phase are analyzed. The insights and findings are then triangulated with the literature review of phase one and validated

through expert reviews. This triangulation aims to increase the validity of the research construct and results by counteracting inherent method, theory, context, or researcher biases (Greene et al., 1989).

Eventually, the array of methods employed in the phases provide more targeted answers to the different research sub-questions (Yin, 2009) and mirror the complexity of the research context itself (Schoonenboom & Johnson, 2017). For the question “To what extent...?” the assessment conducted adopts a quantifying approach and relays interpretable quantified data. For the question “How...?”, a qualitative approach allows a receptive stance for discussions over topic premise over explanations of the assessment results. Subsequently, the combination broadens the potential of both the individual cases analysis and the synthesis at the end. In Figure 4, the research phases with the sub-questions they aim to answer are illustrated.

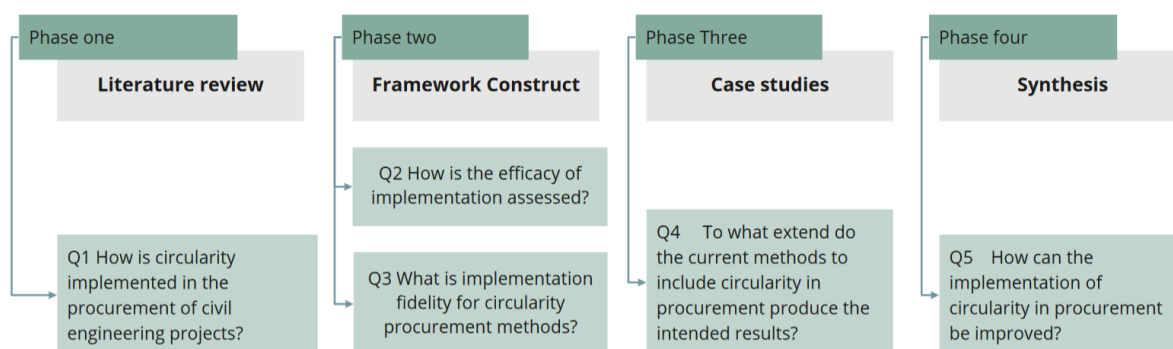


Figure 4 Research phases with associated sub-questions

1.2.1 Phase one | Literature review

The literature review presents necessary knowledge over the methods to implement circularity in the procurement of civil engineering projects in the construction and infrastructure sector (In Dutch: de GWW-sector: grond-, weg- en waterbouw) within three main topics. First, the implementation of circularity starts with an elaboration over the circular ambition in the sector. Then, procurement of circularity covers the procurement process and circular procurement, which are examined to identify the methods of implementing circularity in the process. Subsequently, the methods to implement circularity are defined and discussed. The tendering process is then examined from the perspective of the contractors. Lastly, the issues of implementing circularity in procurements of the sector are investigated. Figure 5 presents an overview of the literature review topics in phase one.

Throughout phase one, explorative interviews have been conducted with professionals to validate and complement the knowledge obtained through the literature review. Interviews were open with experts in circular policy, contract management, project management, and the aspects of the circular design. Interviewees were approached with a purposeful sampling approach: for experience and knowledge with the context of the research (Creswell & Clark, 2006) and “for the identification and selection of information-rich cases” (Palinkas et al., 2015). Questions were posed over circularity in procurement stages, tendering steps, the methods to implement circularity, and issues with circular implementation. The explorative interviews were not scripted, unlike the interviews in the study cases.

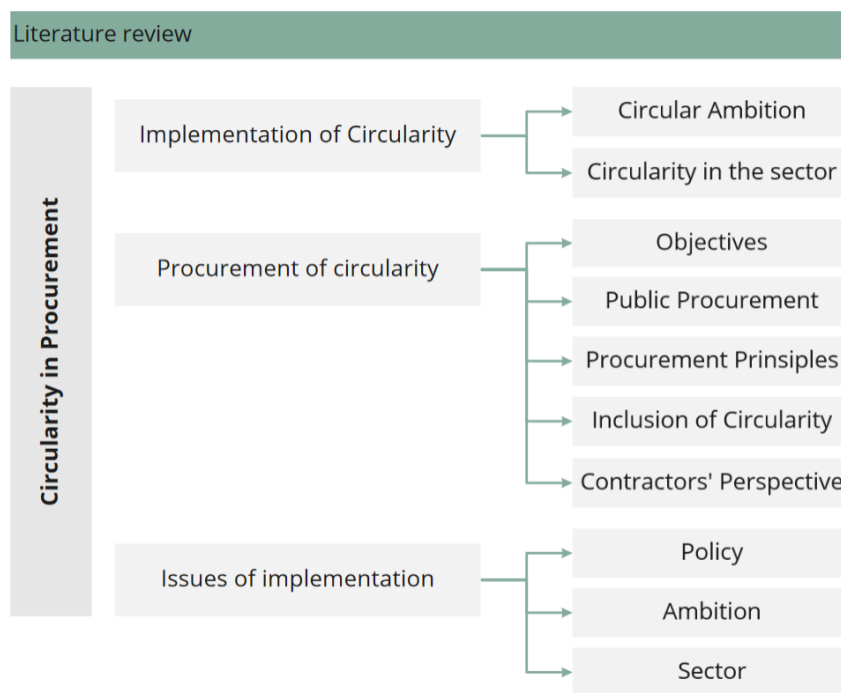


Figure 5 Structure of Phase one

1.2.2 Phase two | Implementation fidelity framework construct

This phase provides an adapted framework to analyze implementation fidelity for the context of circularity in the tendering process. Figure 6 presents an overview of the structure of the second phase. First, the conceptual framework is examined. The definition and objectives of implementation research in general and implementation fidelity specifically are investigated. Within this section, the fidelity dimensions are discussed thoroughly to provide a conceptual understanding of their research and practice scopes.

Then, a construct of the framework for the methods to include circularity in procurement is proposed, first, by presenting the parallel dimensions to the procurement process. Then by establishing the framework's parameters that are compatible with the objectives and scope of this research.

Lastly, the assessment format which will be employed in phase three of this research is presented. The data collection and analysis methods of the assessment are designed to accommodate the context of the research. Literature over the methods to conduct an implementation fidelity research and assessment presents various options to collect and examine data (Lemire, Dionne, & Rousseau, 2020). In this research, a choice has been made to collect survey and interview data, quantitative and qualitative data, in a concurrent design where both components are executed (almost) simultaneously (Schoonenboom & Johnson, 2017) and complement each other to interpret results (Greene et al., 1989).

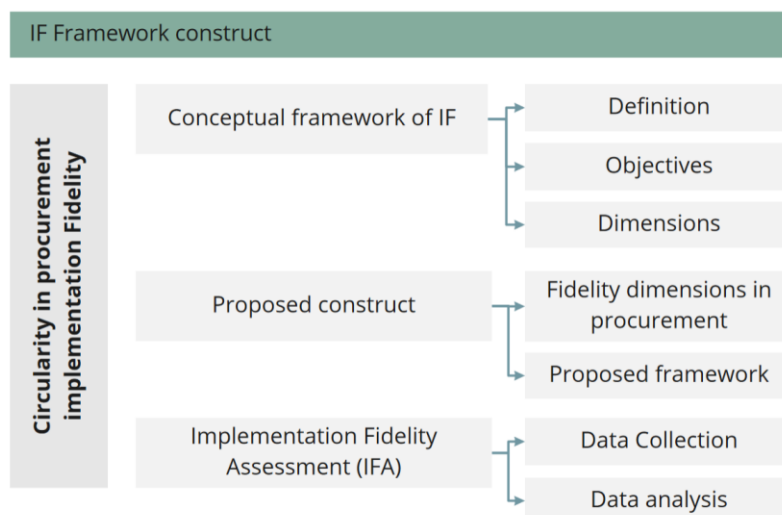


Figure 6 Structure of Phase two

1.2.3 Phase three | Case studies

Based on the framework construct provided in the previous phase, the assessment format is applied to the case studies.

Objective: The case studies help make an evaluation. The summary of the studies' findings helps the research form synoptic reasoning over the overall fidelity of the methods to implement circularity in the procurement of construction and infrastructure projects. Each case presents survey results and interview scripts for all participants and relevant procurement documents, which will be examined to deliver insights into the fidelity of the methods in each case. Using multiple cases facilitates generalizing the findings by verifying the results cross-cases the findings (Verschuren, Doorewaard, Poper, & Mellion, 2010). The data of the cases will be examined in the synthesis, in a cross-case analysis, to identify similarities and differences in the studies' results and present conclusions.

Case selection: Using multiple cases requires enough similarities to compare the cases and draw general conclusions (Verschuren et al., 2010). The research construct is built on the tendering process, a well-structured process, and the procurement documents govern all tendering processes. In the context of this research, the methods include circular ambition in the process. The cases to be assessed:

- are public procurements by government organizations in the Netherlands. Thus, the national circular economy ambition applies;
- are civil engineering construction and infrastructure projects (in the GWW sector); and
- preset procurement documents that explicitly include circular aspects.

Case data: Data collection focuses on the methods to implement circularity in procurement which entails the making and delivery of those methods from the contracting authority; the reception and utilization of these implements in the making of the bid by contractors; and related interactions. The research provides interpretable indicators over circularity in the procurement of these cases and differentiates the efficacy of the different implementation methods. The assessment form is filled individually by practitioners from the contracting authority who make the procurement documents or manage the process and by practitioners from the contractors who participate in bids' making and management. The assessment participants could be employees or consultants outsourced to support the process.

The assessment is focused on the tendering process, which involves the procurement documents of the preparation stage, the tendering stage, and awarding the contract. The participants provide scores of their perception over the statements in the survey and answer follow-up questions over their explanations of the indicators their scores give.

Acquiring cases: Employees of contracting authorities with high circular ambition in the Netherlands on a provincial or municipal level have been approached to participate in the research. Specifically, employees with a focus on circular policy, infrastructure projects, and procurement. Potential interest parties have been approached through the network of Pro6managers (internship company) colleagues, LinkedIn, and emails. Among the approached organizations which had responded: municipality of Amsterdam, municipality of Almere, municipality 's-Hertogenbosch, municipality of Haarlem, province Noord Holland, province Utrecht, province Flevoland, province Overijssel, and province Gelderland. Also, organizations interested in circular procurement and research have been approached to expand the research scope. The personnel approached were connected to, among others, Rijkswaterstaat, Cirkelstad, PIANOo, Bruggencampus, and Platform CB'23.

1.2.4 Phase four | The synthesis

In this phase, a cross-case analysis is conducted to expand the understanding of the results and examine commonalities and differences in the cases. The findings are also triangulated with the findings of the literature review in Phase one. This analysis helps the researcher draw meaningful conclusions over the implementation fidelity of circularity in procurement and the methods employed to achieve that through tendering.

1.3 VALIDITY AND RELIABILITY

The validity of the research is examined to appraise its quality (Creswell & Clark, 2006). To discuss the validity and the limitation thereof, the four criteria of Yin (2009) are used, namely, construct validity, internal validity, external validity, and reliability (Yin, 2009). These four criteria will be reflected upon in 6.26.2 in Discussion.

1.3.1 Construct validity

Construct validity is approached as the operationalization of the construct (Cook & Campbell, 1979), defining what should be measured, by which data, and how to obtain this data to measure what the research aims at ultimately.

Measures have been taken to assure the validity of the construct. First, for the data to be collected, an extensive literature review is conducted to explore procurement and circularity-related literature and implementation research. The literature review is conducted parallel to preliminary interviews with practitioners and experts to discuss the findings. These interviews supported all decisions to expand or exclude areas of relevance to the research and its aim to examine implementation fidelity in the tendering phase. Moreover, during the interviews, participants were openly encouraged to comment on the research focus and suggest additions of relevance to further comment on the validity of the construct in research conclusions.

For the validity of how data is collected, implementation research is scanned for data collecting methods, and the mix-method adopted in this research is cross-examined with alternative options for compatibility with the context of the research and the industry in which it takes place. These decisions are discussed with academic and professional supervisors and guide the implementation fidelity construct design and the structure of the interviews.

To ensure the validity of how the construct delivers on its objectives, the research design includes triangulation within the synthesis between the qualitative and quantitative results of the cases and then with the literature review findings. This is where the researcher is challenged to establish the construct, its assumptions, and its findings. This strategy is typically used to improve the validity of the research and assure high dependability and accuracy of the assessments and scores (Creswell & Miller, 2000; Golafshani, 2003), by combining the different methods (M. Q. Patton, 1990) and by including several data sources and their interpretations with multiple perceptions (Healy & Perry, 2000).

1.3.2 Internal validity

Internal validity supports the claim over the cause and effect relationship (Creswell & Clark, 2006). Attention is paid to safeguard the internal validity and avoid related issues within the boundaries and limits of this research:

- The design of the implementation fidelity analysis allows for cross-validation of assumably correlated indicators to examine consistency in the results.
- To counter the potential bias of the researcher, the same format of the assessment is designed to accommodate all groups of participants. This helps avoid the added bias because of the different phrasing for each party.
- The data collection is done in the same session, filling the assessment taking precedent to the open questions to allow the participants to express their perception without influence.
- The open-ended interviews pose generalized questions and allow the interviewees the space to explain their perception of the entirety of the process without directive.

1.3.3 External validity

The external validity of the research represents the extent to which the research results and conclusions can be generalized to a broader context (Creswell & Clark, 2006). On the one hand, the selection of the cases targets the Dutch public organizations, and the selection and analysis of the cases reflected and embraced real-life settings of each case as part of its construct to examine fidelity, which in turn maintains a balance in the trade-off internal and external validity. On the other hand, with regards to the case and participation selection, within the criteria, all eligible cases found by research or mentioned by practitioners during the preliminary phases have been approached non-discriminable. Moreover, the interviewees were approached solely based on involvement in the case and the tendering process to achieve the conscious, holistic perception.

1.3.4 Reliability

Reliability is concerned with consistency; how representable is the population under study, and how reliable are the instruments employed to reproduce the results (Golafshani, 2003).

Regarding the reliability of the results, the use of mixed methods, multiple triangulations, and reviews have been planned to safeguard reliability.

Concerning study cases and interviews, within the criteria, all eligible cases have been approached non-discriminably. The basis for selection has been independent of the sample and relied only on the prompt response of coordinators and the compatibility with the research time frame. Similarly, all involved parties were invited to participate, and participation was dependent on responsiveness.

In using the assessment instruments and their practicality prior to deployment, the IFA design, language use, and time assumptions have been thoroughly tested and checked by professionals, minor changes have been made accordingly. Moreover, any comments or inquiries over the assessment and the interviews have been documented during the interviews. To ensure reliability and assist the

research recommendation over its practicality, no comments led the researcher to propose significant changes.

All information regarding the assumptions in making the construct and all data obtained through the assessments and the interviews are recorded, well documented, and made available for reviews and results re-generation. This is done to ensure employed instruments' reliability and the opportunity to reproduce the measures and the results, which is also significantly relevant to counter subjectivity, most present in the analysis of the qualitative parts and specifically in the interviews.



2 PHASE ONE | Literature review

This chapter provides background to some fundamental concepts relevant to this thesis to answer the first sub-question Q1:

How is circularity implemented in the procurement of civil engineering projects?

The first section focuses on identifying the objectives of circularity. It starts with an elaboration over the circular ambition in the construction and infrastructure sector (In Dutch: de GWW-sector: grond-, weg- en waterbouw). Then, the procurement process and circular procurement are examined to identify the methods of implementing circularity. Subsequently, the methods to implement circularity are defined and discussed. Procurement is then examined from the perspective of the contractors. Lastly, the issues of implementing circularity in procurements of the sector are investigated.

The literature review of this chapter uses scientific research, articles, and papers on circularity, circular procurement, tendering and bidding strategies, circular criteria, contracting authorities, the transition to a circular economy, construction and infrastructure sector, organizational and environmental policy. Moreover, information over procedures and procurement processes were gathered from research and publications of public, advisory organizations, and practice entities such as Platform CB'23, PIANOo, Copper8, MVO Nederland, and Ellen MacArthur Foundation. Furthermore, the collected information was informed and supported by the explorative interviews with practitioners.

2.1 IMPLEMENTATION OF CIRCULARITY

This chapter examines how the implementation of circularity in the procurement process translates policy ambitions into practical realization. An elaborate objective is to implement circularity in procuring civil engineering projects that genuinely honor its expectations. First, it requires satisfying the core principles of circularity and the intended ambitions of policymakers; second, complying with procurement principles, the integrity of its regulations, and, most importantly, compatibility with the construction and infrastructure sector's nature and projects.

2.1.1 Circular ambition

The current rate of resource consumption is causing alarming environmental changes (IPCC, 2014). The increasing population is expected to amplify the problem (UN, 2019; UNEP, 2017), especially with the demand for infrastructure to accommodate the population. To ensure resource and environmental viability, the need to intervene became the driving force for many international and national organizations to embrace rising calls for a circular approach across all business models to counter and elevate the problem (The Ellen MacArthur Foundation, 2015b).

2.1.1.1 *Circularity and the circular economy*

Insofar, the Circular Economy (CE), also referred to as circularity, has no universal definition in the literature or practice. However, many organizations concerned with circularity have formulated definitions in line with the principles of the CE and their objectives and target groups. Some of these definitions define circularity in terms of its principals or characteristics, while others define it based on its objectives and the context of the attempt to define it (Kirchherr, Reike, & Hekkert, 2017). Nonetheless, all definitions describe an inherently designed restorative or regenerative system that reserves the value and utility of resources and products in lifecycle loops (M Geissdoerfer, Savaget, Bocken, & Hultink, 2017; Hahladakis & Iacovidou, 2019; Potting & Hanemaaijer, 2018; The Ellen MacArthur Foundation, 2015b).

The Dutch ministry of infrastructure and the environment (In Dutch: Rijkswaterstaat) defines circularity as follows: *“An economic system that takes the reusability of products and raw materials and the conservation of natural resources as the starting point and strives for value creation in every link of the system.”* (Rijkswaterstaat, 2014).

In the construction sector in the Netherlands, organizations concerned with the practical implementation of circularity, such as PIANOo and Platform CB'23, try to create a consensus over its definition. Platform CB'23 defines circularity in the construction sector as a way to protect resource materials, protect the environment, and preserve existing value (Platform CB'23, 2020). The platform identifies this definition as a relatively broad definition relative to broader definitions that include all forms of sustainability (people, planet, profit) and narrower definitions that only include the preservation of resources in their definition of circularity.

2.1.1.2 Circular transition

The Netherlands is taking part in the international movement towards a more circular economy to change the working practices away from a linear economy. Circular policy ambition is translated to regulations at three government levels: national, provincial, and municipal. The national government sets the national goal and creates basic statutory requirements that the provinces and municipalities translate into standards and organizational policies in their jurisdictions (Jongh & Morissette, 1996). The national government sets the current policy ambition on the national level to achieve a 50% circular transition by 2030 and become a circular economy by 2050 (Rijksoverheid, 2016).

2.1.1.3 Organizational and procurement policies

The public clients play an essential role in facilitating the transition (Adams, Osmani, Thorpe, & Hobbs, 2017; Nelissen et al., 2018). Studies over the implementations of circularity stress the role of policies and practices at different levels of operations (Ghisellini, Cialani, & Ulgiati, 2016). The transition towards circularity requires aligning different approaches, different levels of application, and the many stakeholders and organizations involved (Adams, Osmani, Thorpe, & Hobbs, 2017). Public entities in the Netherlands spend more than 60 billion euros annually on procurements (Ten Haaf, 2017; van Veenen, 2018), making asking for circular products and services through procurement the most impactful practice to advance the transition agenda (Bastein, Roelofs, & Hoogendoorn, 2013) and stimulate the supply chain to adopt circularity (Chao-Duivis, 2018).

The policy is a translation of the ambition into objectives and adjustments of the work processes. A procurement strategy is a translation of policy into principles and preconditions for projects. The organizational policy provides guidelines to ensure sound and effective use of public funds; the general interest as defined by politics; exuding integrity by example and keeping with the spirit of the policy; and ensuring objective, transparent, and democratic accountability (PIANOo, n.d.-a)

By the directive of organizational policy, public procurement of circularity directives are devised; in Dutch, it is termed 'Circulair opdrachtgeverschap,' and it means how an organization anchors its circular ambition in business processes and how it shapes and implements the interaction with the market and chain partners internally and externally (Platform CB'23, 2021). Based on this, contracting authorities are obliged to formulate an ambition that fits the organization and provides guidelines to procurement processes (In Dutch: inkooptrajecten). This ambition needs to be translated into concrete, measurable procurement objectives, internal work processes and required changes, and collaboration with chain partners. The ambition is then translated into a procurement strategy with preconditions (In Dutch: randvoorwaarden) for all individual procurement processes.

2.1.2 **Circularity in the sector**

The sector is held responsible for significant amounts of waste production in the Netherlands (Rijkswaterstaat, 2017), and the need to become more circular is widely acknowledged (Adams, Osmani, Thorpe, & Hobbs, 2017). The constructions and infrastructure sector are large consumers of raw resources and large producers of waste and greenhouse emissions (Gebremariam, Di Maio, Rem, & Vahidi, 2020). Moreover, this behavior is growing exponentially to an estimation of 23-fold what it was over the past century (Krausmann et al., 2017).

The waste output of the building sector in the Netherlands is almost five times its General National Product (GNP) (De Ridder, 2018). Construction and civil works are the primary resources of concrete waste, and only 9.4% is recycled in the EU compared to total production demand. While in the Netherlands, the production of recycled aggregates is around 25% of the total aggregate production (EAA, 2017; European Commission, 2017b), most of which are down-cycled in road construction projects (Gebremariam et al., 2020). This waste is produced in construction, maintenance and refurbishment, deconstruction, and demolition activities, which are diverse and produce varied waste compositions. Recycling construction materials and waste is vital to achieve circular ambitions in the construction sector (Gebremariam et al., 2020).

In the coming years, structures built in the 1950s in the economic growth are approaching the end of life stages, which presents a looming threat of vast amounts of waste, about 350 million tons of construction and demolition waste (European Commission, 2017b). The construction and infrastructure sector plays an integral role in reaching transition goals by new assignments and renovating existing structures (Rijksoverheid, 2018). Therefore, adopting the circular economy principles in the sector provides great opportunities to address the problems by stopping the linear use of materials and using the accumulated resources in existing structures.

2.1.2.1 *The construction and infrastructure industry*

As a result of the transition towards circularity and necessary renovation in the coming period, a new demand has emerged to upgrade and renovate the built environment to which experts, professionals, and construction companies must respond (Coscia & Curto, 2017; Mangialardo & Micelli, 2017, 2021).

The market has traditionally presented the linear economic model of "take, make, and dispose of" with 80% of resources in the sector becoming waste at the end of their lives (Cheshire, 2019; The Ellen MacArthur Foundation, 2015a). This traditional business model has become unsustainable (Andersen, 2006; Arup, 2016; Bisello, Grilli, Balest, Stellin, & Ciolli, 2017; Cheshire, 2019; The Ellen MacArthur Foundation, 2015a). The consequences of the current behavior could lead to increasingly scarce and costly resources that would compromise the market's sustainability. Not to mention the increasingly costly process to dispose of this waste and the significant environmental and economic damage of the squandered high-value materials due to lack of consideration in the original design to reuse or recycle. The transition to a circular economy provides a sustainable alternative (Mangialardo & Micelli, 2018).

2.1.2.2 *Core concepts of circularity*

First, characteristics of circularity:

Geissdoerfer et al. (2017) explain that circularity suggests replacing the linear process with a circular process that maintains the value of materials and products at the end of the product's life cycle and reduces waste and other adverse effects. The circular product introduces materials, products, and energy into closed use loops (M Geissdoerfer et al., 2017). Circularity also includes activities that lead to slowing resource loops by extending lifetime, closing them by aligning post-use and production, and narrowing the loops by using fewer or reduced materials (Lüdeke-Freund, Gold, & Bocken, 2019).

All the different definitions we examined earlier build on the same set of core characteristics of minimizing waste; reducing resource consumption; maintaining material value; creating resource loops, and reinserting materials and products to; increase use of renewables; multiple value creation; and the integrations of all principals in all phases, activities and to all active components of a project or a product.

Attempts to implement circularity in the sector may focus on one or all the circular characteristics. However, there are two attention areas when adopting circularity in practice (European Commission, 2017a; PIANOo, 2019; Platform CB'23, 2020). First, it is essential to ensure that the methods and solutions applied to support one do not cause adverse consequences on the rest. Second, the implementation of any circular solution should be examined throughout the entire production chain and for all stages of the project's life cycle and extended cycles for the same reason.

Second, circularity strategies:

Reduce, Reuse, and Recycle are considered the three pillars of the circular economy (Kirchherr et al., 2017). These Rs and others, such as Refuse, Repair, Refurbish, Remanufacture, and Repurpose, present a set of options proposed by research and organizations to support practitioners in their transition towards circularity (F. Mendoza, Sharmina, Gallego Schmid, Heyes, & Azapagic, 2017; Reike, Vermeulen, & Witjes, 2018).

The R-ladder of the Netherlands Environmental Assessment Agency (In Dutch: Het Planbureau voor de Leefomgeving) defines ten circular strategies to create circular solutions according to the resource materials as visualized by Potting et al. (2017) in Figure 7. As a rule of thumb, higher steps on the R-ladder are preferred. Platform CB'23 (2021) suggests that the 'degree' by which a project is called 'circular' follows the source of the materials (reused, recycled, or new) and the material's planned future by the project termination (disposal, reuse, recycle) (Platform CB'23, 2021). The most 'circular' is a project that reuses materials in construction and plans future reuse of the materials in the subsequent life cycle by final stages of the life cycle.

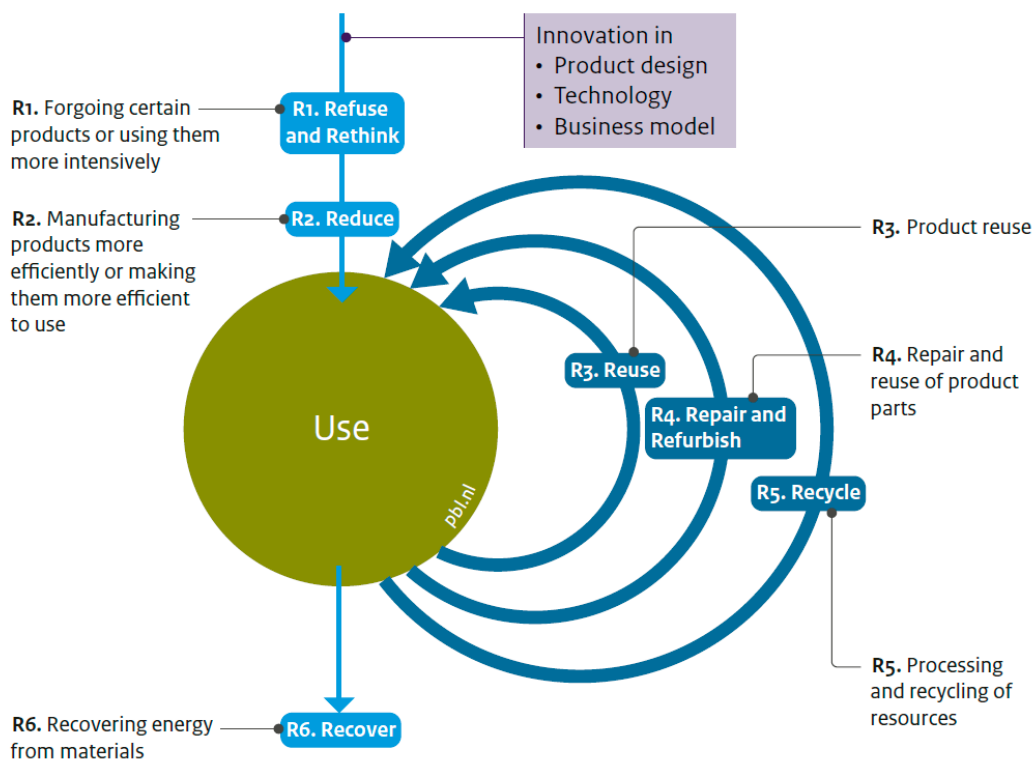


Figure 7 The R Ladder

Source: Potting et al. (2017)

All R's to implement circularity in the construction and infrastructure world boil down to four main strategies in the planning and design of the circular product (REBus, 2017): (1) avoiding waste, (2) circular design thinking, (3) material choice, (4) regenerative use of natural resources.

2.2 PROCUREMENT OF CIRCULARITY

Public procurement is recognized as a critical process in the transition towards a circular economy in the construction and infrastructure sector (Platform CB'23, 2021). Procuring from the construction sector constitutes around 30% of total public procurements and results in 33% of total emissions and 50% of total material use (Metabolic, 2021). Including circular principles in procurements helps public clients realize their sustainable and circular ambitions (REBus, 2017).

Circular procurement is procurement that follows the principles of the CE (Alhola, Salmenperä, Ryding, & Busch, 2017). The European Commission defines circular procurement as "The process by which public authorities purchase works (...) that seek to contribute to closed energy and material loops within supply chains, whilst minimizing, and in the best case avoiding, negative environmental impacts and waste creation across their whole lifecycle" (European Commission, 2017a). Platform CB'23 defines circular procurement as the process to purchase a supply, service, or work whereby the circular impact is a criterion by a focus on circular technical aspects, considering the project's lifecycle, maintenance, and recycling at the end of life, and build in financial incentives to secure circular use (Platform CB'23, 2021).

2.2.1 Including circularity

Circularity in the procurement process requires considering technical aspects in the design and use of materials, process aspects in the cooperation between the different parties involved, and financial aspects through the financial incentives to secure circular performance (Copper8, 2018). This happens at three levels in the procurement process outlined in the European Commission's good practice guidance (European Commission, 2017a). First, the 'system level' is concerned with contractual methods that the contracting authority could utilize to promote circularity. Second, the 'supplier level' is focused on the contractor or suppliers and the circularity of their systems and processes. Lastly, the 'product level' focuses on the procured products.

With every new assignment, the procurement objectives are defined in the procurement strategy based on organizational and procurement policy, general procurement conditions, and client needs and market conditions specific to the assignment at hand; check Figure 8 Procurement Objectives (self-made) for an overview.

Procurement's general organizational objectives focus on reducing integral procurement costs and supply chain risks, increasing quality, and improving the procurement process (PIANOo, n.d.-a). However, public entities aim to employ procurement to achieve other objectives concerning how the procured assignments support their strategic goals for environmental and social aspects, such as quality-price ratio, social responsibility, innovation, social criteria, and involving small and medium-sized enterprises (SMEs) (PIANOo, n.d.-a).

Although circular procurement is perceived as a new concept, some sustainability elements in green public procurement require attention to the environmental impact over the life cycle, which aligns with the circular strategies (European Commission, 2017a). When considering social and environmental objectives, circularity is inherently restorative and rejuvenating. Consequently, circularity is construed as sustainable and as part of sustainability objectives. Still, procuring circularity is a distinguished theme in sustainable public procurement (SPP) (in Dutch: Maatschappelijk Verantwoord Inkopen MVI).

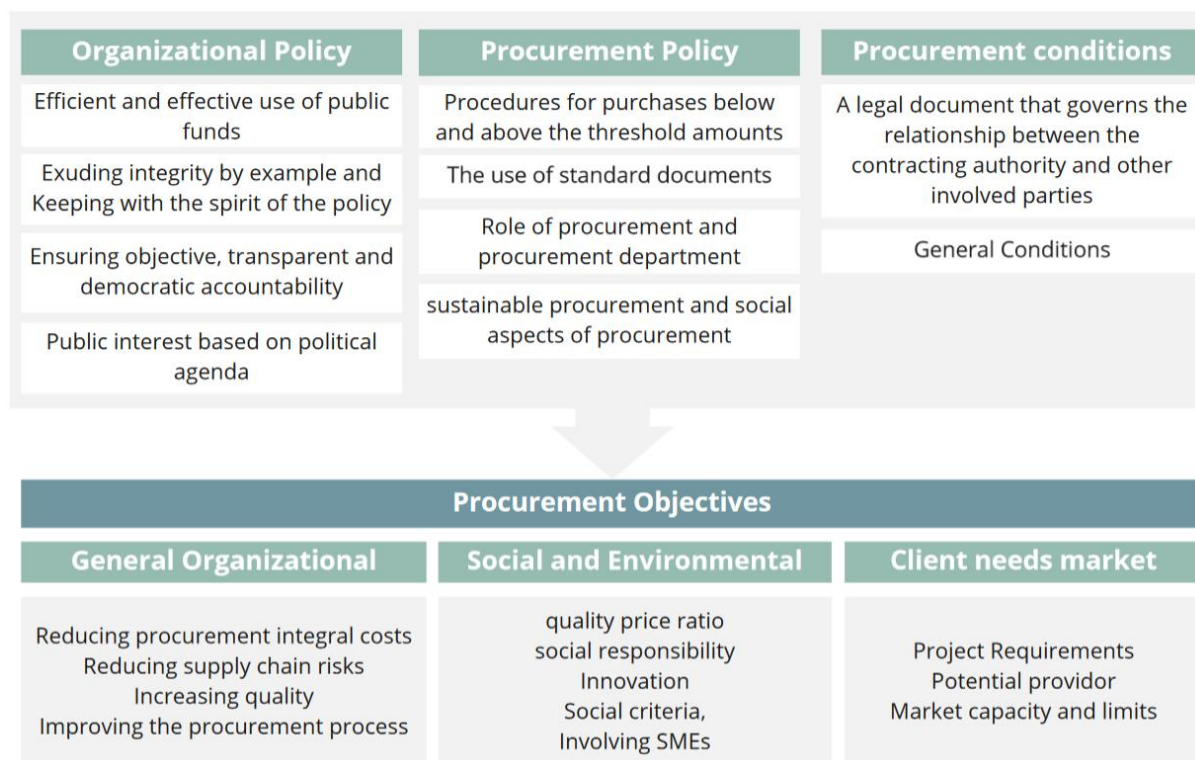


Figure 8 Procurement Objectives (self-made)

The Dutch government presented the latest SPP in January 2021 for 2021 and 2025 under the name 'Procurement with Ambition, Procurement with Impact.' The new plan is a continuation of its precedent plan. It aims to stimulate public entities to use procurement to support the goals of MVI in the fields of CO2 emissions, environmental impact, and the use of raw materials (IENW, 2021). The focus in circular procurement is to maintain the value of products and materials by putting them to optimal use in a new cycle at the end of their life cycle (PIANOo, n.d.-c).

2.2.2 Public procurement

Public procurement refers to a process the public authorities employ to purchase companies' work, supplies, or services. The contracting authority invites economic operators to make offers and select the most suitable offer to execute the public contract (Van Duren & Dorée, 2008).

In the context of this research, the offers are made by contractors, and the purchases are civil engineering projects above the threshold set by the European directive. In this paragraph, the procedural aspects of the procurement process are identified with the main focus on the tendering phases, first from the client perspective, where the tendering process and the organizational structure of the personnel involved are explained. Then from the contractor's perspective, the bidding process and the typical structure of the bidding team are outlined.

The procurement process involves three phases: Procurement preparations, going through the tendering procedure, and execution of the contract, as shown in Figure 9 Procurement phases.

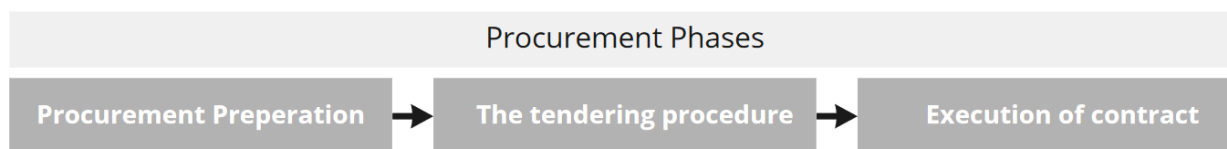


Figure 9 Procurement phases

2.2.2.1 Procurement preparations

Proper procurement preparations entail decisions over the procurement process and the assignment itself that reflect directly on the effectiveness and efficiency of the process and its outcome (Essers & Lombert, 2017). However, it is often the case that contracting authorities either underestimate the planning stage of the processor skip over it entirely (European Commission, 2018).

Defining the assignment's need is the first step the contracting authority must do once the contracting team is selected. In this step, the contracting authority justifies the procurement and outlines what the whole procurement procedure is expected to deliver and when (European Commission, 2018; PIANOO, n.d.-a).

The procurement strategy is an essential part of the preparation phase in the procurement process is to devise a well-rounded and documented procurement strategy. This strategy analyzes the market, the client's needs, organizational and procurement policies, and the procurement requirements/conditions. A procurement strategy aims to assess delivery options, approach to the market, and delivery model essential goals to maximize value and optimize project outcomes (PIANOO, n.d.-c). The contracting authority examines first the project's requirements, constraints, risks, capability, and market position. Consequently, they identify appropriate evaluation criteria and weightings and decide on the best project delivery option. Then the appropriate delivery model is selected after evaluating and comparing the different options. The contracting authority decides for a traditional or an integrated procurement model, which determines the specifications the contracting authority will provide for the assignment and the responsibilities it will take on for the execution of the contract (Essers & Lombert, 2017). The strategy requires good documentation that demonstrates the evaluations of available options and reasoning behind the decisions made throughout to maintain the transparency of the process.

Orientation through engaging the stakeholders and conducting market consultations is recommended in the preparation phase as vital factors for implementing the contract and achieving the desired result (Essers & Lombert, 2017; European Commission, 2018). Involving key stakeholders such as the customers, users, or other technically qualified stakeholders could avail their expertise in the preparation phase and help develop their sense of ownership. This supports a competent design of technical specifications as the procurement process progresses and if the need changes, from the specs formulation to monitoring the contract performance (PIANOO, n.d.-b).

Market consultations are expressly recommended to the contracting authorities to facilitate and better the procurement preparations and the procedure (European Commission, 2018). Market consultations also help the contracting authority in defining what they will buy and the according costs. Later, that reflects and raises the integrity of selection and award criteria (European Commission, 2018) with a better understanding of potential solutions available in the market and the supply chain to satisfy the need and achieve the best value for money. Thus, in the consultations, the contracting authority examines the maturity and capacity of the market, standards and conditions, contract values, selection and technical criteria, and contract performance-related risks and planning aspects. As a rule, transparency and auditability must not be compromised throughout market

consultations (Ten Haaf, 2017; van Veenen, 2018). Accordingly, all activities related to market consultations should be adequately documented and reported for all procurements (PIANOo, n.d.-d).

Finally, the execution plan and how the contracting authority plans to deliver the procurement strategy. Within the planning all governance, organizational, and procedural aspects are mapped out for the tendering process.

2.2.2.2 The tendering process

Tendering, also known as the sourcing phase, is the phase of the procurement process where specification, selection, and contracting are made (PIANOo, n.d.-b). A public procurement procedure starts when the preparation phase is completed with a public invitation to tender. European tendering is tendering following the European Union prescribed procedures. The directives of the European tendering have been transferred into the 2012 Procurement Act (PIANOo, n.d.) and are obligatory to apply when the assignment exceeds threshold amounts.

In the Netherlands, an announcement of the public contract is made electronically through the Dutch electronic platform for procurement, TenderNed. This is obliged for contracts above the European threshold (2014/24/EU art. 49) and optional for national contracts. Based on the tender documents, the contractors decide to participate. If a contractor decides to take part, he requests participation using the same mean, TenderNed. The minimum time limits for the tendering process have been reduced significantly to speed up procedures but still permit longer timeframes for cases that require it (European Commission, 2018).

The decision concerning which procedure to use in the preparation phase is critical and affects the whole procurement process (European Commission, 2018). This decision requires the contracting authority to weigh each procedure's requirements, potential, benefits, and disadvantages. According to the Aanbestedingswet (art. 2.2.1.), the contracting authority can choose between an open procedure, restricted procedure, negotiated procedures, competitive dialogue, innovation partnership, and other procedures for social and other specific services.

The open and restricted procedures remain the main types available for all sorts of public procurement (European Commission, 2018). In the context of this research, only the open, restricted, and competitive dialogue procedures are considered because they relatively follow the same process structure; check Figure 10. The tendering process could follow a restricted procedure where the contractors are invited to pre-qualify. After analyzing the prequalification data, the selected contractors are reinvited to tender. A competitive dialogue follows the same steps as the restricted procedure with an added dialogue after the re-invitation to tender and before contractors submit their bids. An open procedure is open for all contractors and begins with the submission of bids.

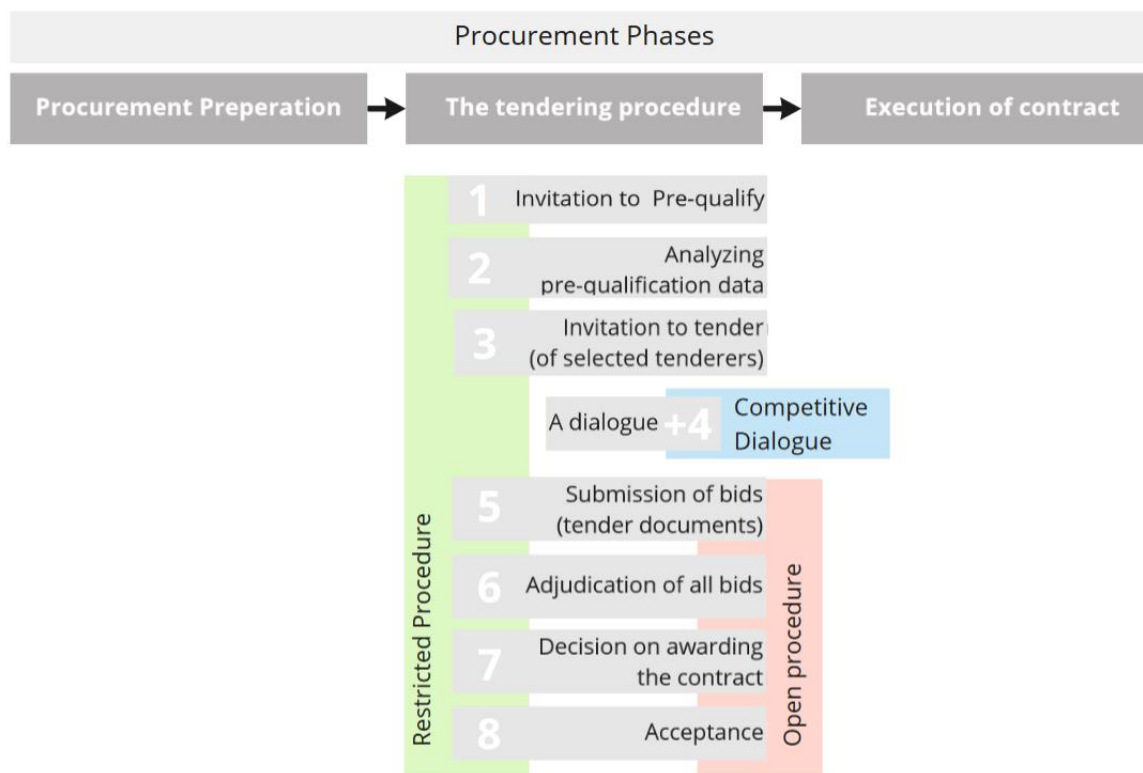


Figure 10 Tendering procedures (Self-made)

2.2.2.3 The contracting team

The first step of the procurement process is creating a procurement team. This team consists 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). Roles and responsibilities during the procurement process should be clearly defined in the operational manuals of the contracting authority (European Commission, 2018).

Typically, the contracting authority sets up a project team to carry out the procurement procedure based on core and larger working groups (European Commission, 2018). Rijkswaterstaat proposes that public assignments are carried out by an integral project team (Rijkswaterstaat, 2008, n.d.). The team is created following the Integral Project Management (IPM) structure to optimize internal and external cooperation, as can be seen in Figure 11. The IPM structure aims to clarify which tasks are assigned to project team members during all processes (Femke et al., 2008). The Contract management manages the interactions and contracts with market parties during and after the procurement phase.

Implementation of circularity in the procurement process is formally embedded in the organization by assigning and agreeing on responsibilities for different parts of the circular policy, the procurement strategy, and communication (platform 23', 2021). Wijdoogen (2020) considers implementing environmental and social ambitions and proposes seven roles to support successful implementation (Wijdoogen, 2020). Platform 23' (2021) allocates these roles for the employees involved in the public procurement of circularity: (1) network role, (2) strategic role, (3) coordinating and initiating role, (4) stimulating and connecting role, (5) mentor role, (6) innovating role, and finally, (7) monitoring role. These roles accommodate circularity requirements on the different implementation levels on the inner organizational front and with external parties.

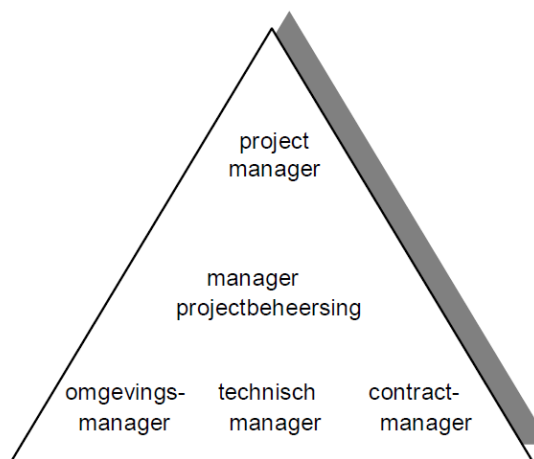


Figure 11 IPM model source: (Rijkswaterstaat, 2008)

2.2.3 Procurement principles

The four principles from the Public Procurement Act apply to circular procurement like any other procurement to safeguard competition (Rijksoverheid, 2021). Every procurement is expected to ensure the principles of non-discrimination, equal treatment, transparency, and proportionality and that the tendering procedure is soundly managed (Hoekman, 1998). To a certain level, these principles justify the public accepting that the tendering process is expensive and time-consuming (Falagario, Sciancalepore, Costantino, & Pietroforte, 2012).

Non-discrimination means that the contracting authority must offer equal opportunities to market parties without distinction based on nationality (Essers & Lombert, 2017, p. 57; Pijnacker-Hordijk, van der Bend, & Van Nouhuys, 2009).

Equal treatment means that candidates should never be favored or put at a disadvantage throughout the tender process (Essers & Lombert, 2017, p. 57; PIANOo, n.d.-b; Pijnacker-Hordijk et al., 2009), which also entails conducting the tendering procedure and awarding the contract objectively and within reason.

Transparency means that the contracting authority must ensure all aspects of the procurement are open and clear to all participating parties. This includes all the announcement documents interaction and decisions of the contracting authority, which must be well formulated, shared, and documented to safeguard this principle (Essers & Lombert, 2017; PIANOo, n.d.-b). Transparency requires that the contracting authorities provide the awarding criteria and the weights of the assessment system in advance (Essers & Lombert, 2017, p. 57; van Haagen, 2018). If the contracting authorities cannot provide the weights in advance due, for example, to the nature of the project, then they must justify their decision aptly (Aanbestedingswet, art. 2.115).

Proportionality requires setting the project's requirements to be relevant and proportionate to the nature and scope of the contract (PIANOo, n.d.-b; van Haagen, 2018). This covers the technical specifications requirements, grounds for exclusion, eligibility requirements, selection, award criteria, etc. It is also concerned with the project's scope and does not allow merging public contracts (Aanbestedingswet, art 1.5 lid 1.a).

2.2.4 Circular procurement principles

The literature and practical guidelines combine the implementation of circularity with the need for innovation and collaboration (Copper8, 2018; Nelissen et al., 2018; Padding, Croon, Haastrecht, &

Dijkstra, 2015; Rood & and Kishna, 2019). Copper8 (2018), in their guideline for circular procurement in the sector, suggests the addition of Innovation and Collaboration as principles of circular procurement (Copper8, 2018). Combining innovation such as new product design, technologies, and business models with any of the circularity strategies of the R ladder in the early stages of the design creates the most significant environmental benefits (Rood & and Kishna, 2019). The significance of including innovation stems from the relatively short period of applying circular principles and the absence of standards to its applications (Platform CB'23, 2021). At the same time, a collaboration between all chain partners is essential to ensure circularity over the long-life cycle of circular projects. It also promotes the required innovation to realize circularity established by previous experiences (Adetunji, Price, & Fleming, 2008; Copper8, 2018; Nelissen et al., 2018; Padding et al., 2015; Pomponi & Moncaster, 2017). The methods to make the process more innovation or collaboration friendly align with the methods to make the procurement more circular.

The methods employed to stimulate innovation in procurement depend on the type of the procurement strategy (Lenderink et al., 2018) and include innovation-oriented specification and awarding criteria in the procurement (Demand-side Innovation Policies, 2011). Lenderink, Voordijk, & Halman (2019) identify market consultations, specifying functional requirements, allowing alternatives, and awarding based on BPQR or LC with high-quality standards as the methods to favor innovation (Lenderink, Voordijk, & Halman, 2019). Procurement procedures that provide possibilities for negotiations with suppliers include the competitive dialogue and negotiation Procedures. Competitive procedures are negotiated and are based on a first tender offer which requires the contracting authority to provide more elaborate explanations of the need and requirements than in a competitive dialogue (Lenderink et al., 2019).

2.2.5 Circularity inclusion in the tendering process

In practical guides of circular procurement, it is recommended to integrate circularity in existing procurement practices and systems (European Commission, 2017a). Identifying the critical points of a typical procurement process pairs them with circular procurement principles and practices that fit the best. Circular procurement is not a particular procurement process; it is a typical procurement process that includes circular considerations to achieve circular ambitions in the procurement of the assignment over its life cycle.

2.2.5.1 Need definition

The organizational policy's environmental and social ambitions could be included in the need definition following the contracting authority's needs, the market situation, and project-specific needs. The contracting authority looks beyond the actual need of the civil engineering project when defining the need and includes organizational policy and ambitions (Antea Group & Metabolic, n.d.; van Haagen, 2018). Consequently, the strategy looks beyond the organizational values of efficiency, effectiveness, fairness, competition, and accountability that the public procurement is required to achieve and considers other environmental and social public values (Nurmandi & Jovita, 2017). Thus, circular objectives in the project as a translation of the circular ambition in the procurement policy occur in the assignment's need definition (Antea Group & Metabolic, n.d.).

2.2.5.2 Specifications

The need of the contracting authority of the outsourced assignment is translated into requirements and wishes, called specifications, that determine if and how the bidding contractors can satisfy the needs of the contracting authorities (Aanbestedingswet 2012 art. 2.75). The circular requirements can be described in technical or functional terms in the "schedule of requirements," the "specifications" in tender documents, or "descriptive" documents of the tender. However, functional specs or other

variations might provide the contractors with more flexibility to come up with circular solutions (Chao-Duivis, 2018). The specification could also include a prescription of any special performance conditions or social requirements the contracting authority wishes to impose on the bidders according to circular principles. Which enables specifying requirements over the life cycle of the project: construction, operation, termination, demolition, disposal, and any extended life cycles (Padding et al., 2015).

The formulation of the circular specifications must comply with the procurement principles (Aanbestedingswet 2012 art. 2.75 lid 6). Thus, the contracting authority must ensure that the specifications are appropriate to the project, transparent, and non-discriminating. They also must enable equal access to contractors without unreasonably hampering competition. The contracting authority could use various types to encourage competition and innovation if the specifications are still proportionate to the assignment and compatible with the awarding criteria (Essers & Lombert, 2017, p. 228). The European court of justice indicated that contracting authorities must formulate the specifications of a contract in a clear, precise, and unambiguous manner so that all well informed and reasonably observant bidders can understand the exact scope of the contract and interpret it in the same way, and the contracting authority can verify that bids comply with the assignment's specifications.

Technical and functional requirements

Technical requirements provide detailed descriptions of the assignment required, e.g., dimensions, properties, or required norm. The contracting authority formulates technical specifications by referring, for example, to technical specifications, national, European, and international standards. Always 'or equivalent' to create room for any alternative solutions that meet the specifications.

While functional requirements, also termed performance-based, describe the intended function or performance of the assignment required. Functional requirements provide fewer details and more room for the contractors to employ their expertise and knowledge to devise their bids. The contractors describe how their bid will achieve the result and quote a price for it.

Providing detailed technical specifications demands a great deal of time and therefore costs. It also leaves no room for innovative solutions. Assessing the bids, however, is relatively simple. Drawing up a functional specification is relative to the problem at hand. Assessment, however, takes much time and can be complicated. It also requires an objectively verifiable assessment framework to compare bids.

In practice, the functional specification is often chosen to challenge the market to develop creative/innovative solutions or when it is difficult to specify the contract technically. With functional specifications, less detailed requirements are set for how (potential) contractors shape the contract. This gives the contractor more responsibility. The difference between technical and functional specifications is reflected in the formulation of the question. In the functional specification, this is not yet specified in a product but in a problem that needs a solution.

2.2.5.3 Pre-selection (Restricting bidders)

The contracting authority formulates grounds for exclusion and minimum suitability requirements. If the tendering procedure includes prequalification, the contracting authority forms selection criteria to select the most suitable contractors that satisfy the minimum suitability requirements. These criteria relate to the individual situation of the contractor, assessing the bidders and not the bids (Essers & Lombert, 2017, p. 229). This allows the contracting authority to assess the contractor's suitability and weed out the unsuitable ones for capacity, financial standing, or relevant experience (Keyser, 2014).

Circular aspects can affect the exclusion grounds and take part in minimum suitability requirements and circular Selection Criteria. In smaller projects or due to exceptional circumstances, the contracting authority could invite the contractors to bid and then ask for documents to prove their eligibility and suitability.

(Minimum) suitability requirements

The requirement must always be proportionate, non-discriminatory, and sufficiently connected with the procured assignment. Circular aspects can take part in the suitability requirements (Ten Haaf, 2017, p. 108; van Veenen, 2018). However, it is difficult to prove at that stage that contractors comply with technical capability requirements related to circularity (Chao-Duivis, 2018), which constrains the use of circular-related restrictions.

Selection criteria

If there are more eligible contractors than the contracting authority wishes to invite to tender, they can reduce the number by utilizing objective and non-discriminatory selection criteria. These Criteria can also be employed if bidding requires more than the average effort from the market. The same restriction of circular suitability requirements applies to employing circular selection criteria. Still, the contracting authority employs circular selection criteria such as reference projects that employed circularity or circular visions (van Haagen, 2018). The criteria could indicate financial and economic standing and/or technical and professional competence of bidders. In terms of content, the selection criteria are often an extension of minimum suitability requirements. They could also refer to the number and quality of references.

2.2.5.4 Awarding criteria

Including sub-award criteria is a potential method to implement circularity in the procurement of civil engineering projects (Ten Haaf, 2017, p. 108; van Veenen, 2018)

The Aanbestedingswet 2012 obligates the contracting authority to formulate the assessment framework and the awarding criteria in a manner that allows objective comparability among the bids and determines which bid is the economically most advantageous tender (EMAT) (European Commission, 2018; PIANOo, n.d.-a). This method assesses quality and price in the tenders to motivate contractors to offer more value than the minimum required. Later in 2016, the EMAT was amended to include three types of award criteria Best Price quality ratio, Lowest cost based on cost-effectiveness (lifecycle), and lowest price.

The Aanbestedingswet 2012 also obligates that awarding should be based on the best price-quality ratio (BPQR) unless the contracting authority can justify using the lowest price or the lowest costs based on cost-effectiveness. The justification follows individual cases. For example, if the minimum quality is sufficient and determinable, the priority shifts to reducing costs. Awarding based on the lowest price means that the lowest-priced bid that complies with suitability (qualifications) requirements are awarded the contract (PIANOo, n.d.-b).

The contracting authority is obligated to ensure that circular awarding criteria are suitable for the assignment and comply with the procurement principles of transparency, non-discrimination, and equal treatment (Chao-Duivis, 2018). The assessment technique and the awarding criteria should be formulated to reasonably clear which awarding criteria should be fulfilled by the candidates. The offers should be assessed objectively, and the contracting authority should motivate the awarding of the contract in such a way that it is traceable how the offers are assessed and why a certain score is given (Ten Haaf, 2017; van Veenen, 2018).

Lowest costs based on cost-effectiveness

An example of the lowest costs based on cost-effectiveness is the life cycle costs (LCC), where costs related to operation, maintenance, and disposal are included.

This means the contracting authorities look beyond the *short-term needs and consider the long-term impact of the purchase* (European Commission, 2017a), which makes life cycle costs (LCC) especially relevant to circularity principles (Chao-Duivis, 2018) because it can be employed to address costs of environmental aspects following the life cycle of the raw materials. However, these aspects must be reasonably monetized and assessed, and the 'what' and 'how' of the LCC aspects assessed must be specified in advance (Essers & Lombert, 2017, p. 287).

The best price-quality ratio (BPQR)

In the best price-quality ratio (BPQR), the contracting authority could include sub-award criteria for environmental and innovative aspects additional to the price, including circularity (van Veenen, 2018). These sub-criteria are scored and considered with the price in the assessment. The weights of the scores between qualitative aspect and price in each criterion are determined and justified by the contracting authorities.

The effectiveness of the criteria in implementing qualitative aspects requires the contracting authority to give quality aspects significant enough weight to alter the assessment (Chao-Duivis, 2018, p. 13). Van Hagen (2018) recommends around 70% of weight to quality aspects to stimulate contractors to offer innovative circular solutions (van Haagen, 2018). As a result, contractors cannot ignore the qualitative aspects and rely solely on low price. Moreover, the qualitative aspects will create a desirable room for the contractors to distinguish their offers and create a competitive advantage.

The contracting authority could determine the maximum they are willing to pay based on estimating the project costs as a price ceiling within BPQR (Aanbestedingswet art. 2.28 sub-4). The price ceiling clarifies the contracting authorities' expectations overprice for the contractors (Van de Rijt & Santema, 2013) and shifts the focus to technical and functional requirements.

The central government has developed an annually updated list of SRP criteria based on the European criteria (GPP). Circularity is one of the main themes of SRP as a policy priority. The contracting authority is obligated to include the core criteria and can choose to include other comprehensive criteria for individual assignments. The awarding criteria proposed for the construction sector are proposed for all stages of the projects' life cycle, such as design, construction, operation, and decommissioning stages. The criteria can be employed in the tenders of new projects and repair and maintenance assignments.

These ready sets intend to make implementing environmental policy ambition in the criteria easier for contracting authorities (PIANOO, n.d.-c). This follows the objectives of the GPP on the European level and makes it advantageous to use standard criteria to prevent restrictions of competition due to diversification (Kozik, 2014; Pouikli, 2021). However, contracting authorities still must choose based on their level of ambition and individual assignment situations. Accordingly, the contracting authority selects the awarding criteria and adapt or specifies them as necessary. Then they determine their weights and required verification.

2.2.6 The bidding process

Bid, tender, and proposal are all used interchangeably to describe the act of formally presenting an offer duly made in writing by one party to another party (most likely a public entity) at an inclusive price or rate to supply or purchase goods (Nickson, 2012). The bidding process has a limited lifecycle and follows part of the procurement process. The process begins with the decision to bid and is concluded with awarding the winning bid. Bidding aims to define the contractor's offer and convince the client to accept it (Nickson, 2012). Both goals necessitate that the contractor is aware of the proposal's context: for whom the offer is being made and for what assignment.

Nickson (2012) identifies Quality, Technical, Management, Projects, Human Resources, Implementation, Finance, Sales, and legal contexts in every proposal. Each context is a specialization that has its own cultures and approaches, and the success of the proposal requires integrating all contexts into a single, compelling story if the bid is to succeed. Availing the required resources to complete the bid is critical (Nickson, 2012).

Contractors use their market knowledge and network to support their bids (Nickson, 2012). This is accomplished by being aware of bids and their context as early as possible, anticipating and tracking trends in the market, and becoming a pioneer in gaining the knowledge, expertise, and resources sought after.

A basic simple process of bidding is initiated after the client issues the Requirements. The contractor reviews the opportunity and examines the requirement internally. Based on this review, the decision to bid or not is taken. If the contractor decides to bid, the first step is allocating and planning resources and assigning tasks. The selected team proceeds to present drafts that will be reviewed internally, and if possible, the client's input is requested. The drafts are reviewed and optimized until a final proposal is reached. Produced for submission and finally submitted. The activities of this process are parallel for the different contexts of the project (a written proposal, costing or pricing, technical design). The driving element in the bidding process is the management of time (Nickson, 2012). The required time for activities in the process and the number of iterations depend on the project. In Figure 12 a simple bidding process is visualized.

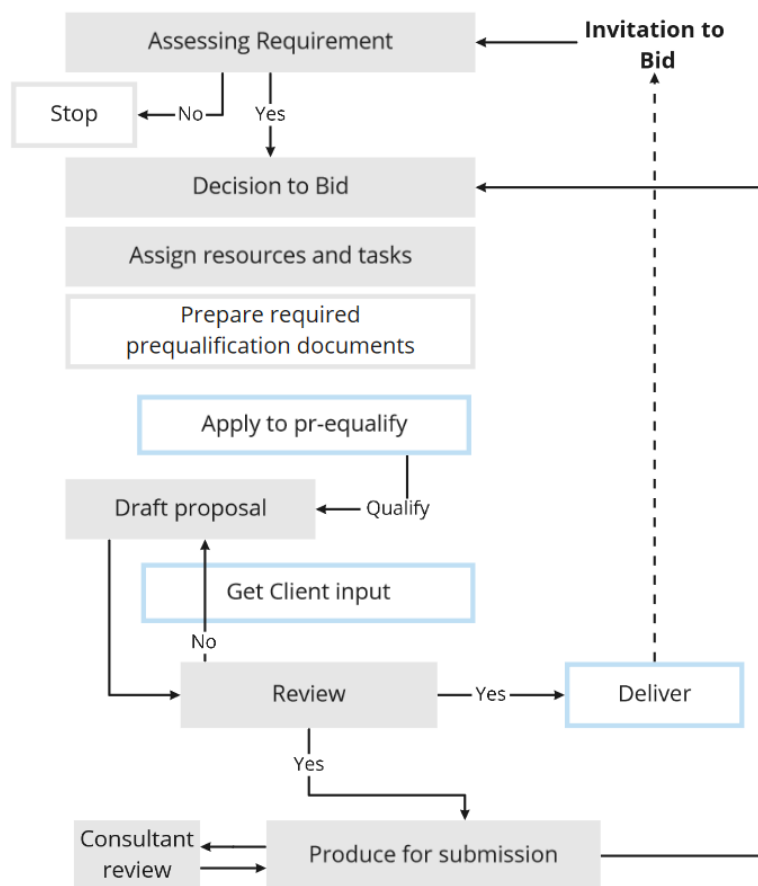


Figure 12 A simple Bid Process based on Nickson (2012).

2.2.6.1 The decision to Bid.

In his presentation of the principals to win every tender, Keyser (2014) puts pre-qualifying every opportunity as the first principle contractors must fulfill (Keyser, 2014). When a contractor assesses the assignment at hand, they decide to respond to an Invitation to Tender or Request for Proposal or not, the bid/no-bid decision. In the analysis, the contractor conducts an 'opportunity analysis' or 'cost-benefit analysis' and looks at aspects such as cost of the bid, use of resources, time frame and management time, effect on ongoing assignments, or potential opportunities. Those aspects are compared to the potential benefits of winning the tender and delivering the contract while keeping the potential of losing the tender in the equation (Keyser, 2014).

2.2.6.2 Building Circular

Adopting circular principles changes the conceptual approach to design and conceive civil engineering assignments by optimizing system performance by employing concepts to prolong components' lifespan, designing modular systems, and the off-site production of the elements (Nasir, Genovese, Acquaye, Koh, & Yamoah, 2017). For the circular economy to deliver its potential in the construction and infrastructure industry, changes in the value chain at all stages are required. This means a long-term view of the assignment must be adopted with the inclusion of designers, developers, engineering professionals, and all other involved stakeholders must be invested and interested in maintaining the value and supporting the circular loops (Mangialardo & Micelli, 2018).

The circular model is conditional to the feasibility and economic efficiency of the processes, which requires quality improvements and cost reductions in the design and management of structures and systems (Mangialardo & Micelli, 2018). Technically this necessitates the use of intelligent and higher-performance materials and technologies such as new management systems, BIM tools, automated operation and maintenance systems, 3D printing ...etc. In financial terms, when examining the economic benefits of the circular model applied to the construction industry in linear and circular models in terms of the revenues and the costs in a long-term view, the expectations of circular projects to extend the lifecycle and preserve value compared with linear projects that are concluded by demolition and disposal of materials are significant (Cheshire, 2019).

2.3 ISSUES OF CIRCULARITY IMPLEMENTATION

Implementation research indicates a frequent conflict between government policy objectives and ground-level reality (Annor & Allen, 2009). The nature of assignments in the construction and infrastructure sector and its agencies makes it even more susceptible to fragmentation in implementation (Maud, Gajendran, & Brewer, 2018).

The potential of implementation research stems from the wide range of areas that could be examined in the implementation process to identify the barriers and the issues and provide mechanisms to improve future implementation activities (DeGroff & Cargo, 2009; Nilsen, Ståhl, Roback, & Cairney, 2013). First by identifying whether the gap between the policy and the outcome is due to the implementation itself, and then accordingly, by identifying where things are going wrong in the policy process and the barriers to achieving optimal outcomes (DeGroff & Cargo, 2009; Kendal, 2010; Pressman & Wildavsky, 1984).

Identifying the barriers and their impact on the transition to CE is essential because it helps prioritize corresponding actions to 'enable' better policy implementation and address those barriers. Academic literature usually uses an objective approach to identify the barriers and enablers by using consultations and systematic reviews of published study cases (Hart, Adams, Giesekam, Densley Tingley, & Pomponi, 2019). Many papers over CE implementation investigate the barriers to its progress. These papers follow the assumption that removing or bypassing these barriers will push the

transition forward. Consequently, enabling actions 'enablers' to support these efforts and the transition must be implemented. On the other hand, papers from the industry focus more on identifying lessons from the study cases or presenting manifestos for CE and just terming the barriers and enablers (Hart et al., 2019).

2.3.1 Issues categorization

In identifying issues that hinder or prevent the implementation of environmental policy ambitions in practice, the literature presents frameworks to identify failure causes and barriers to implementation and preconditions to minimize their impact. In the context of implementation fidelity within this research, it is particularly of interest to identify the cause behind the issues. Howes et al. (2017), in their review of potential causes behind environmental policies failing to meet their ambition, categorize the causes into structural causes, implementation traps, or knowledge/scope issues. Interrelated structural causes are overarching factors that prevent successful outcomes from being achieved in a combination of economic, social, environmental, political, technical, legal, and discursive factors (Howes et al., 2017). While implementation traps have been identified in environmental policy handbooks to incorporate all causes that manifest during the implementation process (Althaus, Bridgman, & Davis, 2020; Howes et al., 2017; Kamieniecki & Kraft, 2012). Lastly, issues in knowledge or scoping relate to theory failure (C. Patton, Sawicki, & Clark, 2012) with insufficient or poor understanding of the policy issue, which leads to a narrow or not appropriately targeted use of policy instruments (Howes et al., 2017).

This categorization is employed in this research to differentiate issues within the tendering process into, first structural causes, case-related issues that impact individual cases due to the nature and context of the assignment being tendered. Secondly, implementation traps are implementation-related issues that manifest during the process due to the decisions and practices in the design and management of the tendering process and policy operationalization in the procurement. Third, knowledge and scoping, circularity-related issues due to the current theory, understanding, and appropriateness of circular instruments and strategies in the sector.

2.3.2 Issues Identification

Hogwood and Gunn (1984) approach implementation issues from a distinct perspective, identifying ten preconditions for optimal policy implementation (Hogwood & Gunn, 1984). The working assumption is that perfect implementation is unattainable, but implementing without considering these preconditions negatively affects the implementation phase (Hordern, 2013; Maund et al., 2018). The framework devised by Hogwood and Gunn (1984) have been used in policy implementation studies to identify the shortfalls of policy implementation, enable deeper understanding to explain misalignment between the policy intent and the outcome of implementation (Hordern, 2013), and to aid strategy development to improve outcomes by outlining barriers (Ditlopo, Blaauw, Rispel, Thomas, & Bidwell, 2013).

For this research, issue identification and categorization will be based on the issues and categories proposed by Howes et al. (2017), and the key issues identified by Hogwood and Gunn (1984) with the addition made by Maund et al. (2018), check Figure 13 Potential issues of circularity implementation in the procurement process. The framework will discuss the barriers identified in the literature over the procurement of circularity in the building and construction sector.

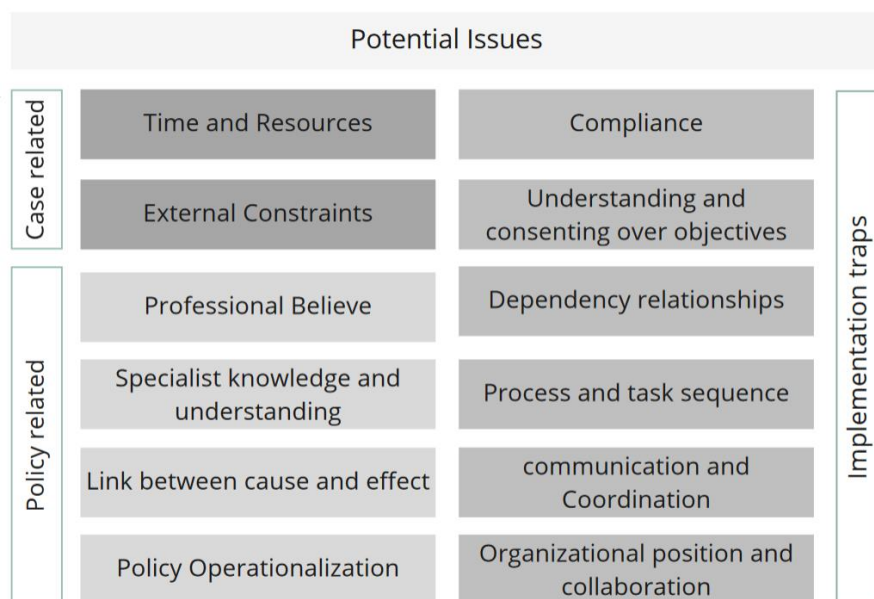


Figure 13 Potential issues of circularity implementation in the procurement process

2.3.2.1 Structural causes: External constraints

This includes organizational, legal, social, political, technical, financial, and other discursive causes that stand to affect the whole process; the literature recognizes that these structural causes are interrelated and are usually identified in combination (Howes et al., 2017).

Organizational accreditation of quality standards or conformity is understood and practiced in a manner that distracts from sound practices, prioritizing complying with accreditation standards rather than a context-specific application of policy (Maund et al., 2018).

The transition from linear to circular approaches without risking the financial and marketing values is fundamental (Iacovidou, Hahladakis, & Purnell, 2021; Schandl et al., 2015). Some of the barriers identified to implementing circularity in the sector are attributed to environmental and economic domains of value (Ghisellini et al., 2016). Market-related issues, such as favoring of economic outcomes over environmental sustainability (Howes et al., 2017), or lack of market instruments, and economic markets themselves inhibited the ability to address environmental issues (Fieldman, 2014; Howes et al., 2017; Phelan, McGee, & Gordon, 2012). Circular economy-related issues such as the supply chain management challenges and the fragmented supply chain (Govindan & Hasanagic, 2018; Korhonen, Nuur, Feldmann, & Birkie, 2018; Velenturf & Purnell, 2017); an unclear business model and financial case; and a lack of incentives to implement the circular economy in building projects (Adams, Osmani, Thorpe, & Hobbs, 2017). Economic hindering constraints include volatile prices and a lack of market competition (Campbell-Johnston, Calisto Friant, Thapa, Lakerveld, & Vermeulen, 2020).

Obstructions to promoting innovation still exist in the law, and frameworks to stimulate innovation should become more critical (Dijksma & Kamp, 2016). The current legal frameworks have been modeled to accommodate linear economy models per field. They do not allow cooperation between different areas for waste streams, leading to an accumulation of obligations and compliance costs (Mohamed, 2021). Alternatively, having legal frameworks that obligate full circularity for emissions will stimulate the innovation of circular materials and techniques. The legislation should accommodate the space needed for the principles of circularity (Dijksma & Kamp, 2016).

The literature identifies the limited knowledge and awareness among stakeholders of circularity as a barrier to its implementation at a project level and its underperformance when implemented (Adams, Osmani, Thorpe, & Hobbs, 2017).

2.3.2.2 Structural cause: Time and resources

When an organization is under-resourced or pressured for time, this would create a passive regulation practice (Maund et al., 2018). Issues arise when there is a lack of dedicated funding, time, or other resources to the policy ambition (Howes et al., 2017).

2.3.2.3 Implementation trap: Compliance

As an authority, the regulator can demand perfect compliance; however, in reality, they are often unable to confirm due to procedural or technical reasons (Maund et al., 2018). Public procurement promotes circularity and encourages market parties to support its implementation. Still, this is hindered by financial and market uncertainties or organizational issues such as transparency and the lack of adequate compliance control (Campbell-Johnston et al., 2020). Considering these constraints to increase the efficiency of the interventions further complicates the already complex decision-making processes of CE transitions (Iacovidou et al., 2021; Millward-Hopkins & Purnell, 2019).

This transition at a project level is characterized by complexity and uncertainty, which requires policy-making based on long-term thinking; considering multiple domains and actors at different scales; focusing on learning through experience; fostering system innovation and system improvement; avoiding lock-in, and keeping options open (Martin Geissdoerfer, Morioka, Carvalho, & Evans, 2018; Rotmans, Kemp, & Asselt, 2001).

Issues arise when the incentives are insufficient, whether for the contracting authority personnel to implement as a result of either a lack of official accountability or lack of public demand for action (Ashford & Hall, 2011; Howes et al., 2017) or for the contractors to ensure compliance because the inclusion of the policy ambition fails to formulate sufficient financial incentives to achieve the desired outcomes (Howes et al., 2017).

2.3.2.4 Implementation trap: Dependency relationship

This involves issues of dependency that hinder the implementation process by creating reliance and division (Maund et al., 2018). This dependency could exist between the same organization, between different parties involved, and between parties involved at different stages of the process. For example, when practitioners rely on other colleagues and parties for policy interpretation and methods of action or to move from one stage of the process to another.

2.3.2.5 Implementation trap: Model and procedure

Maund et al. (2018) identify sequencing and task fluidity as impactful areas. Issues arise when compliance with a sequencing structure is not aligned with the required activities (Maund et al., 2018). The tendering process is well structured; however, the choice of the procurement model and the tendering procedure determines the task sequence and governs the assigned responsibilities and the interactions going into the process and until the completion of the procurement. Considering the costs, risks, and potential benefits to the contractor with every tender, just like the contracting authority, a failed procurement is an undesirable outcome. However, a rising number of failing procurement processes has been recently noted in the Dutch building industry (De Leeuw, 2018) and a decrease in the number of received bids to procurements (Koenen, 2018). A procurement fails due to, for example, mistakes in tender documents, the number of participating contractors being lower than anticipated, and budget-related issues when the bids are offered (Slockers, 2019). Moreover, a

connection is made between the delivery models and awarding frameworks with the workload of bidding and, consequently, the decision to bid (Slockers, 2019).

2.3.2.6 Implementation trap: Organizational position and collaboration

In any policy implementation, acknowledging professional positions and fostering collaborative relationships reduces fragmentation and conflict and assists in achieving sound environmental management practices and policy intent (Maund et al., 2018). Research on policy implementation has identified policymakers' incomprehension of implementation difficulties, such as interrelated agencies, interests, and required collaborations, as a factor to poor implementation and policy implementation failures (Pressman & Wildavsky, 1984). In the context of procuring circularity, this is even more relevant when the stimulation of collaboration between different departments of the contracting authority and with the contractors and other relevant actors in the chain is considered one of the process principles (Malinauskaite et al., 2017).

2.3.2.7 Implementation trap: Communication and Coordination

Issues related to communication and coordination within the tendering process could exist internally within the contracting authority or between the involved parties. The procurement process is governed by legal and organizational directives that govern these interactions as part of the process integrity. Possible issues include accessing information, exchanging knowledge, documenting interactions (Maund et al., 2018), and conflicting directives (Howes et al., 2017).

2.3.2.8 Implementation trap: Understanding and consenting over objectives

These issues include lack of concurrence by agents over objectives, lack of understanding of policy objectives and intent, and incomplete specifications (Howes et al., 2017; Maund et al., 2018). Ambiguity or presenting the policy ambition in a manner that enables choice of practice creates disparity and negatively impacts outcomes (Maund et al., 2018). Moreover, it makes policy goals too vague or broad to be converted into actions (Meehan & Bryde, 2011; Voisey & O'Riordan, 1997; Yanarella & Bartilow, 2000; Zhang & Liang, 2012).

The literature considers the varied and sometimes contested approaches to implement circularity principles by the multiple stakeholders involved in the value chain as one of the main barriers to its implementation (Mayer et al., 2018). This, in turn, could be attributed to the absence of an established accepted definition of CE (Corona, Shen, Reike, Rosales Carreón, & Worrell, 2019; Mayer et al., 2018). Achieving commonly approved objectives could be done using different paths, measures, and activities (Geels, 2004). In the procurement process, the contracting authority is tasked with presenting their objectives and their translation of the circular ambition for the assignment.

2.3.2.9 Policy related: Professional belief.

These manifest in individual values and perspectives of other professionals, collaborative partnerships, and professional respect. Fragmentation between professionals could negatively impact implementation activities (Maund et al., 2018). Although the need to become more circular in the sector is well established, the circular economy is a contested concept with competing interpretations at different social, ecological, and political levels (Calisto Friant, Vermeulen, & Salomone, 2020).

2.3.2.10 Policy related: Specialist knowledge and understanding

These issues are related to the specialists responsible for regulating policy implementation, obtaining and maintaining specialist knowledge, and understanding policy-related issues (Maund et al., 2018). The circular is a slow, complex, non-linear process that follows interrelated changes at different levels (Geels, 2019). These changes are not consistent in their progress and usually face hindering barriers, making understanding the transition integral for its governance and success.

2.3.2.11 Policy related: Link between cause and effect

Cause and effect in environmental policy implementation have a non-linear relationship, introducing inconsistency and ineffective practices and contributing to a flawed policy cycle and implementation process (Maund et al., 2018).

Strategies that aim to support circularity interventions are formulated at different levels and scales, namely, macro, meso, and micro (Kirchherr et al., 2017; Moraga et al., 2019). Ambitions and strategies at higher levels are too broad and usually produce targets (Morseletto, 2019), ignoring impactful specifics of the implementation (Iacovidou & Lovat, 2021; Lonca, Muggéo, Imbeault-Tétréault, Bernard, & Margni, 2018). These targets (ambition targets at higher levels) are directives and action motivators and meeting these targets require the commitment of the stakeholders involved, and their delivery is monitored via a practical and measurable means (Akenji, Bengtsson, Bleischwitz, Tukker, & Schandl, 2016; Morseletto, 2019). Which, even when met, provide an illusion of the system's overall circularity (Iacovidou et al., 2021). Not to mention the political perception of the policy added value, which is always negotiated within the democratic polity (Stoker, 2006).

A growing body of literature is devoted to the CE and other related concepts (Hart et al., 2019). Nevertheless, many papers on the CE and its definition inconsistently consider environmental, economic, and social dimensions (Kirchherr et al., 2017). Furthermore, principal concepts in the definition of circularity such as life cycle and resources are still lacking. There is a need for established knowledge and a consensus over what resources are and their pathways in different cycles, which is lacking due to the different perceptions of human behavior, socio-economic aspects, and socio-technical regimes (Iacovidou, Martin, & Jobling, 2020) and the understanding of the specificities of the resources and their flows and transformations in the systems (Iacovidou, Velenturf, & Purnell, 2018).

2.3.2.12 Policy related: Operationalization

Operationalization moves beyond the objectives and considers the need to understand policy intent and operation (Maund et al., 2018). This is where the critical link between policy, the regulatory environment, intent, and functionality, is shaped.

Projects in the construction and infrastructure sector are characterized by a long lifespan, many stakeholders, complex component constitution, and interrelated ancillary materials, all of which interact dynamically spatially and throughout the life cycle (Hart et al., 2019). It depends on raw materials and generally does not design structures to be dismantlable or demountable structures (McDonough & Braungart, 2021). This creates siloed thinking where the efforts are fragmented between initiatives at the sector level or by different public entities at a specific stage in the value chain or targeting a particular group of stakeholders (Williams, 2019).

There are many unknown risks of the practical application of circularity to the ecosystem and human well-being. These risks could be related to untested systems and innovations, errors in management, and estimations for the loops and resource recovery (Iacovidou et al., 2021). Other unknown risks are the results of the long lifespan of the structures. These structures could undergo unpredicted but significant changes in form and function during their lifetime, making them difficult to predict. This uncertainty is underpinned by the uniqueness of assignments in the sector and the array of stakeholders involved in each project, which leaves less room for standardization and results in different solutions to fulfill the needs of individual assignments (Mohamed, 2021). An example is presented over the reliance upon one document or one source of assessment, which creates false indicators, and policy implementation becomes questionable.

2.4 PHASE ONE SUMMARY

In the first two sections of this phase, the circular ambition and how it is translated into the procurement process is examined, then the inclusion of circularity in the process is thoroughly discussed. Making the following conclusions:

- Circular procurement is any procurement where a circular impact is a criterion in the assignment. The directives to include circularity from a national to an organizational level are translated through organizational and procurement policies.
- Including circularity in the procurement process is done by many strategies at multiple levels. The circularity level in the assignment depends on how many strategies are put to action to achieve a circular impact. This inclusion requires attention to interrelated consequences of strategies on each other, throughout the lifecycle, and through the production chain.
- Decisions over the assignment, what and how circularity is included are made in the preparation phase in a process that considers all-encompassing factors to project delivery. An orientation could inform this decision of the market and market parties.
- The tendering process is defined by the outcome of the preparation phase and governed based on the selected procedure. Within the tendering process, four methods are employed to include circularity, inclusion through the need definition, the specifications, the awarding framework, and as a consideration or an aspect to restrict bidders. The process and all conduct and interactions are restricted by procurement principles to safeguard process integrity and sustainable competition in the market.
- The need definition defines the circular ambition level expected of the assignment and how the contracting authority implements it. It also describes how the process will be conducted. The specifications, be it technical or functional, could include circular requirements directly or impact its implementation by availing room for circular solutions. Restricting bidders could be done by requiring eligibility or preselection criteria related to experience with circularity, innovation, and collaborative contracting; or plans and ambition of circular nature. In smaller projects, the contracting authority could invite the contractors to bid. The awarding criteria could include circular qualitative aspects in cost-effectiveness or best price-quality ratio where the weight of the criteria determines its impact. It is also possible to set the budget of the assignment and award based only on qualitative aspects.

In the last section of the phase, the issues facing the implementation of circularity. Using the expanded framework of Maund et al. (2018), a distinction can be made between the type of issues that could face policy implementation in the sector; between issues that could be specific to the project, the organization, or the individual implementation of the tendering process itself, and issues that are inherent to circularity, the sector, or procurement. This distinction of issues will be employed within this research in 3.2.6, Issues concerning the dimensions, to assess the fidelity implementation assessment by connecting the issues to the fidelity dimensions, which present a similar distinction between the issues that face intervention.

The findings of this phase will be revisited in phase four to examine the findings of the cross-case analysis.



3 PHASE TWO | Implementation fidelity framework construct

This chapter provides background to some fundamental concepts with relevance to this research. The first section aims to answer the second sub-question: *How is the efficacy of implementation assessed?* It defines implementation fidelity, its dimensions, and other relevant aspects to implementation studies and introduces the conceptual framework of its assessment. The second section aims to answer the third sub-question of the research: *What is implementation fidelity for circularity procurement methods?* It proposes an assessment framework for the methods to implement circularity in procurement and sets the assessment approach.

3.1 CONCEPTUAL FRAMEWORK OF IMPLEMENTATION FIDELITY

It is quite intuitive to assume that poorly implemented interventions do not realize their expected impact. However, it is still possible that effectively implemented interventions fail to produce satisfactory results due to a loss of efficacy during the implementation process or lack of practical impact inherent to the intervention itself. When interventions are applied, the assumption is that prescribed and theorized results can be replicated. However, that is not always the case; when the implementation occurs in complex, diverse contexts, it loses impact and applicability.

3.1.1 Definition

Implementation science focuses on examining the processes and components to understand their transition to real-world settings (Bhattacharyya et al., 2009). Implementation fidelity is defined as the degree or extent to which an intervention, program, or procedure is conducted, applied, and implemented as prescribed by its developers (Carroll et al., 2007; JBA, 2009; Mowbray et al., 2003). The literature defines implementation fidelity in five dimensions (Carroll et al., 2007; Durlak, 1998): adherence; exposure or coverage; quality of delivery; participant responsiveness; and program differentiation.

3.1.2 Objectives

A comprehensive implementation of an intervention requires identifying the desirable outcome, which defines undesirable outcomes and helps estimate the required efforts to generate the desired outcomes. This is fundamental for political-technical decision-making to avoid investing resources in a faulty implementation of interventions, leading to the same results as employing ineffective interventions (Durlak, 2015).

Implementation studies analyze the execution of an intervention by involving the social contexts in which the implementation takes place and the technical resources and organizational conditions that support it. These studies are motivated by recognizing that collaborative efforts are needed to improve the likelihood that theorized results are taken up (Bauer et al., 2015; Naom et al., 2005). To obtain results from interventions, it is vital to adopt an analysis and assessment approach that considers and reviews empirical results, professional experience, and user characteristics in connection with the intervention.

The Implementation Fidelity Assessment (IFA) is a relatively new framework that researchers and policymakers have increasingly emphasized. The assessment attempts to provide comprehensive evaluations that respond to the need to understand the outcome of policy interventions and the processes and elements that influence the outcomes (JBA, 2009). Implementation fidelity is a core

aspect of implementation and efficacy studies. The assessment is critical to understanding how interventions or programs are implemented and transition from research to real-world settings (Fagan, Hanson, Hawkins, & Arthur, 2008; JBA, 2009). It is utilized as a moderator that examines the relationship between interventions and their intended outcome to identify the actual effort of the former on the latter (Carroll et al., 2007; JBA, 2009; Mowbray et al., 2003).

It has been demonstrated in the literature that the success of an intervention is affected by the fidelity by which it is being implemented (Carroll et al., 2007; Harachi, Abbott, Catalano, & Fleming, 1999; JBA, 2009; Mihalic, 2004). This effect requires a valid assessment to evaluate the implementation fidelity and its contribution to the outcome by discerning the intervention's actual effect (Carroll et al., 2007). In the absence of such an assessment, the reason behind the lack of impact is undeterminable (Godard, 2001). The lack of impact could be attributed to poor implementation, issues inherent to the intervention itself, or Type III error where the question and the solution are incompatible (Dobson & Cook, 1980). Moreover, the assessment evaluates whether it is possible to improve the desired outcomes due to lacking implementation and the extent of possible improvements (Carroll et al., 2007).

The assessment is also integral when an Evidence-based implementation approach is being adopted, in which the implementation in experimental cases is being generalized to comprehensive implementation (Carroll et al., 2007). Practitioners and policymakers need to understand the fidelity of an intervention to decide whether replication is viable. Otherwise, they will assume that it is being implemented as prescribed, not considering the inconsistencies of real-world applications where conditions vary and differ. In addition, a well-conducted IFA supports the overall interpretation of project findings (JBA, 2009).

When it comes to research into the intervention, creating common data on implementation supports secondary research (systematic reviews and meta-analyses) from pooling or aggregating data inappropriately compromising the credibility and utility of the research (Carroll et al., 2007).

In Figure 14, IFA objectives are bundled into practical application objectives and research objectives.

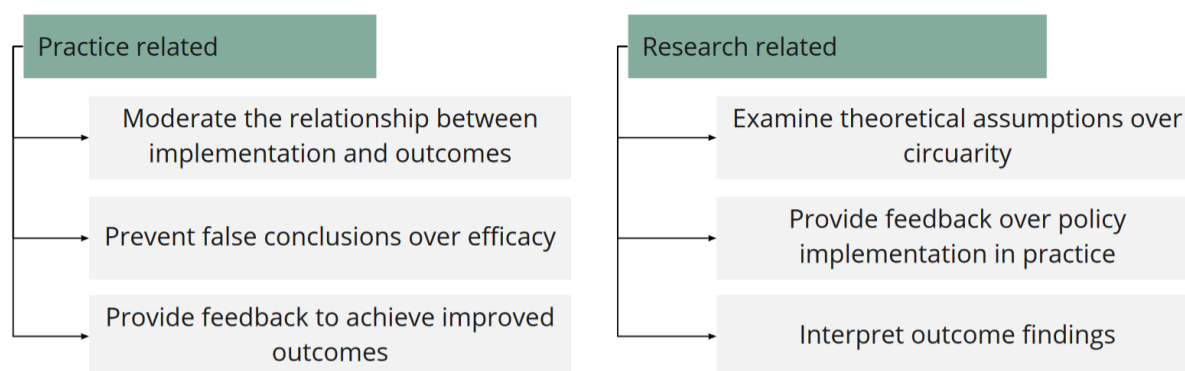


Figure 14 Objectives of the IFA

Since the assessment is focused on the implementation process, it is affected by the people involved in the process and by their interactions (Ammerman et al., 2007; Blakely et al., 1987; Carroll et al., 2007; Durlak & DuPre, 2008; E., 2001; JBA, 2009). This includes people assigned with delivery and people participating in the implementation process. This also means that the IFA is affected by support systems deployed to train, assist, and guide delivery or participation.

Despite the established relation between implementation fidelity and outcomes, it is also assumed that modifications and adaptations are inevitable for individual cases (Durlak, 1998) and could even be necessary, which highlights the role of innovation and flexibility in implementation to increase

ownership and involvement (Blakely et al., 1987; Kelly, Heckman, Stevenson, & Williams, 2000). Nonetheless, substantial deviations could prove problematic and carry a parallel negative impact on the outcome (Dusenbury, Brannigan, Hansen, Walsh, & Falco, 2005), which could be due to unintentional addition, change, or removal of content or changes in methods or process. This highlights the need for IFA to educate the results of implementation and outcome findings and create the most effective balance between fidelity and the optimal room for flexibility and innovation (JBA, 2009).

3.1.3 Dimensions

The five dimensions provide five elements to the implementation fidelity (Carroll et al., 2007). Adherence and exposure are discreet elements. Suppose a clear benchmark is assigned to quantitatively assess how much has been implemented of a theoretical ideal. In that case, the quality of delivery is treated as a discreet element in assessing implementation fidelity. Otherwise, quality of delivery could be viewed as a moderator between an intervention and the fidelity of its implementation. In this case, the quality of delivery examines the delivery qualitatively in terms of bad and good fidelity based on its impact on the intervention (Carroll et al., 2007).

The fifth dimension, program differentiation, identifies an intervention's essential components providing information over the impact on the outcome, redundancy (if any), and difficulty implementing. The methods applied to identify the essential elements use canvassing the prescribers/designers of the intervention or by examining the effect and impact of the component on the outcome.

Two additional dimensions have been put forward by Carroll et al. (2007) based on their review to support the assessment framework. The first added element is intervention complexity, following the basic concept that complex ideas are more challenging to adopt. The second added dimension is facilitation strategies such as manuals, guidelines, training, monitoring and feedback, capacity building, and incentives.

3.1.3.1 Adherence

Adherence presents the bottom-line measurement of implementation fidelity as it evaluates the implementation process based on the practical realization compared to the planned or prescribed (Carroll et al., 2007). The more adherent an intervention to its prescribed content, methods, and activities (active ingredients of delivery), the higher its fidelity (JBA, 2009).

Measuring adherence can be quantitative for predefined components as in how much content (how many components) of the prescribed content has been implemented. Still, it is unrealistic to assume that all content will be applied in practice (Durlak, 1998). If the essential components are not identified, then adherence to the whole intervention is required.

3.1.3.2 Exposure

The second dimension, exposure, is how much of the intervention is delivered. Coverage could be included under the same dimension as exposure, and it is concerned with how many of the people who should be participating in the intervention are being included. Is the amount delivered compared to the amount prescribed by the program model (JBA, 2009). In other words, it represents what was selected or possible for a particular case compared to the full possibilities the prescribed ambition presents.

3.1.3.3 Quality of delivery

Quality of delivery is the way the people assigned with the implementation deliver it. The quality of delivery also involves techniques or external benchmarks to examine how much the assigned personnel to deliver are approaching a theoretical ideal of the intended delivery. It is whether a

program service or intervention is delivered as designed or prescribed. It focuses on delivery and acts as a moderator between outcome and intervention (JBA, 2009). For example, complete implementation of the content coupled with poor delivery could still lead to adverse outcomes for the participants.

It aims to determine whether the content of the intervention is suitably delivered to achieve the intended results. Quality assurance or delivery improvement strategies explicitly acknowledge the importance of quality of delivery and its effect on implementation fidelity (Carroll et al., 2007). Elements of quality of delivery include preparedness of the providers and availability of relevant or relatable examples, responsiveness to inquiries, interaction, and communication style, and showing respectfulness, confidence, and enthusiasm.

Intervention complexity

This dimension examines whether the prescription is simple or complex, detailed, or vague. Details, higher levels of specification, and well-planned and identified components have been found to deliver higher fidelity (Carroll et al., 2007). The less complex the intervention is, the easier it is to increase implementation fidelity as the 'response barriers' to the interventions are reduced (Greenhalgh, Robert, Bate, Kyriakidou, & Macfarlane, 2004). At the same time, complexity leads to higher variation in delivery and possible implementation components, which heightens the vulnerability to faulty implementation and less fidelity.

Facilitation strategies

Facilitation strategies are employed to optimize and standardize implementation fidelity. Such strategies aim to increase fidelity by making a uniform implementation process and ensuring that all people assigned with implementation are receiving similar information and support (Carroll et al., 2007). This includes availing manuals, guidelines, training, and monitoring and feedback to the practitioners. The need and moderating effects of these strategies depend on their need to follow the simplicity/complexity of the intervention (Carroll et al., 2007).

3.1.3.4 Participant responsiveness

The fourth dimension, participant responsiveness, examines the extent of response the intervention triggers from the intended participants; it is also referred to as "reaction evaluation" (Kirkpatrick & Craig, 1970). This dimension focuses on participants; it assesses whether they are engaged, the relevance of the intervention to them, their experience with it, and their reaction to the outcome.

The participants' engagement or acceptability of the intervention determines its success or lack of application (Rogers, 2010). Which naturally moderates implementation fidelity (Carroll et al., 2007). In the literature, participants do not only encompass the receiving end of the implementation, but it also includes the personnel tasked with it and their involvement and enthusiasm about the intervention (Bullock & Batten, 1985; Carroll et al., 2007). Elements of participant responsiveness include the level of interest, engagement, enthusiasm, and willingness, and perceptions over relevance and usefulness.

3.1.3.5 Program differentiation

Program differentiation aims to distinguish essential or critical components in the implementation process and examine the impact of the different components to produce positive outcomes (JBA, 2009; Mowbray et al., 2003). Attention must be paid to essential or impactful components that would lead to successful implementation without the need for all components to be implemented (Carroll et al., 2007). Identifying these components could also provide information over which areas allow for flexibility and adaptability in individual cases (Blakely et al., 1987). (Which highlights the need for differentiation as mentioned before).

3.2 PROPOSED CONSTRUCT

Conteh (2011), in his review of policy implementation in multilevel environments, notes that implementation research shifted '... from trying to build meta-theory towards explaining concerted action across institutional boundaries to accommodate the transitions to more complex multi-actor policy processes (Conteh, 2011). This is in line with the parallel between the need for a broader approach that examines multi-focus perspectives to research policy implementation (Creswell & Clark, 2006).

The assessment framework developed for the objectives of this research focuses on the methods to implement circularity in the procurement process through tendering. Which means that, within this research, the outcome of the tendering process is the bids submitted and the awarding. Consequently, although a way of implementing circularity in the procurement process, the contract clauses fall outside the scope of the assessment developed in this research. Thus, the broader approach of the IFA is maintained to cover the five main dimensions of implementation fidelity but narrowed down to focus on implementation methods that are documented in the procurement documents and employed throughout the tendering process.

3.2.1 Proposed assessment framework

All five-dimension present measures for fidelity, and some literature presents these dimensions as alternatives to assessing implementation fidelity (Mihalic, 2004). Others propose that using all five dimensions introduces a more comprehensive assessment because the dimensions are interrelated but not inclusive (Carroll et al., 2007). The literature defines bundles the dimensions as adherence and moderators, and differentiation. Adherence measures the extent to which the people assigned to implementing the intervention adheres to its prescribed implementation (Carroll et al., 2007), including adherence and exposure.

The moderators, quality of delivery, participant responsiveness, intervention complexity, and facilitation strategies influence or affect the intervention. The moderators are not necessarily discrete elements, and their effect on implementation fidelity could be interrelated. Facilitation strategies and intervention complexity influence the quality of the delivery and, as such, could be considered as elements of that dimension. The quality of the delivery could affect the enthusiasm of the participants. However, as mentioned above, although these dimensions are correlated, none of them is inclusive. Together, they provide a comprehensive understanding of the implementation fidelity as the interactions will be included in the assessments and provide better explanation and understanding of lower or unsatisfactory implementation (Carroll et al., 2007).

Differentiation, although an established dimension in the literature, is not measuring fidelity perse. Still, it determines the elements essential to its realization, which is vital in evaluating any intervention (Carroll et al., 2007). In other words, the relationship between an intervention and its outcomes is external to implementation fidelity. However, the extent or degree of fidelity affects this relationship and feeds back into the assessment.

3.2.2 Fidelity dimensions in procurement

The conceptual framework of implementation fidelity presents three elements for a well-rounded assessment. Firstly, assessing the outcome of the process by examining adherence; secondly, assessing the moderators of implementation in the process by examining exposure, quality of delivery, and Participant responsiveness; thirdly, differentiating impact of implementation methods.

The relations between dimensions are visualized in Figure 15, where the five dimensions and their compatible areas in tendering are presented. The dashed arrows indirectly relate the moderators and adherence, unlike their direct relation with methods efficacy.

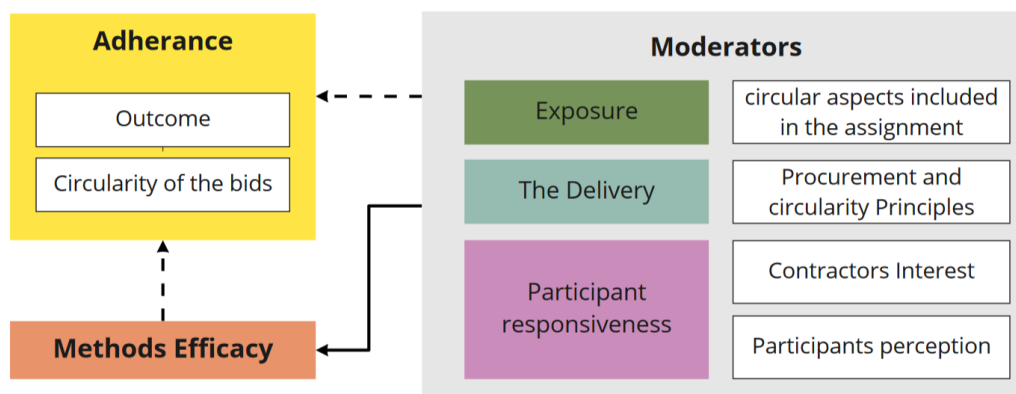


Figure 15 Assessing implementation fidelity of circularity in the tender process

3.2.3 Assessing the outcome of the procurement

Based on adherence, the bottom-line measurement of implementation fidelity, this evaluates the implementation process based on the effective realization of the outcome of the process. In the procurement process, the output of implementing circularity is the bids submitted by the contractors. Based on this output, the outcome of the process is determined by selecting one of the submitted bids and awarding the contract. Assessing the circular content in the output and the outcome of the process relates to the circular content of the bids compared to the circular content requested by the contracting authority in the project need, specs, and circular sub-criteria.

3.2.4 Assessing implementation moderators

Moderators of implementation are based on the three dimensions exposure, quality of delivery, and participation.

First, exposure in the procurement process represents how many circular aspects were included in the procurement process compared to possible options available for the contracting authority. The contracting authority can include circularity in the procurement documents by five methods. Moreover, the contracting authority determines the scope of circularity it includes for each assignment for each of these methods.

Second, the quality of delivery represents how the contracting authority delivers circular aspects throughout the process; poor delivery leads to a negative outcome. The quality of delivery in the procurement process is determined by adhering to public procurement principles that guarantee that any method's circular aspects have been aptly delivered. This means that competition, equality, proportionality, and transparency are safeguarded throughout the process and in all interactions between the contracting authority and contractors over circular aspects, with the addition of proposed circular procurement principles to enable collaboration and innovation. Figure 16 presents principles related to the quality of delivery dimension. The quality of delivery here will focus on the aspects related to safeguarding principles rather than on the performance of the contracting team. Although the performance of the contracting authority could be a moderator, it is not specific to the implementation of circularity.

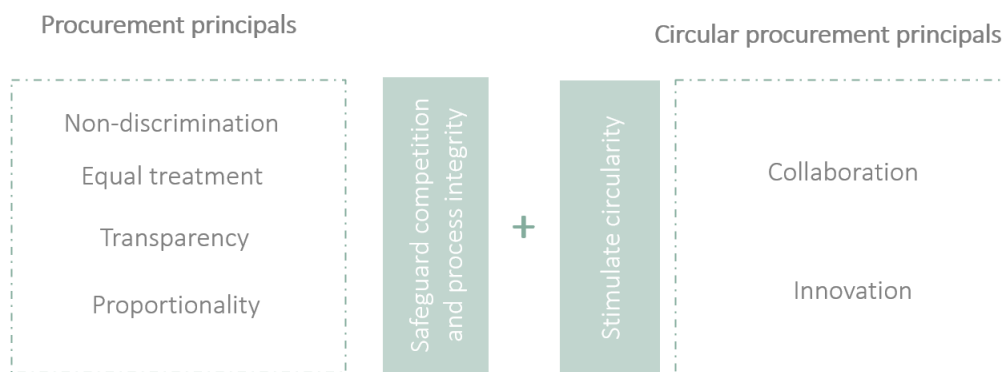


Figure 16 The combination of principles related to the quality of delivery dimension

Third, Participant responsiveness is the moderator concerned with the parties involved in the process, both the contracting authority and the contractor teams. This entails relevant aspects, first the individual perception of the involved personnel, whether on the contracting authority or the contractors' side. Second, how the inclusion of circularity impacts the contractor's decision to bid, which offers the chance to get a sense of the market's situation and how circularity affects the desirability and the potentials of the assignment from a contractor's perspective, on the other hand, it reflects how the contracting authority assumes this impact.

3.2.5 Differentiating impact of implementation

Differentiation aims to recognize and examine the perceived impact of the different methods to include circularity in the procurement process to produce more circularity in the outcome of the procurement process. Differentiation in these cases aims at producing fidelity indicators for each of the methods to include circularity. In Figure 17, the main questions of the framework assessment areas are presented.

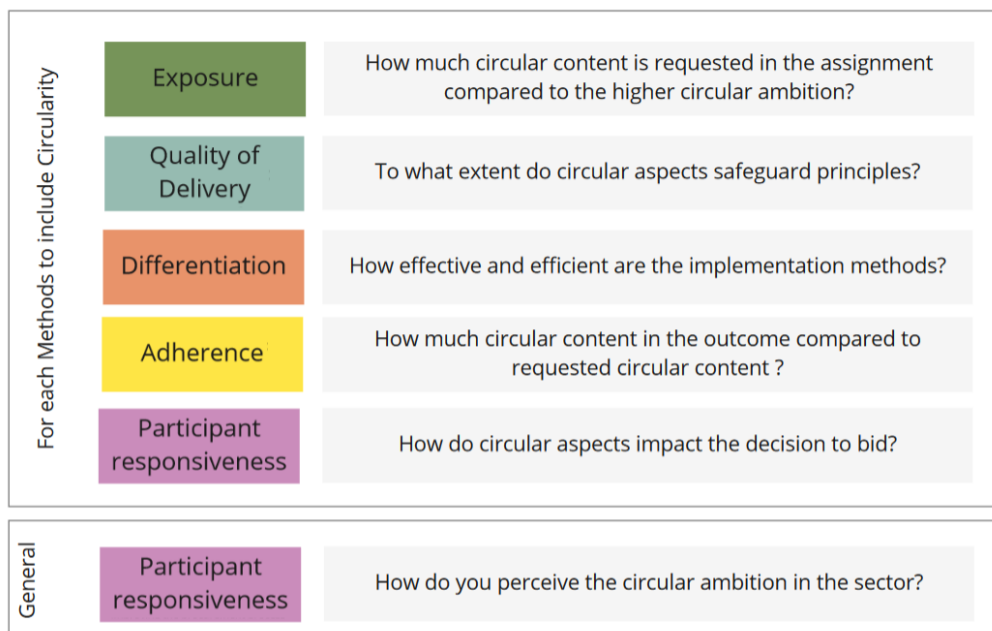


Figure 17 The main question of the framework assessment areas

3.2.6 Issues concerning the dimensions

Based on the issues identified in phase one 2.3 for the implementation of circularity in procurement. The impact of these issues could be linked to the dimension of fidelity. Structural issues, such as time

and resources, were identified to limit the proactive approach when dealing with circular policy ambition; as such, their impact is expected to be most paramount on the exposure dimension. The same applies to operationalization; operationalization instruments provide the contracting authority's framework, affecting the exposure dimension.

Implementation traps affect the quality of the delivery and the process's ability to safeguard its integrity and the competition between the market parties and stimulate collaboration and innovation. Circular policy-related issues also impact it in establishing the link between cause and effect. Lastly, participant responsiveness and engagement in implementing the circular ambition are impacted by professional belief and specialist knowledge and understanding. Moreover, it is expected to be affected by the implementation trap of creating enough incentive for compliance.

Like the dimensions, these issues and their consequences on the process are interrelated. However, this paragraph argues the most significant impact on each dimension. In Figure 18, implementation issues in relation to the moderators of implementation fidelity are represented.

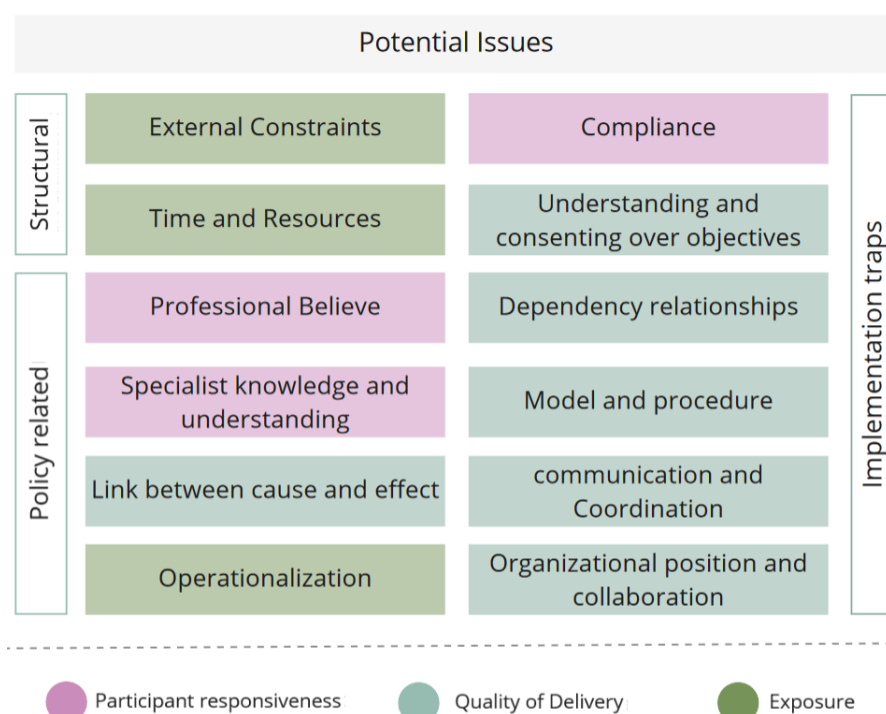


Figure 18 Implementation issues with the moderators of implementation fidelity

Implementation traps are strongly related to the quality of delivery and the integrity of the tendering process. Still, policy-related issues impact integrity, and all traps could accentuate this impact. In other words, the link between cause and effect, which represents the current limits of our knowledge of circularity, would be more problematic and apparent in tendering when combined with implementation traps.

3.3 IMPLEMENTATION FIDELITY ASSESSMENT (IFA)

Case studies of procurement processes are examined using a structured assessment with stakeholders involved in the procurement process. The assessment explores circularity implementation fidelity in cases of civil engineering projects procurement through the experiences of practitioners with a multi-perspective approach.

3.3.1 Data collection

Literature over the methods to conduct an IFA presents an array of evaluation methods to collect and examine the data (Lemire et al., 2020), among the methods, logs or implementation reports; self-reported checklists; questionnaires; compilation of contacts or attendance; duration of the interventions; observations (on-site or video); audio recording and interviews. The methods selection and combinations have been justified in the literature based on context and complexity and to assess a broader range of dimensions.

For the context of this research, a combination of an assessment questionnaire in the form of a rating scale and interviews is selected as the literature indicates that using several methods is more advantageous than using one (Guo et al., 2016). Moreover, the combination of surveys and interviews counterbalance each other, which would provide a compensatory component that improves the quality of the results' analysis (Lemire et al., 2020). This compensatory complement is further boosted by including different data sources to allow for triangulation, firstly, by selecting the interviewees of contracting authority, consultants, and contractors' practitioners, secondly, in the selection of multiple cases. This creates room for triangulating the results within each case and later among the cases results in phase 4. This triangulation aims at countering the present reliability issues of any method (Halle, Metz, & Martinez-Beck, 2013).

The assessment and the interview will be conducted within the same meeting of one-hour duration to accommodate the tight research schedule and facilitate potential interviewees' participation.

3.3.1.1 The assessment form

This framework is utilized to design an assessment that aims to develop an understanding of circularity implementation fidelity through the lived experiences of practitioners from both client and contractor perspectives. A rating scale assessment could be used to indicate the level of usefulness of the assessed intervention and its ambition, and the participants' attitude towards it (Powell & Diamond, 2013). It has also been used to assess the quality of implementation methods such as relevance, usefulness, and measurability (Snyder et al.). This tool provides the convenience of covering the range of dimensions the research aims to address by obtaining insight into participants' perceptions without being too time-consuming or demanding for the research participants (Lemire et al., 2020).

The objective of the assessment is to produce quantified indicators for the fidelity of the case and enable differentiating the results for the different methods employed to include circularity in the tendering. Therefore, the assessment is structured in 5 distinct sections, as visualized in Figure 19 where each circle presents an assessed aspect through a statement.

The first four sections are dedicated to the four methods with statements that indicate each of the five dimensions of fidelity. The fifth section is over the individual perception of circularity. The statements for each method have been replicated to present a comparable equal number of statements in each section. The different dimensions complement each other in presenting the overall fidelity of the assessed case. The average of each aspect is used to calculate the overall indicators. The assessment form is available in appendix A.

Other than providing interpretable data for each of the methods, differentiating the assessment statements helps avoid generalized answers by the participants and stimulates more in-depth reasoning when selecting answers with regards to different phases of the tendering process where each of the methods is most relevant. Moreover, differentiation highlights the relation, which could be counterproductive, between the methods and the phases, consequently increasing the validity of the overall fidelity results.

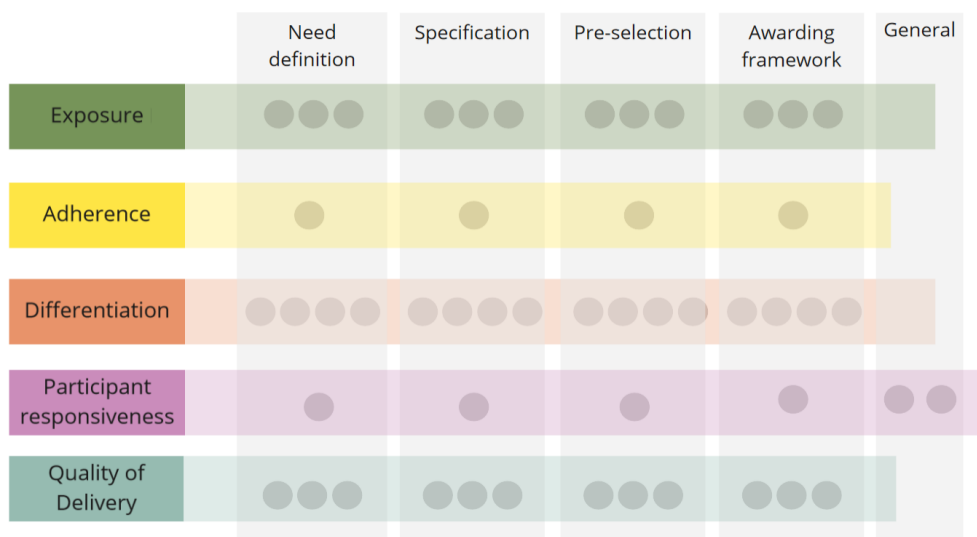


Figure 19 Assessment form structure

The scale selected for the assessment presents a scale of 1 to 5 for each statement to indicate to what extent it applied to the tender in which you were involved (1 = hardly applicable to 5 = fully applicable). This Likert-type scale is frequently used in survey research, where participants are presented with five equal intervals, including a neutral midpoint. Research has shown that going beyond five intervals has no added reliability (Hinkin, 1998).

3.3.1.2 The interviews

The assessment form on its own still presents challenges in the limited scope of information it presents. So, to further validate the assessment form and complement data obtained from the assessment, semi-structured interviews as a second method have been selected. Semi structure interviews mean that the results of the assessment will function as a guide. Questions have been formulated based on potential results of the assessment, with follow-up questions posed depending on the direction of the conversation. The question will focus on the interpretation of the assessment results and issues identification. These interviews are recorded and transcribed.

3.3.2 Data analysis

The data obtained through the assessment and the interviews will be analyzed and triangulated to produce results and insight for each case, as seen in Figure 20.

First, the results of the assessment will produce an overall fidelity indicator of the case. The overall fidelity will be calculated by averaging all averages of the dimensions through the five sections. The overall scores will be analyzed as is, then in comparison to groups of participants.

Second, the assessment results will produce a fidelity indicator for each of the methods with will be analyzed as is and in comparison, with differentiation impact factor before factoring in the rest of the fidelity dimensions. Third, the interview transcripts will be reviewed for statements relevant to the

methods, the four dimensions, and the issues of implementation that justify the implementation fidelity dimensions scores and the implementation methods differentiation scores.

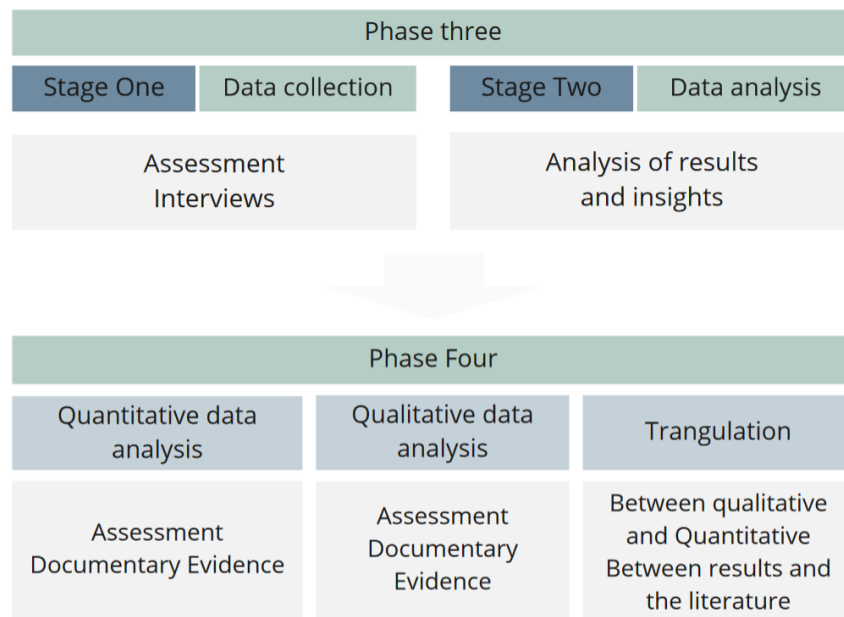


Figure 20 Analysis approach

3.4 PHASE TWO SUMMARY

In this chapter, the proposed construct for is established based on five dimensions. The moderating dimensions are linked to circular policy implementation issues within the procurement process. The analysis is designed to assess the tendering process through the differentiated implementation fidelity of the methods to include circularity in tendering. The analysis framework is visualized in Figure 21, the color schemes connect the dimensions with their assessed aspects and potential issues.

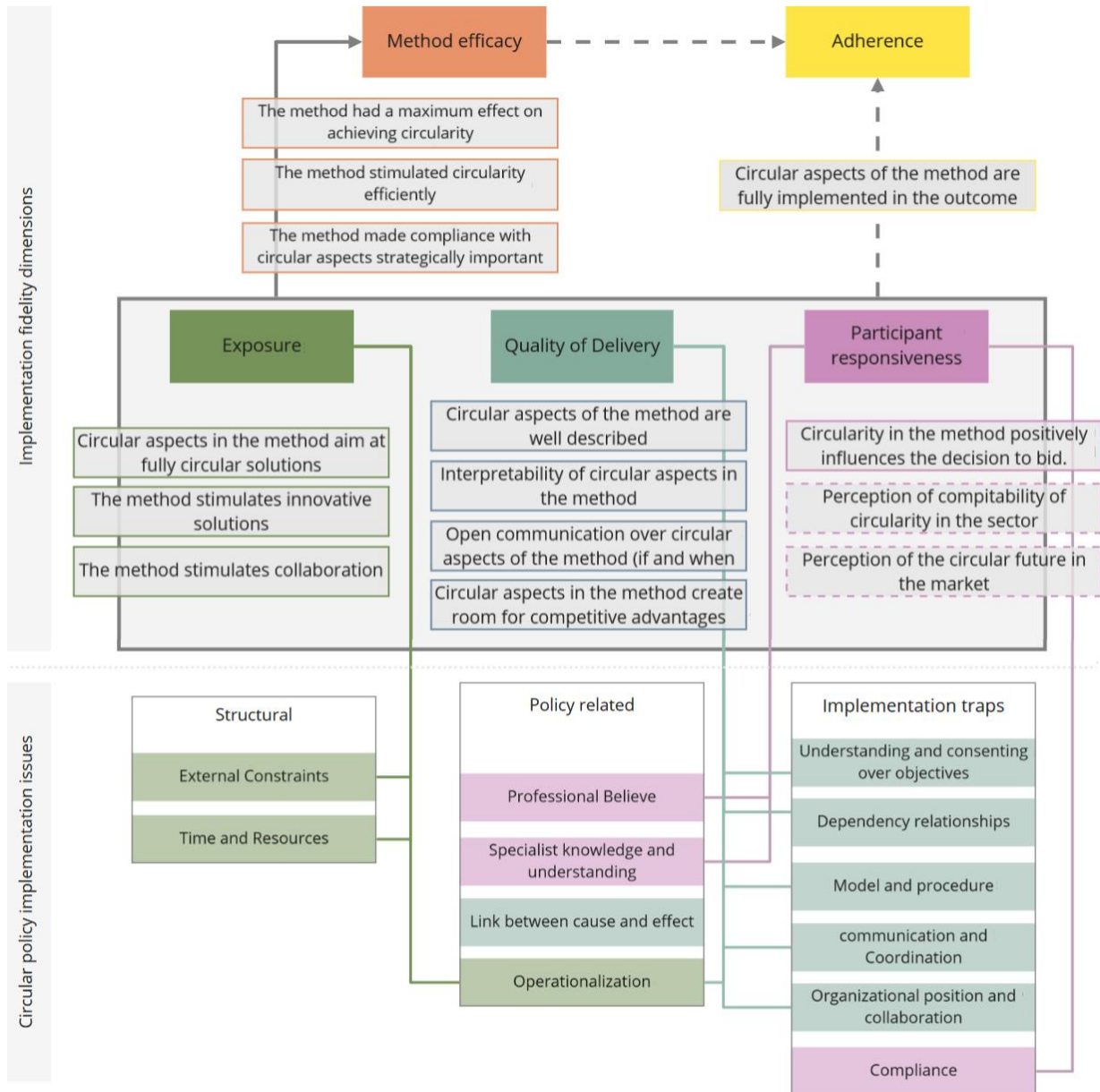
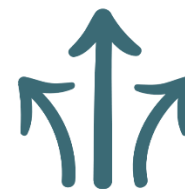


Figure 21 Implementation fidelity analysis framework



4 PHASE THREE | STUDY CASES

In this chapter, three cases and their results of the IFA are presented. This chapter aims at answering the third sub-question: To what extent do the current methods to include circularity in procurement produce the intended results? Each case and the available data and the participation are amply described before presenting the analysis results of the three cases. All three cases, the Cruquiusbrug bridge, the innovative and circular Floriade bridges, and the Groote Wielenplas cycling bridge, meet the predefined set of criteria in paragraph 1.2.3. However, they present different scopes, tendering processes, and levels of circular ambition. This introduces case context-related similarities and differences between the cases; this is later expanded upon in phase four with the findings of the IFA. All interviews referenced in this chapter are indexed and scripted in Appendix C.

4.1 STUDY CASE 1: DE CRUQUIUSBRUG

4.1.1 Case information

Client:	North Holland
Time frame:	The invitation to tender was published in March 2019, tendering duration 9 months
Assignment:	The replacement of bridge A and major maintenance for bridge B
Ambition:	Circular, Energy neutral, Low maintenance, and Minimizing inconvenience
Requirements:	Industrially Flexible Demountable (IFD/NTA 8086), materials passport including disassembly manual
Tendering procedure:	Competitive dialogue
Award framework:	EMVI - Minimizing MKI

4.1.2 Participation and Documents

The assessment has been filled by eight practitioners who participated on behalf of their respective organizations. Participation included employees of the province Noord Holland, employees of two of the contractors who joined the tendering process, and contract managers and circular procurement consultants.

The available documents included the project definition, ambition, registration guide, and the awarding framework among the publicly available documents. Moreover, the awarded contractor has presented their bid plan to better understand the tendering process's outcome.

4.1.3 Case Results

4.1.3.1 IFA | Quantified data

The case's overall fidelity averages at 3,97 out of a possible 5. This indicates a high-fidelity level reflected across all five dimensions; none deviates from the average significantly, with quality of delivery as the lowest at 3,84 and participation as the highest at 4,18. Figure 22 represents the fidelity of the case on all five dimensions.

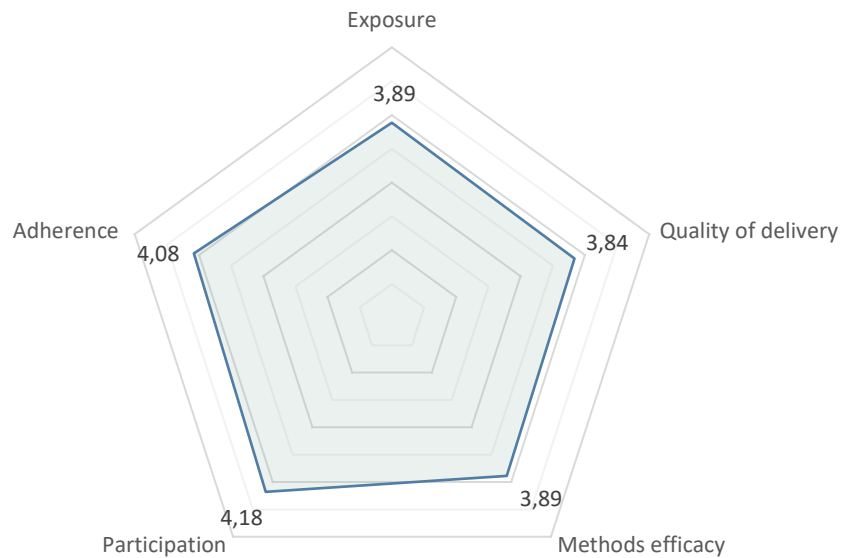


Figure 22 Case one: Implementation fidelity dimensions

The differentiated fidelity scores of the methods show more divergence contributing to the overall score between the different methods to include circularity, this divergence can be seen in Figure 23.

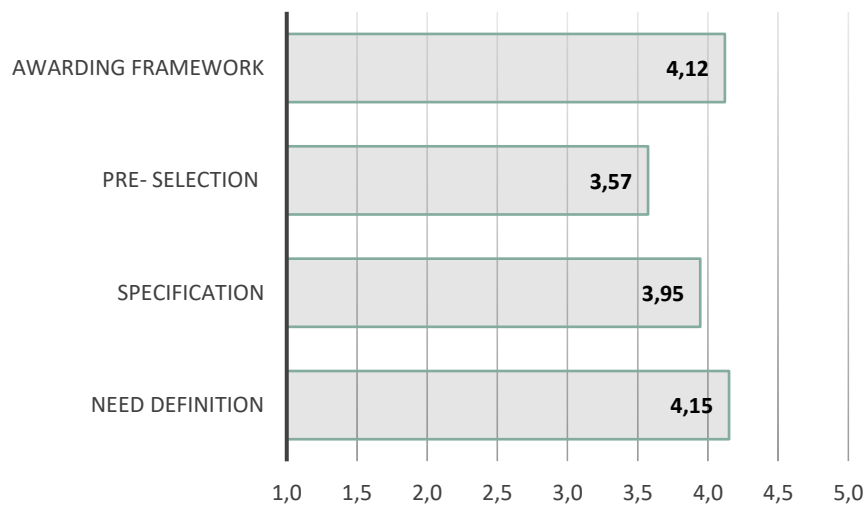


Figure 23 Case one: differentiated implementation fidelity for the four methods

Indicators by groupings show a higher perception of implementation fidelity from the contracting authority than the scores assigned by other involved parties in the case. This divergence is most notable in the exposure and quality of delivery dimensions and with the fidelity of the specifications in the differentiated results. It is also notable that in the indicators obtained from the consultants, the contracting authority consultants have assigned higher fidelity values to the participation dimension in the case than the other two parties and lower differentiated values to the awarding framework. This divergence is visually notable in Table 1 in Appendix B; the table show the detailed results by dimensions, methods, participants, and different groupings of participating parties.

4.1.3.2 Interview results | Qualitative data

All issues identified in the interviews have been listed by impact on the moderating dimension (Check Table 2 in Appendix B). In Figure 24, the issue areas brought up by the case participants are framed in red.



Figure 24 Identified issues according to causes and by dimensions.

First, regarding the moderating dimension exposure (related issues are highlighted in green in Figure 24), structural issues have been identified, high technical and functional requirements due to the nature and locational circumstances of the project, and the long preparation period that preceded the tendering. Operationalization issues, as policy-related, have also been identified by most participants due to the lack of uniform directives for the procurement of circularity, lack of reliable measures, and the restrictions of the European tendering rules.

With regards to the second moderation dimension, quality of delivery (related issues are highlighted in blue in Figure 24), implementation traps have been brought up by some participants, with regards to the understanding of objectives over the use of IFD and the length of procedure, while one participant has mentioned issues of coordination and in-organization collaboration. Moreover, issues in the link between cause and effect, policy-related, have been identified by most participants due to the recognized inadvertent impact of the different ambitions.

Finally, regarding the third moderating dimension, participation (related issues are highlighted in purple in Figure 24), policy-related issues of specialist knowledge and understanding have been identified by most participants due to the restriction imposed by the specification on circular innovation. One participant identified professional believe related issues in the case. Regarding compliance as an implementation trap, two participants mentioned that the process has failed to spur the contractors to take on the case's overall risk, which has resulted in only one contractor making a bid in the end. It is worth noting that contracting participants did not connect circularity as a primary reason for not making bids at the end.

4.1.4 Conclusion

Cases overall average for implementation fidelity is high, according to the participants. While the indicators for adherence reflect high fidelity in the outcome and the indicator for participation indicates the high interest of participants, the indicators of the remaining three dimensions suggest

room for increased fidelity. The exposure indicates that the included circular aspects are still below the desired ambition, the quality of delivery indicates that the process integrity in handling principals presents rooms for improvement. Lastly, differentiation shows that the efficacy of the methods could be further enhanced. In the qualitative part of the assessment, issues regarding the three mediating dimensions have been mentioned by the participants. These issues are structural, policy-related, and implementation traps. The most mentioned issues are Structural External constraints, policy-related operationalization, Specialist knowledge and understanding, and the link between causes and effects.

Building on the quantified and qualitative results, it is concluded that:

- Issues related to participant responsiveness have had less impact on the efficacy of the methods and, in turn, on adherence.
- the impact of structural issues and the implementation traps, in combination with policy-related issues, has led to a lower score on the exposure and quality of delivery dimensions, consequently lowering the overall fidelity of the case.

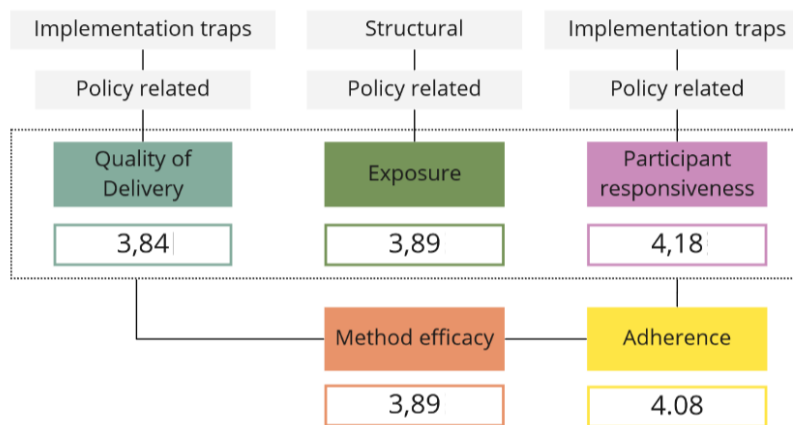


Figure 25 Issues effect on the dimensions

4.2 STUDY CASE 2: INNOVATIVE AND CIRCULAR FLORIADE BRIDGES

4.2.1 Case information

Client:	Province of Flevoland and the municipality of Almere
Time frame:	The invitation to tender was published in March 2019. The tender process duration was six months.
Context:	Floriade Almere 2022 is an international expo that presents what a "green city" is and uses four themes: Feeding, Greening, Energizing, and Healthy the city.
Assignment:	The design and possible construction of two bridges (Bridge 2 = the Beverbrug, bridge 4 = rondje Weerwaterbrug)
Ambition:	As innovative and as circular as possible. This project comes in the client wishes to present an approach towards 2040; 40,000 bridges in the Netherlands will have to be replaced.
Requirements:	Comply with the bridge passport (design principles derived from the Floriade design principles); set due dates and budgets; avail all data to the common data environment (Gemeenschappelijke Data Omgeving GDO)
Pre-Selection:	Experience with designing and building innovative, circular bridges; experience with designing in a construction team/multidisciplinary teams; the score on the CSR performance ladder and the CO2 performance ladder, or demonstrable development of policy in the field of CSR and CO2 reduction; acceptance of the conditions for the design challenge; acceptance of the conditions for collaborating on the shared data environment.
Tendering procedure:	Three contractors were invited to participate in a multi-negotiated tender procedure (In Dutch: Meervoudig onderhandse aanbestedingsprocedure). The tender does not require a quotation with a price but for participation in a design challenge. The contractors submit a sketch design and plan for each bridge.
Award framework:	Project's budget is predetermined, and the criteria are focused on qualitative aspects. The awarding criteria (from most weighted to lowest): <ul style="list-style-type: none">- Reducing waste and CO2 as possible throughout the LCA- Adding value to the benefits of the Floriade- The material chosen must be reusable, biodegradable, and recyclable.- As many insights from the hackathon* as possible should be incorporated into design and realization.- Transferred knowledge surrounding (co-creation) in design and realization of the bridges Price based on the following formula: lowest price / own price x 5,000

4.2.2 Participation and Documents

The assessment has been filled by six practitioners who participated on behalf of their respective organizations. Participation included employees of the province of Flevoland and the municipality of Almere and employees of two of the contractors who joined the tendering process.

The available documents included the procurement documents, including the assignment description, the tendering documents, the awarding framework, and the elaboration on the requirements and criteria.

* During the hackathon held in October 2018, 140 innovative insights and ten innovative and circular concepts were extracted from the market on various topics, such as collaboration, procurement, financing to design, materials, circularity, etc.

4.2.3 Case Results

4.2.3.1 IFA | Quantified data

The case’s overall fidelity averages at 4,08 out of a possible 5. This indicates a high level of fidelity supported by exposure score as the highest at 4,39. Quality of delivery presents the lowest dimension score at 3,73. Figure 26 represents the fidelity of the case on all five dimensions.

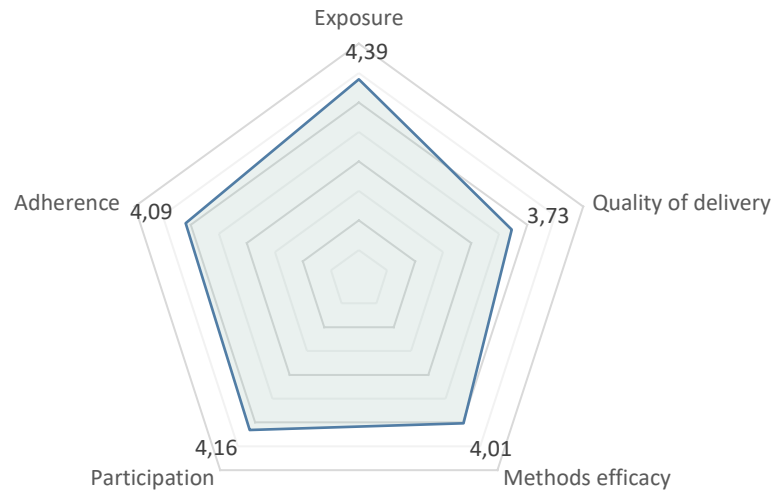


Figure 26 Case two: Implementation fidelity dimensions

The differentiated fidelity scores of the methods reflect the high overall fidelity of the case, with the need definition scores reflecting the participants' perception of higher implementation fidelity among the methods at 4,23 and specifications as the lowest at 3,91. Figure 27 shows the differentiated implementation fidelity for the four methods.

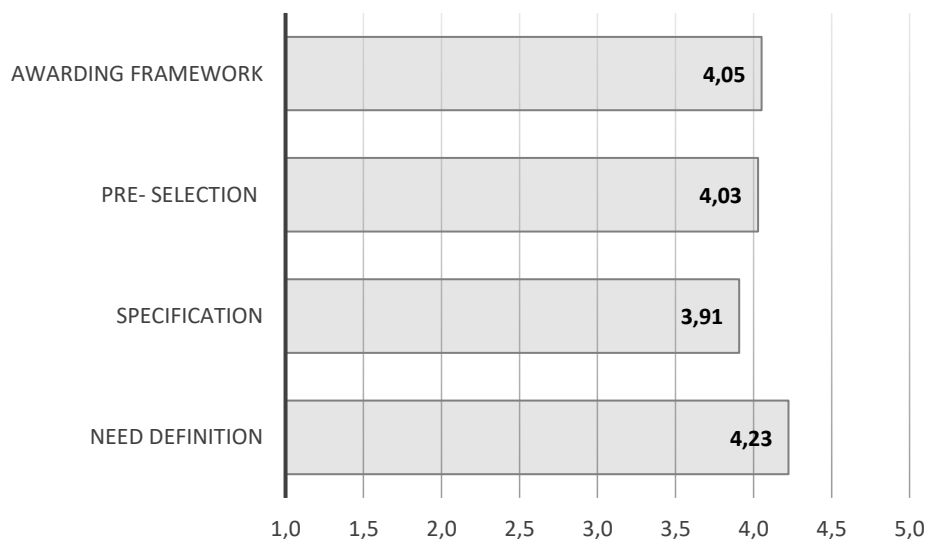


Figure 27 Case two: differentiated implementation fidelity for the four methods

Indicators by groupings show agreeing indicators among the participant on both the contracting authority and the contractors on all dimensions but the adherence dimension. The contracting authority score on adherence reflects high satisfaction with the circular outcome relative to what was

asked in this assignment. Similarly, in the differentiated results, the differentiation shows a slight divergence in the scores over the fidelity of the methods. The most significant difference is noted between scores of the specifications and the awarding framework; in both methods, the contracting authority assigned higher fidelity. This is visually notable in Table 3 in Appendix B; the table show the detailed results by dimensions, methods, participants, and different groupings of participating parties.

4.2.3.2 Interview results | Qualitative data

All issues identified in the interviews have been listed by impact on the moderating dimension (Check Table 4 in Appendix B). In Figure 28, the issue areas brought up by the case participants are framed in red.



Figure 28 Case two: Identified issues according to causes and by dimensions

First, with regards to the moderating dimension exposure (related issues are highlighted in green in Figure 28), no structural issues have been mentioned by the participants, and only one participant identified an operationalization-related issue regarding the measure frameworks of the different environmental effects of design choices.

Regarding the second moderation dimension, quality of delivery (related issues are highlighted in blue in Figure 28), the implementation trap of consenting and understanding objectives have been brought up by all participants due to the big room of interpretations left by the open design freedom. Two participants mentioned issues with documentation, internal coordination, and dependency on the contracting authority side. Two other participants mentioned policy-related issues in creating the link between cause and effect in the compatibility between different circular solutions.

Finally, with regards to the third moderating dimension, participation (related issues are highlighted in purple in Figure 28), policy-related issues have been identified by most participants of specialist knowledge and understanding in the framing of the circular aspects in the assignment, and professional belief-related issues with tolerance to circular strategies across the different departments in the longer term.

4.2.4 Conclusion

Cases overall average for implementation fidelity is high, according to the participants. The indicators for exposure and adherence reflect the high ambition and high compliance in the circularity of the

outcome, and the indicator for participation suggests the high interest of participants. The indicator of the quality of delivery suggests room for increased fidelity by working on the process integrity in handling principals. According to participants, all methods have contributed to high implementation fidelity of the case, with the need definition with the higher fidelity indicators. In the qualitative part of the assessment, issues regarding the three mediating dimensions have been mentioned by the participants. These issues are policy-related, and implementation traps. Most mentioned issues are implementation traps with regards to understanding and consenting over objectives.

Building on the quantified and qualitative results, it is concluded that:

- Issues related to participant responsiveness have had less impact on the efficacy of the methods and, in turn, on adherence.
- In the (almost) lack of issues that impact exposure, the case has scored very high on the dimension
- The impact of implementation traps, in combination with policy-related issues, has led to a lower score on the quality of delivery dimension, consequently lowering the overall fidelity of the case.

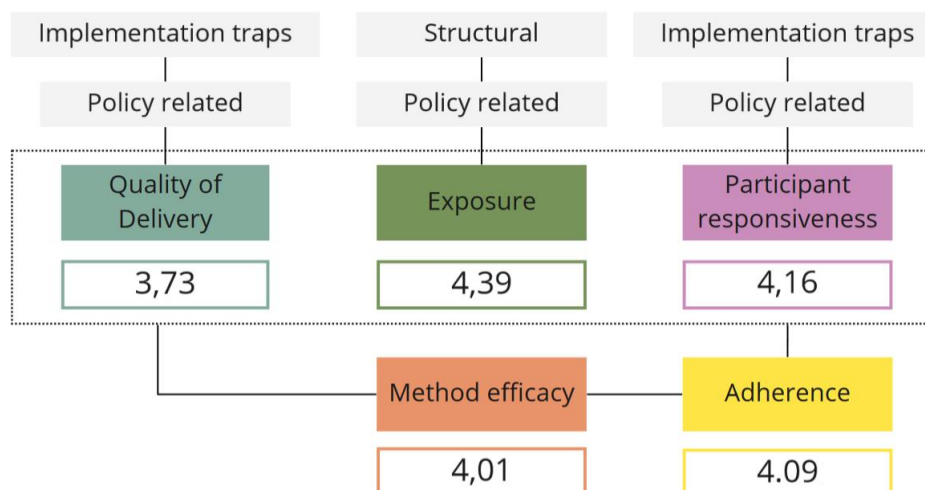


Figure 29 Issues effect on the dimensions

4.3 Study Case 3: Fietsbrug Groote Wielenplas

4.3.1 Case information

- Client:** The municipality 's-Hertogenbosch
- Time frame:** The invitation to tender was published in April 2021. The awarding was announced in August 2021. The tender process duration was five months.
- Assignment:** The design and construction of a new bicycle bridge with all its constituents and components, including the connections to the existing public area.
- Ambition:** A new, circular bicycle bridge with a high-quality appearance that fits in with the desired image and whose design and execution contribute to the sustainable and circular ambitions of the municipality.
- Requirements:** Functional and technical requirements, visual Quality Plan in which the aesthetic principles are laid down, a set of standards (norms), regulations, and guidelines.

- Pre-Selection: Made internally in the municipality based on contract control, design experience, and circularity or sustainability.
- Tendering procedure: Five contractors were invited to bid for a multi-negotiated tender procedure (In Dutch: Meervoudig onderhandse aanbesteding - conform de ARW2016). Five question rounds on TenderNed.
- Award framework: The Gunnen Op Waarde (GOW) system is used, best value for money. The qualitative awarding criteria are visual quality (in Dutch: Beeldkwaliteit) and circularity. Awarding weight ratio is 3:2, respectively.

4.3.2 Participation and Documents

The assessment has been filled by 11 practitioners who participated on behalf of their respective organizations. Participation included employees of 's-Hertigenbosch municipality, ReConnect &CO, Strukton Civiel, Dura Vermeer Infra, Heijmans, Van Hattum en Blankevoort, and Bam Infra.

The available documents included the procurement documents such as the assignment description, the tendering documents, the awarding framework, and the specifications.

4.3.3 Case Results

4.3.3.1 IFA | Quantified data

The case’s overall fidelity averages at 3.69 out of a possible 5. The results present the lowest score on the dimension of exposure at 3,23, indicating moderate circular requirements in the case and a high score on the dimension of adherence at 4,18, reflecting participants’ satisfaction with the circular outcome compared to the circular ambition within this assignment. Figure 30 represents the fidelity of the case on all five dimensions.

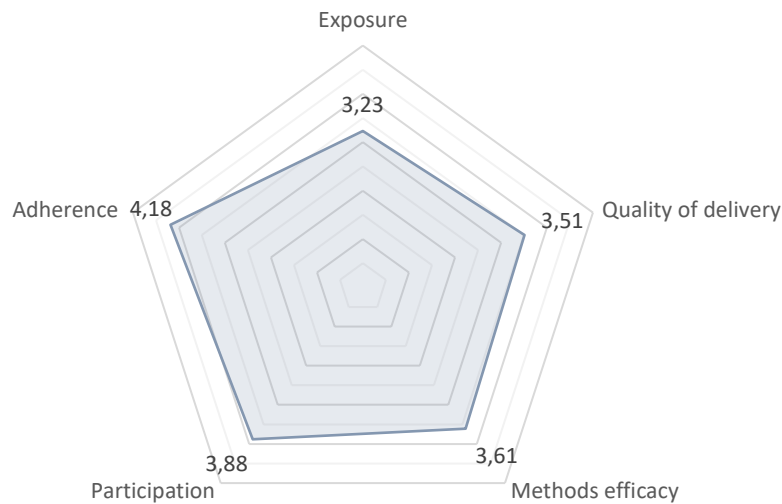


Figure 30 Case three: Implementation fidelity Dimensions

The differentiated fidelity scores of the methods reflect the overall case fidelity; none of the methods' scores show significant divergence from the average, as can be seen in Figure 31.

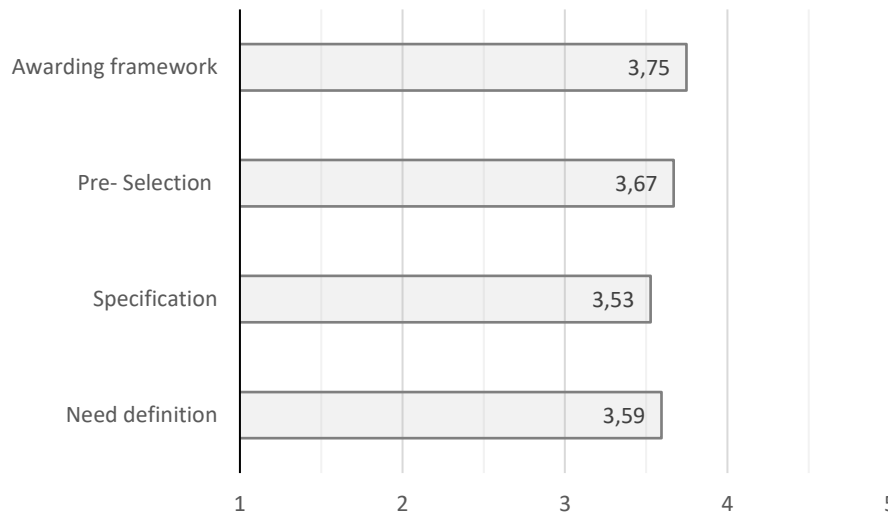


Figure 31 Case three: differentiated implementation fidelity for the four methods

Indicators by groupings show no significant difference in the overall implementation fidelity perception between the participant on the contracting authority and the contractors. On the dimensions, the contractors' participants' perception is reflected on higher scores over participation and adherence dimensions and lower scores on exposure, quality of delivery, and method efficacy with a relatively significant margin of difference across all five dimensions. Regarding the fidelity of the methods, both groups have agreeing scores on the methods except for the awarding framework, where the contracting authority perceives the fidelity of the method as considerably higher than the other parties. This is visually notable in Table 5 in Appendix B; the table shows the detailed results by dimensions, methods, participants, and different groupings of participating parties.

4.3.3.2 Interview results | Qualitative data

Issues identified in the interviews have been listed by impact on the moderating dimension (Check Table 6 in Appendix B). In Figure 32, issue areas brought up by the case participants are framed in red.



Figure 32 Case three: Identified issues according to causes and by dimensions

First, with regards to the moderating dimension exposure (related issues are in green in Figure 32), structural issues have been brought up by many participants with regards to prioritizing image design by the client, context constraints for the design to resemble a nearby bridge, and the budget being very limiting to circular options. Also, as policy-related, operationalization issues are mentioned regarding no directives of the municipality for the organizational circular ambition realization and the restricting preference of procurement models.

Concerning the second moderation dimension, quality of delivery (related issues are in blue in Figure 32), the implementation trap of limited room to discuss and present circular opportunities in the assignment is mentioned by most participants because of the procurement model and the tendering procedure. Another implementation trap brought up by the participant has to do with organizational position and collaboration as an internal issue in the municipality. This manifests in the technical requirements of the asset management department and architectural department, limiting the circular potential with the constricting expectations and norms. Moreover, two participants mentioned policy-related issues regarding the link between cause and effect in the comparability between the circular solutions.

Lastly, concerning the third moderating dimension, participation (related issues are highlighted in purple in Figure 28), as an implementation trap, the contracting authority has lowered potential compliance due to the prioritization of image over circularity, which resulted in all contractors focusing on image design aspects to secure the bid. Moreover, as policy-related issues, the specialist knowledge and understanding are mentioned due to restrictive specifications and required norms.

4.3.4 Conclusion

Cases overall average shows room for higher implementation fidelity. The circular ambition as a second priority is reflected in the relatively low score on the exposure dimension. Still, according to the participants, the implementation resulted in relatively high adherence to the circular ambition within the context of the assignment. Among the methods, the awarding framework is considered the more impactful on the overall fidelity, especially by the contracting authority participants. In the qualitative part of the assessment, issues regarding the three mediating dimensions have been mentioned by the participants. Most mentioned issues have been structural, implementation traps of compliance and model and procedure relation, and policy-related specialist knowledge and understanding.

Building on the quantified and qualitative results, it is concluded that:

- Issues related to the three moderating dimensions have led to reduced method efficacy.
- Structural issues have impacted the exposure dimension in the case significantly.

The tendering process's outcome is perceived as relatively highly adherent for the context of the case.

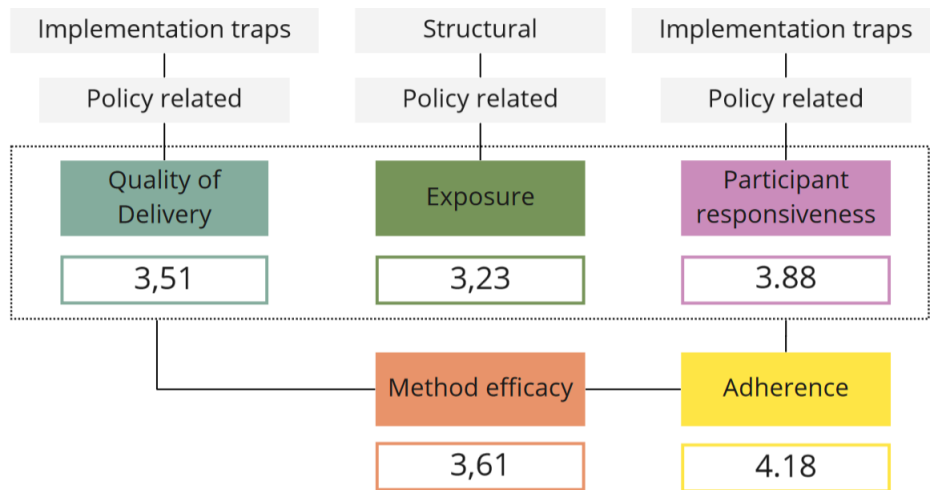


Figure 33 Case three: Issues effect on the dimensions

4.4 PHASE THREE CONCLUSION

The three study cases offer a range of organizational policy ambitions, circumstances, participation specialties and expertise, and different approaches to the procurement of circularity and the tendering process. The relation between the implementation fidelity assessment results and the qualitative data obtained from the interviews show consistency with the assumption of the implementation fidelity analysis framework. The first and second cases show high fidelity on exposure of the ambition, high adherence in the outcome of the process, and high overall fidelity in the process and the use of the four methods to include circularity. The third case shows lower fidelity on the exposure dimension, high adherence in the outcome of the process, and relatively lower fidelity in the process and the efficacy of the methods to include circularity. While all three cases faced issues related to policy knowledge and understanding and implementation traps, it is noted that no structural issues were identified concerning the second case. In the synthesis, in phase four, the results of these cases will be cross-examined.



5 PHASE FOUR | Synthesis

In this chapter, a cross-case analysis is conducted to expand the understanding of the cases' results and examine this understanding considering phase one findings. This chapter aims at answering the fifth sub-question: How can the implementation of circularity in procurement be improved?

The implementation fidelity analysis assumes the effect of real-world settings on circular policy ambition implementation in procurement. The use of the dimensions intends to reflect how the multidimensional considerations of individual assignments impact the fidelity, the instruments, and the outcome. On the other hand, each assignment could face structural and policy-related issues or implementation traps, affecting the five dimensions of the analysis. These interactions are discussed here. The cross-cases analysis first examines the results by fidelity dimensions and then examines the methods' implementation fidelity to include circularity in the tendering process.

5.1 FIDELITY DIMENSIONS

The assessment of the cases captured the interference of the real-world setting of circularity implementation. The most divergence on the exposure score reflects the ambition requested of each assignment and a minor divergence on the adherence dimension for the circularity of the outcome compared to what is requested. In Figure 34, the dimensions' scores for the three cases are visualized. In appendix B, the scores across the three cases are combined in Tables 7 and 8. The dimensions in details are discussed in the following paragraphs.

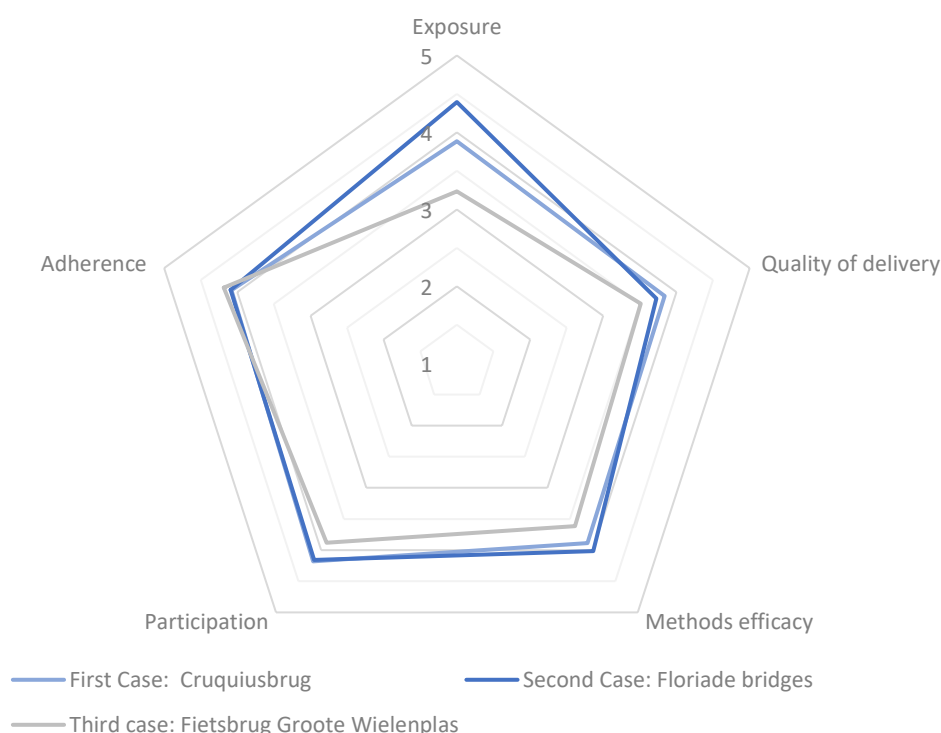


Figure 34 Cases implementation fidelity scores on all dimensions

5.1.1 Exposure

In this dimension, the impact of the structural issues is evident in all three cases. In the first case, while the client supports the circular ambition and the project was preceded with efforts to facilitate it, the

technical complexity of the assignment has limited the circularity scope in the project. The third case is even more affected by structural issues of the organizational source. The limited budget and time frame, in combination with prioritizing image quality and context directives for the design, have led to a low perception of the participants on the exposure dimension. In contrast, very ambitious clients fully support the second case to produce a highly circular product, eliminating potential structural issues resulting in a high exposure score.

Also impacting exposure, operationalization as a policy-related issue is mentioned by most participants in the first case due to, on the one hand, doubts over the measures of the circularity of strategies and the inadvertent effects. On the other hand, issues related to the procurement restrictions of communication and how that restricts open discussions over circular solutions. Issues regarding the procurement restriction were also mentioned in the third case, but more in line with the restriction of the organization's preference of procedures and lack of directives to implement the circular ambition.

In the three cases, the impact of the political and organizational support of the circular ambition is very evident. In the first case, the province has developed the IFD and has already involved the market in making it. In the second case, the project is on the Floriade Expo grounds, sponsored by the province and the municipality to push the circular ambition. Both projects had structural elements to boost the circular ambition pre the procurement. Hence the budget accommodates the circular ambition, and the procurement model accommodates the anticipated collaboration. In the third case, on the other hand, the contracting authority employees have included the circular ambition based on the general organizational directives. However, the budget and procurement models have not been altered to accommodate the potential addition of the circular ambition.

A pattern has been observed with the contracting authority in all three cases because the cases present the first experience with a high focus on circular ambition for the participants, which makes them reluctant to 'dare' and go for more circular ambition especially given the nature of the infrastructure assignments. However, in all three cases, contracting authority participants stated that they would 'dare ask more from the contractors, implying that the bids and what the contractors offered seemed to exceed their expectations.

5.1.2 Quality of delivery

This dimension is most susceptible to implementation issues. Participants in all three cases have mentioned issues affecting the quality of delivery dimension. However, the scope and impact of these issues varied by case. In the first case, no dominant issues have been recognized by a majority of the participant, issues mentioned included the lengthy process and understanding the role and impact of the IFD on the process. While in the second case, recognized by most participants, the open approach to the assignment resulted in broad interpretations of circular options which required readdressing. In the third case, also recognized by most participants, the process design created a disconnect between the contracting authority and the contractors adding in gauging circular opportunities of the assignment for both parties. Moreover, the combination of the budget limits and the technical restrictions posed by the norms and the maintenance department has narrowed circular options.

Policy-related issues in the link between cause and effect were mentioned in all three cases. Whether through the inadvertent impact of the specification's elements on the criteria in the awarding framework, the inadvertent impact among different ambitions in the awarding framework, and the comparability of different circular solutions.

Although the first case scored the highest on this dimension, the difference is relatively small across the three, and the cases' scores on the quality of delivery dimension are, on average, the lowest among the dimensions. This could be attributed to the novelty of circularity and the process and methods to implement it.

In the third case, unlike the first and second cases, only direct communication between the contracting authorities and the contractors was through public question rounds. Interestingly, concerning the clarity of the assignment's circular ambition, none of the interviewees indicated that having more direct communication would have impacted their bids. Nonetheless, it was suggested that discussions at an earlier stage when determining the scope and the budget would have been very welcome on the contractor's side.

While participants acknowledged the potential benefits of collaboration in the making of the assignments or the design of solutions, the potential of the market parties is addressed as the more efficient and effective manner to achieve circular ambitions, even in the absence of collaboration. In other words, improving the ambition-related aspects required of the contractors on the short and long terms, through the tenders, could prove more impactful on the individual itself and the market responsiveness to the circular ambition.

5.1.3 Methods efficacy

Since the issues mentioned in the cases manifest in the use of the methods and impact their implementation efficiency and effectiveness, method efficacy scores have mirrored the moderating dimensions. Consequently, although the issues in the first two cases, be it due to structural and policy-related issues or implementation traps, have impacted the efficacy, the impact has been limited. While in the third case, the issues have had a more significant impact. All identified issues could be traced to the methods, either by obstructing efficiency or reducing methods effectiveness. An example of case one is the use of the IFD in the specifications, which due to the cases structural, policy-related, and implementation traps, has led to a reduced efficiency to the process, and reduced effectiveness to the awarding framework. Another example in case three, the definition of the need in the assignment due to structural issues and implementation traps have had lowered efficiency and resulted in lowered effectiveness of the awarding framework.

5.1.4 Participant responsiveness

Two indicators factor into this dimension: practitioners' perception, the influence of the circular aspects, and how they are implemented in tendering on the contractor's decision to bid.

The scores of all three cases indicate consistency in the individual perception results of all 25 participants, as can be seen in Figure 35.

Issues regarding the method's influence on motivating the decision to bid have been mentioned in all three cases in varying occurrence. Implementation traps in the creation of enough incentive to ensure compliance are brought up in the first case concerning the contractor's decision not to make a bid because there was not enough incentive to take on the risks and in case three with the weights of circularity in the awarding framework reducing the significance of the circular criteria. In comparison, compliance-related issues have not been mentioned in the third case. The policy relates issues of professional belief have been mentioned in the first and third cases about the client's tolerance and acceptance of new circular methods of other relevant departments and entities. Not mentioning those sorts of issues in the third case could be attributed to the design of the tendering process limiting active interactions. Issues regarding specialist knowledge and understanding have been related in all

three cases to the newness of circularity implementation and the methods focusing on circular ambition.

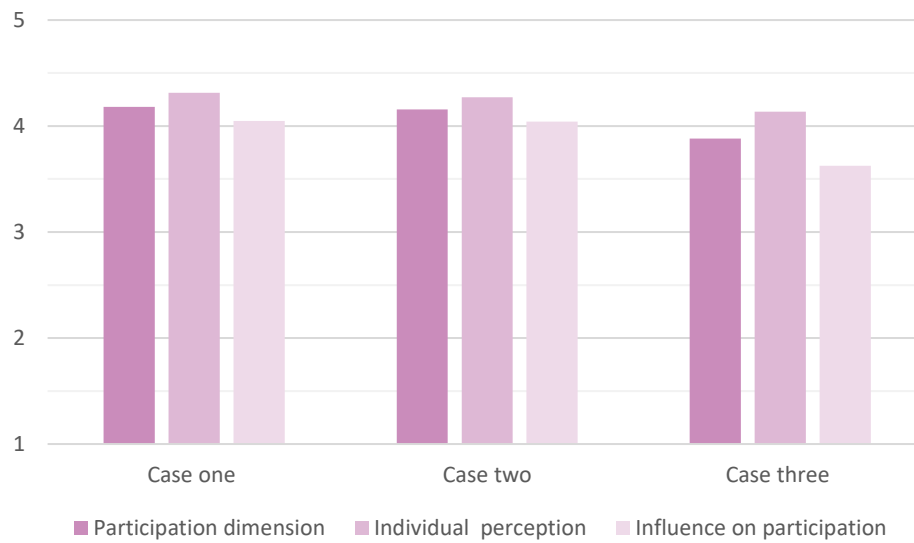


Figure 35 The two indicators of the participation dimension

It is noted that these issues have had the most impact on reducing the influence on the contractors' decision to bid in the third case. Although the first case had issues regarding two out of three contractors not submitting a bid, interviewees indicated that circularity in the assignment is not to blame for that, and the score confirms that.

5.1.5 Adherence

The scores for adherence in all three cases have been the most consistent at a relatively high average. This reflects an overall impression of the tendering outcome delivering on the circular aspects required in the case.

While exposure reflects circular ambition-related elements in the assignment, adherence reflects what was submitted in the bids relevant to those elements. In Figure 36, the relationship between exposure and adherence is visually represented. It can be seen how exposure as a moderator impacts adherence as a bottom-line measurement of implementation fidelity representing effective realization. Although adherence is high in all three cases, this relation discerns the effective fidelity of the outcomes, with the second case producing the most circular outcome through its tendering process.

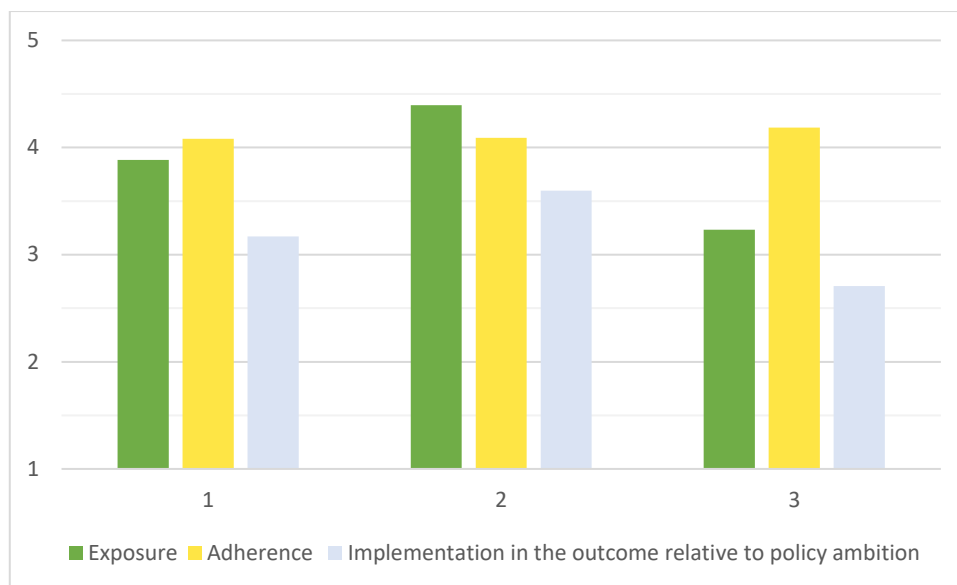


Figure 36 Implementation in the outcome relative to policy ambition in all three cases

The outcome of the case is regarded as all bids that the contractors have presented. This regard reflects the implementation fidelity construct, which is concerned with circularity in the tendering process and its methods. The applicability of this assumption in the construct of this research is most notable in the third case. The high score on the adherence dimension reflects the faithfulness of the bids to the case's circular ambition, specifically in its context. The lower scores of the three moderating dimensions have had the most impact on the method's efficacy, and not necessarily on the adherence, which is also confirmed in the interviews with both the contracting authority and the contractor's showing satisfaction with the outcome bearing in mind the circumstances of the case and the restrictions posed by the methods on the circular ambition requested in the case.

5.2 METHODS DIFFERENTIATION

In the three cases, the strong relationship between the need definition, the specification, and the awarding frameworks through the circular aspects is very apparent. The fidelity of the methods across the cases has been relatively level, apart from strong interference due to structural issues or implementation traps. For instance, in the first case, the scope and technical complexity of the project took precedence in the pre-selection and eliminated the need for circular pre-selection criteria to reduce the number of participating contractors. In the second case, the open approach to the assignment reduced the efficacy and delivery quality of the specifications. The scores of the three cases on the four methods are seen in Figure 37.

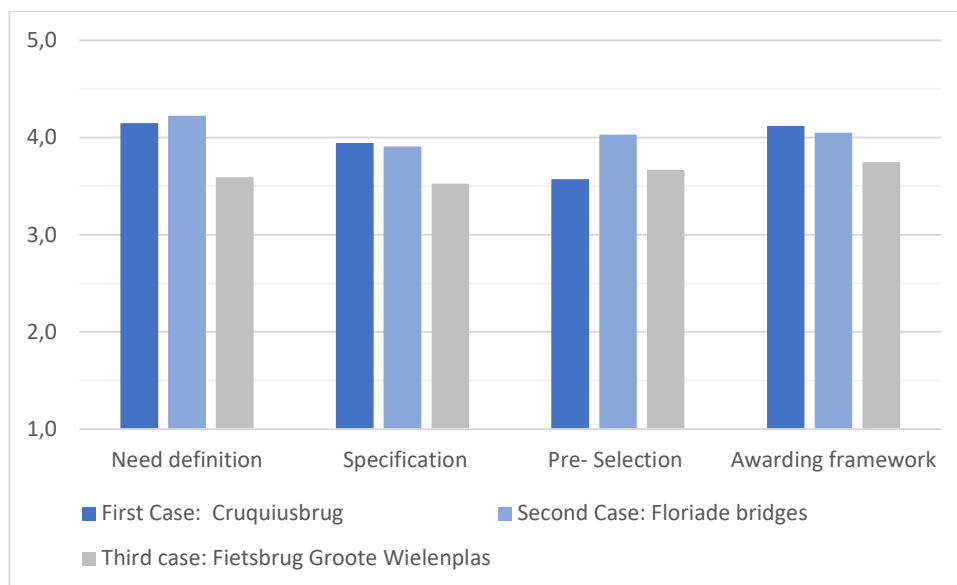


Figure 37 Differentiated implementation fidelity values for the four methods to include circularity

5.2.1 Need definition

The fidelity of the need definition is highly esteemed in the first two cases by the participation. Issues regarding this method have been identified in the third case regarding choices for the scope in the assignment. With regards to defining the circular ambition, from the perspective of the contractors, it is challenging. Regarding circularity's definition, the participants recognize the challenge due to the lack of universal definitions of circular aspects in the sector. However, it is up to the contracting authority to clarify their expectations regarding the circular ambition in the tender process. In the second case, the difficulties due to the loose definition at the beginning were overcome by responding to the contractors' inquiries and clarifying adopted objectives and frameworks. In the third case, all contractors have confirmed that the circular ambition of the municipality and the qualitative awarding aspects were clear from their perspectives.

The relevance and added benefits of orientation and market consultation activities in the preparation phase are notable. In case one, the making of the IFD, as a dominant part of the specifications, was done in collaboration with market parties. In case two, the participants were selected based on scanning potential parties, and the parties were awarded for including creative ideas of the hackathon. The added benefits because of these efforts were noticeable through the analysis. In the third case, both parties of the contracting authority and the contractors have suggested that some aspects of the need definition and specification could have been discussed earlier to improve the potential circularity.

5.2.2 Specification

The fidelity of the specification is relatively lower than the other assignment at implementing circularity. The dimensions scores for all three cases are relatively consistent, but exposure with the second case scoring much higher. Issues in the cases have resulted in the specification limiting circular options in the solutions. Implementation traps, with regards to in-organization collaboration, have been relevant in the second and third cases. While establishing a shared understanding and consenting over the objectives of the specs was relevant in the first and second cases. Policy-related issues have also had a pronounced relevance in the use of the specifications, with operationalization issues in the first and third cases and specialist knowledge and understanding in all three cases.

5.2.3 Pre-selection

The three cases presented different situations with regards to the pre-selection circular aspects. In the first case, the pre-selection follows the European tendering rules, and the number of participants was limited without the need for circularity pre-selection criteria. In the second and third cases, the contracting authority invited the contractors. While in the second case, the contractors were made aware of the motivation behind inviting them. The decision was made internally in the third case, and the contractors were made aware later. Inviting the tender parties in the second and third cases is considered a strategy to increase the potential and probability of the circular product considering the limited time available. The fidelity of the pre-selection has had the most impact on the second case due to the extensive focus of the contracting authority on maximizing the circular product. Although attention has been paid to circular aspects in the first and third cases, it was paid moderate attention in comparison, which is reflected in the method results across the cases.

Open tendering frameworks have been mentioned as a restricting aspect in the second and third cases. The choice to invite the contractors instead of making an open invitation to bid has been explained by the need for trust and familiarity to enable the complex, innovative process and the time constraints in the third case. It is also implied that the risks of procuring circularity warrant selecting contractors based on their established mindset in similar ambitions and innovation. Both cases also mentioned it as rewarding to the contractors' efforts in that direction to be invited to make bids on other tenders.

5.2.4 The awarding framework

Many participants in all three cases have named the awarding framework the most important of the four methods. The framework presents room for the contractors to build their competitive advantage in the tenders. However, as the results show, the fidelity of the method is sensitive to issues that reflect directly in the use of the method, as apparent in the third case where structural issues led to lowering the weight of circular aspects. This also shows through the other methods' influence, such as the specifications'-imposed limits in the first and third cases. The nature of the assignment has been linked to many policy-related issues when discussing the awarding framework. The impact of policy-related issues in creating the link between cause and effect is most influential in this method. In the first and third cases, it was relevant to the inadvertent effect of awarded aspects of one ambition on the other. While in the second and third cases, it was relevant to the comparability of different circular approaches to the solutions. It has also been interesting that the contractors thought scoring on the circular awarding criteria was more straightforward than the image quality criteria in the third case.

5.3 BETWEEN THE CONTRACTING AUTHORITY AND THE CONTRACTORS

On fidelity dimensions within the cases, due to the number of participants, it is not representative to examine the scores per grouping. However, a trend is detected that the given scores by the contracting authority personnel are higher than the scores given by the contractors. Considering issues, following the nature of the issue, and the participant's perception within their party issue category differed. However, both parties have recognized and mentioned some structural- or policy-related issues or implementation traps.

It is also interesting to note how the issues detection in the cases was highly relevant to the procurement model and extent of interaction between the contractors and the contracting authority. In the first two cases with dialogues and design sprints, both parties were aware of the common issues. While in the third case, a distinct dis-part was detected in recognizing issues and, more significantly, their causes. Most reasons behind the issues were made clear to the involved parties eventually by the discussions when the process was concluded.

In the third case, the model scores assign higher participation scores for the contractors than the contracting authority. This indicates that contractors' perception of procurement documents and their impact on participation is more favorable than that of the contracting authority personnel, also verified in the interviews.

5.4 PHASE FOUR CONCLUSIONS

Based on the cross-case analysis and triangulation with the literature review and the construct assumptions, the following conclusions are made:

- Increasing the fidelity on the exposure score is highly dependent on reducing the impact of structural issues, such as political support, budgeting, availing sufficient preparation time.
- Increasing the fidelity on the quality of delivery dimension requires reducing and avoiding, if possible, creating implementation traps throughout the tendering process.
- The newness of circularity-related implementation practices affects the fidelity of all three moderating dimensions, generating the assumption that reoccurring experiences will level up the overall scores and potential the perception in scoring those dimensions.
- Policy implementation structural, policy-related issues, or implementation traps impact the efficacy of the methods to include circularity in the tendering process. They affect all methods' efficacy because the methods are designed to complement each other throughout the process.
- The moderating dimensions affect, whether directly or indirectly, the remaining two dimensions. However, this effect is only reflective of the relation between the dimensions. High moderating scores do not necessarily mean high adherence or method efficacy, and the reverse is correct.
- Individual perception of circularity in the market and for the sector shows high consistency across all participants. This makes the participants' responsiveness more sensitive to case-related influence on participating in the tendering process.
- Most policy-related issues related to participants have been attributed to the newness of implementation, which means that continued application could reduce these issues' influence.
- More research could establish the framework for benchmarking for the fidelity in using certain procurement models or tendering procedures.
- The scores of the cases reflect their real-world settings based on the cases' context and the decisions made in the procurement strategy. This means that some of the issues that influence or manifest during the tendering are a product of the case's procurement model and tendering procedure.
- Exposure as moderator impacts adherence as a bottom-line measurement of effective realization.
- Issues in the tendering process and the use of the methods to include circularity can be traced to policy implementation issues.
- The fidelity of the methods in the cases is interrelated. Implementation issues show interrelated impacts on the methods, indicating that reducing or eliminating the implementation issues will reflect on the methods fidelity and their influence on each other.
- A link is made to increased difficulty due to the nature of civil engineering projects in policy-related issues.
- Differentiating the participants' scores could reflect disagreements between the parties on certain aspects of instruments of implementation fidelity. Still, consistent trends over fidelity are observed in the research cases.



6 Results and discussion

In this chapter the research results are presented followed by an elaborate discussion of the validity and limitations. To conclude the research recommendations are made for practice and future research.

6.1 RESEARCH RESULTS

In the previous chapters, along with four phases, the research devises and uses a framework to assess the implementation fidelity of the methods to include circularity in the tendering phase of civil engineering works procurement. In phase one, relevant research is thoroughly scanned for relevant themes to the circular policy ambition, the procurement process, and the issues and barriers. In phase two, a five-dimension analysis framework is proposed to assess the implementation fidelity of the tendering process and the methods to include circularity at delivering the circular policy ambition. The implementation fidelity of three civil engineering projects is assessed using the proposed analysis framework in phase three. Lastly, in phase four, a cross-case analysis is conducted to analyze the results of the cases in phase 3 and triangulate the findings with the findings of the literature review in phase one. In this paragraph, the research findings are summarized to answer the main research question: *How to improve the efficacy of the methods to include circularity in the procurement of civil engineering projects at delivering the circular policy ambition?*

6.1.1 Using implementation fidelity

The implementation fidelity framework has been used to create a holistic analysis that captures the many facets impacting procurement and tendering; second, to determine sources of implementation issues and subsequent room for improvements; and finally, to differentiate between the methods to include circularity. The analysis's construct managed to capture the quantitative and qualitative data in a consistent and interpretable manner through three study cases. Thus, it consistently links the fidelity dimensions, the corresponding issue categories, and the methods to include circularity in the tendering process.

Due to the interrelated impact of the five dimensions on implementation, the research did not attempt to compare or quantify the dimensions themselves, as it would not have been possible within this research's scope and time limits. Therefore, the research examines overall fidelity with equal weights assigned to all five dimensions, assuming that participants attach significance to themes with inherent comparability due to the nature of the assessment. Furthermore, in line with the research objective to determine room for improvement in implementation, the analysis of the results focuses more on scores by dimension and treats the overall score as a general impression.

6.1.2 Higher fidelity: room for improvement

The room for improvement covers the three moderating dimensions, exposure, quality of delivery, and participation. The research categorizes the issues impacting the implementation fidelity of the circular ambition by the three moderating dimensions to three sources: structural issues, implementation traps, and policy-related. Improvements on any of these issues reflect on all three moderating dimensions and, consequently, on the remaining two dimensions, method efficacy and adherence.

The use of the methods to include circularity is affected by the implementation fidelity of the circular ambition in the tendering process. Increasing this fidelity reflects on the methods, individually and as

a group of instruments intended to complement each other. On a case level, the contracting authority has room to increase fidelity:

- first, by reducing or eliminating potential issues of structural nature that impact the entire procurement process. Hence, it creates a more proactive stance of the contracting authority in handling the circular ambition in the assignment.
- second, by reducing or eliminating potential implementation traps generated as a result of decisions within the procurement process over the implementation of circularity in the tendering procedure.

On a policy level, the circular ambition still faces issues concerning our knowledge and understanding of circularity and the limitations and consequences of its strategies. Policy-related issues impacted all attempts to include circularity in civil engineering procurements and required addressing at higher policy levels. Moreover, the complexity and nature of civil engineering assignments make their procurements more susceptible to these issues. However, policy-related issues are amplified by other implementation and structural issues. Thus, reducing the impact of implementation and structural issues limits the impact of policy-related issues per case.

6.1.3 Compatibility with circularity implementation

The need for the IFA has been discussed in the build-up to the construct. This need stems from the sector's multidimensional levels and considerations of circularity, which reflect in its definitions, implementation approaches and levels, and application methods and scopes. The IFA is proposed to examine circularity in tendering civil engineering projects for two core purposes. First, to educate the implementation results in the tendering of those projects, which as procurement assignments could be more challenging to the circular ambition due to technical, political, or organizational reasons. Second, to assess the contracting authorities' efforts to create the most effective and efficient balance between fidelity to the circular policy ambition and the optimal room for flexibility and innovation in case-to-case standings and the practical requirements of the assignments and the sector. These two purposes lead back to the basic concept that complex ideas are more challenging to adopt. The assessment has managed to capture how the different levels and aspects essential for circularity implementation affect its fidelity through the dimensions.

The implementation fidelity construct proposed in this research is tailored for circularity which presents a new policy intervention implemented in the existing procurement frameworks. The dimensions and the aspects within have linked circularity as an intervention to the procurement frameworks without restricting this relation. In other words, the fidelity of circularity implementation in any procurement model, tendering directive or procedure, and contract types could be assessed whether it is existing or devised, which is specifically of relevance to the circular policy, a policy that requires process innovation and is still facing barriers related to the combination of its newness and urgency.

6.2 DISCUSSION

This research is a novel attempt to use the implementation fidelity analysis in procurement, specifically for the tendering process of civil engineering projects. Therefore, the research is explorative in the sense that it explores some uncharted grounds when combining the methodology with the scientific field. The research has managed to establish the potential of its approach, but it is still limited by it.

The validity of the research and its limitation are discussed here in line with the four criteria defined for the research quality.

6.2.1 Validity and reliability

Regarding the constructed framework in defining what data to be collected, two areas are relevant: the aspects examined within each dimension and differentiation between the methods. An extensive literature review in phase one has educated the decisions in phase two over what impacts professionals have reviewed the policy implementation fidelity within the tendering process and these decisions before use. In phase three, in the scope of the three cases, with 25 interviews analyzed within this research, none of the responses to the open questions brought up relevant aspects that were not already covered by the proposed construct. This has been further validated in the cross-examination of the quantitative and qualitative data bringing consistent conclusions.

Moreover, interviewees were asked at the interview end if they would add something of relevance to the discussion or the research framework to improve the content or the process. No direct suggestion was made to the collected data, and some responses appreciated what the assessment was attempting and how. Nonetheless, within those themes, the data collected could be differentiated more to detect more direct relations to the issues, which was not possible within the time limits of this research, which is also a reflection of the methods employed to collect the data and its compatibility.

In the validity of how the construct delivers its objectives, results between qualitative and quantitative data and triangulation in the cross-case analysis showed consistency with the construct assumptions, validating that it delivers according to its design. It is also apparent in the relationships within the dimensions, between implementation and moderating dimensions, and among the issues and methods.

However, although the research recognizes the overall impact, it still focuses on the direct effect in the relation between the implementation issues and the moderating dimensions. It ignores the indirect effect of the issues on multiple dimensions. Furthermore, the categorization of issues is made based on the perception of the interviewees, which means that the same problem could be attributed to different causes. An example is the contractual framework issues in the first case which led to contractors not submitting a bid. One contractor attributed the issues to a lack of trust and the inability of the contracting authority to foster the collaborative environment needed for the innovation in the following phases. Consequently, it was considered as an 'organizational position and collaboration' implementation trap. While another interviewee considered it was irrelevant to circularity and applied to the assignment. Thus, it was considered as an 'operationalization' structural issue, which also explains why it was not listed as a 'model and procedure' implementation trap.

The scores assigned to dimensions in the assessment have reflected the participant's perception of the process and the outcome. While in the interviews, the participants reflect on their experience and share issues that they have faced or considered relevant to circularity in the assignment, the scores still reflected the significance the participants assigned to the issues on respective dimensions.

The scores between the contracting authority and the contractors have shown differences and similarities reflecting their perspectives on the different methods across the dimensions. However, the contracting authority participant giving higher scores on average could be a sign of bias, or it could reflect an overall higher perception of fidelity as a divergence of perception between the two parties. The research assumes these possibilities but could not confirm either.

In case one, a divergence is noted between the experts and consultants and the contracting authority. Optimally, this trend would have been followed upon in the cross-case analysis. However, the two remaining cases didn't present participants to expand on that grouping. Consequently, in the cross-case, two participants groupings were identified: contracting authority's and contractors' participants.

True to the implementation fidelity conceptual framework, the selection and analysis of the cases reflect and embrace real-life settings, which maintains a balance in the trade-off between internal and external validity. This supports the external validity of the research to be generalized. On the other hand, with regards to the case and participation selection, within the criteria, all eligible cases found by research or mentioned by practitioners during the preliminary phases have been approached non-discriminable. Moreover, the interviewees were approached solely based on involvement in the case and the tendering process to achieve the conscious, holistic perception. However, the novel construct is aimed at the inclusion of circularity in civil engineering projects. This leaves room for a broad scope of projects and levels of circularity inclusion that were not available at the time of the research and within the researcher's network.

6.2.2 Limitations

Next to the limitations mentioned above and in the previous paragraph, the following limitations are identified:

Literature limitations: research on circularity in procurement on the academic level is still limited, specifically the research focused on the procurement of civil engineering projects and circular policy implementation issues, which required some reliance on papers and guidelines published by government and market parties. Moreover, few papers focus on implementation and fidelity research on environmental policy or the construction and infrastructure sector. Hence, the research used studies on other fields of science to support the making of the construct.

Assessment limitations: within the scope of this research and its time frame, complete focus is bestowed on the tendering process and the methods to include circularity to examine the implementation fidelity. Attention to the inclusion of circularity in the preparation and contract execution phases of procurement is considered in a limited matter. This limitation reflects most on the implementation issues identification. It is assumed that expanding the scope would result in the broader identification of issues.

Cases limitation: as already mentioned in the previous paragraph, the scope of available cases that fit the scope is minimal. The range of participation is affected in the first and second cases by the small number of contractors in the tendering process and being able to reach two out of the available three in each case.

The researcher speaks English and Dutch as second and third languages. At the same time, the participants are practitioners in the Dutch market. Measures have been taken to facilitate the exchange of information:

- First, the assessment is in Dutch and have been reviewed multiple times with Dutch-speaking professionals and supervisors for terminology and ease of understanding.
- During interviews, the interviewer is present while participants fill in the assessment for any questions over the statements.
- The introductory presentation was presented in Dutch, and the interviewees were encouraged to use the language they were most comfortable with to answer questions.

In the interviews, to balance the conversation with the participants over the process, the introduction is focused on improving the circular ambition and not assessing the tendering process itself. Although this has prompted a sense of reflection, a certain level of bias in the answers is inevitable.

Results limitation: the assessment relies on individual perception and understanding of circularity; the participants are considered practitioners and professionals, and their perception is relevant for the case implementation fidelity. On the other hand, different cases have shown different benchmarks to their objective levels and circular ambition. At the same time, the participants were directed to consider the national circular ambition as the target of circular ambition. Their organizational context and policy directives impacted their impression of the case and their scores for exposure and adherence dimensions.

6.3 RECOMMENDATIONS

6.3.1 For Practice

The purpose of the framework is to feed into the body of expertise within the organization to improve on future tendering processes to include, enable, and produce more circular solutions with more efficacy in the use of the methods. Therefore, the research recommends practical use of the implementation fidelity framework, which would benefit the contracting authority on many levels.

- It allows the contracting team to reflect on the process and the circular policy implementation.
- It provides insight into potential improvements and opportunities while identifying potential impactful interferences in the process.
- It gathers insight into the process from multiple points, which is essential for the early stages of circularity implementation.
- Participation of the contractors in these assessments provides insight into the direction and objectives of the contracting authority.
- It allows the contractors the opportunity to suggest improvements and express their concerns or reservations indirectly.

The research acknowledges that policy-related issues due to the currently limited knowledge over circularity, inadvertent effects, and the long-term consequences of its implementation in civil engineering projects impact at a sector level as issues inherent to the policy itself. Nonetheless, the research recommends using the IFA to identify the sources of issues impacting the fidelity of circularity implementation. Because, on an organizational level, removing structural issues and implementation traps raise overall fidelity and reduce the effect of policy-related issues.

6.3.2 For research

Given the time limits, the research has appropriately used the implementation fidelity analysis to achieve its objectives. However, the limitations discussed in the previous paragraph identify potentials for future research:

While the research included all dimensions of implementation fidelity, future research could examine the potentials of focusing on one dimension or a combination of dimensions to address certain aspects of circularity implementation, procurement models, or tendering procedures.

For example, there is potential for research using the framework over open public tenders, focusing on the participation dimension. Such research would include a broader scope of contractors to involve contractors who decided not to participate in the tenders. This would provide insightful findings by

evaluating the impact of including circularity on the contractor's decision to bid. It would also reflect the perception and reception of circularity on a market level.

The construct used in this research links dimensions to sets of issues, policy-related, structural, and implementation traps, in an explorative manner that has been verified. Still, further research on the implementation fidelity framework could explore the potential of devising a more precise identification of issues. This would be possible by differentiating the moderating dimensions to connect to specific issues instead of issue areas.

Moreover, future research might produce interesting results by employing the implementation fidelity framework to examine the fidelity of interventions to overcome the different types of implementation issues and, specifically, implementation traps, with continued use of the assessment to feed results back into following procurements.

It would also be interesting to examine the diverging perception among the different parties involved in the tendering process over implementation fidelity with more discrimination on their expertise, organization, or specialty. This would help the efforts to align the interests of the different parties involved in the process.

Implementation fidelity studies for the circular policy could be replicated for different phases of the procurement process, such as preparation and execution. For example, future research that focuses on the need definition using the implementation fidelity framework and its dimensions would link the decisions and assumptions made in the preparation phase to the tendering phase. The results of such research could challenge existing procurement frameworks to increase compatibility with the circular ambition and address policy-related issues more efficiently in the preparation phase.

Examining all five implementation fidelity dimensions for the instruments and processes at the different levels throughout the procurement cycle is most compatible with the circular ambition in the building and infrastructure sector. This could be most beneficial to establish a more vital link between policymakers and policy implementers. Moreover, it would support future efforts to update the circular ambition goals and milestones by presenting a more encompassing image of the policy implementation fidelity in real-world settings.

References

- Adams, K., Osmani, M., Thorpe, A., & Thornback, J. (2017). Circular economy in construction: current awareness, challenges and enablers. *Proceedings of the Institution of Civil Engineers - Waste and Resource Management*, 170, 1-11. doi:10.1680/jwarm.16.00011
- Adams, K., Osmani, M., Thorpe, T., & Hobbs, G. (2017). *The role of the client to enable circular economy in the building sector*. Paper presented at the Conference contribution.
- Adetunji, I., Price, A., & Fleming, P. (2008). Achieving sustainability in the construction supply chain. *Proceedings of The Institution of Civil Engineers-engineering Sustainability - PROC INST CIV ENG-ENG SUSTAIN*, 161, 161-172. doi:10.1680/ensu.2008.161.3.161
- Akenji, L., Bengtsson, M., Bleischwitz, R., Tukker, A., & Schandl, H. (2016). Ossified materialism: introduction to the special volume on absolute reductions in materials throughput and emissions. *Journal of Cleaner Production*, 132. doi:10.1016/j.jclepro.2016.03.071
- Alhola, K., Salmenperä, H., Ryding, S.-O., & Busch, N. (2017). *Circular Public Procurement in the Nordic Countries*.
- Althaus, C., Bridgman, P., & Davis, G. (2020). *The Australian Policy Handbook: A practical guide to the policy-making process*.
- Ammerman, R., Putnam, F., Kopke, J., Gannon, T., Short, J., Van Ginkel, J., . . . Spector, A. (2007). Development and Implementation of a Quality Assurance Infrastructure in a Multisite Home Visitation Program in Ohio and Kentucky. *Journal of Prevention & Intervention in The Community*, 34, 89-107. doi:10.1300/J005v34n01_05
- Andersen, M. (2006). An introductory note on the environmental economics of the circular economy. *Sustainability Science*, 2, 133-140. doi:10.1007/s11625-006-0013-6
- Annor, S. O., & Allen, P. (2009). Why is it difficult to promote public mental health? A study of policy implementation at local level. *Journal of Public Mental Health*, 7, 17-29.
- Antea Group, & Metabolic. (n.d.). *Whitepaper circulaire dienstverlening: circulaire aanbesteden*. Retrieved from https://gvag.nl/wp-content/uploads/2016/10/whitepaper_circulaire_aanbesteden.pdf
- Arup. (2016). *The circular economy in the built environment*. Retrieved from <https://www.arup.com/perspectives/publications/research/section/circular-economy-in-the-built-environment>
- Ashford, N. A., & Hall, R. P. (2011). The Importance of Regulation-Induced Innovation for Sustainable Development. *Sustainability*, 3(1), 270-292. Retrieved from <https://www.mdpi.com/2071-1050/3/1/270>
- Bastein, T., Roelofs, E., & Hoogendoorn, A. (2013). *Opportunities for a circular economy in the Netherlands*. Delft: TNO.
- Bauer, M., Damschroder, L., Hagedorn, H., Smith, J., & Kilbourne, A. (2015). An introduction to implementation science for the non-specialist. *BMC psychology*, 3, 32. doi:10.1186/s40359-015-0089-9
- Bhattacharyya, O., Reeves, S., & Zwarenstein, M. (2009). What Is Implementation Research?: Rationale, Concepts, and Practices. *Research on Social Work Practice*, 19(5), 491-502. doi:10.1177/1049731509335528
- Bisello, A., Grilli, G., Balest, J., Stellin, G., & Ciolli, M. (2017). Co-benefits of Smart and Sustainable Energy District Projects: An Overview of Economic Assessment Methodologies. *Green Energy and Technology, Smart and Sustainable Planning for Cities and Regions*, 127-164. doi:10.1007/978-3-319-44899-2_9
- Blakely, C. H., Mayer, J. P., Gottschalk, R. G., Schmitt, N., Davidson, W. S., Roitman, D. B., & Emshoff, J. G. (1987). The fidelity-adaptation debate: Implications for the implementation of public sector social programs. *American journal of community psychology*, 15(3), 253-268.

- Bullock, R. J., & Batten, D. (1985). It's Just a Phase We're Going Through: A Review and Synthesis of OD Phase Analysis. *Group & Organization Studies*, 10(4), 383-412. doi:10.1177/105960118501000403
- Calisto Friant, M., Vermeulen, W., & Salomone, R. (2020). Analysing European Union circular economy policies: words versus actions. *Sustainable Production and Consumption*, 27, 337-353. doi:10.1016/j.spc.2020.11.001
- Campbell-Johnston, K., Calisto Friant, M., Thapa, K., Lakerveld, D., & Vermeulen, W. (2020). How circular is your tyre: Experiences with extended producer responsibility from a circular economy perspective. *Journal of Cleaner Production*. doi:10.1016/j.jclepro.2020.122042
- Carroll, C., Patterson, M., Wood, S., Booth, A., Rick, J., & Balain, S. (2007). A conceptual framework for implementation fidelity [Electronic version]. *Implementation science : IS*, 2, 40. doi:10.1186/1748-5908-2-40
- Chao-Duivis, M. A. (2018). Privaatrechtelijke aspecten van de circulaire economie in het bijzonder circulair bouwen (Deel III). *Tijdschrift Voor Bouwrecht*, 1(1), 2–14.
- Cheshire, D. (2019). *Building revolutions: Applying the circular economy to the built environment*: Riba Publishing.
- Conteh, C. (2011). Policy implementation in multilevel environments: Economic development in Northern Ontario. *Canadian public administration*, 54(1), 121-142.
- Cook, T., & Campbell, D. (1979). *Quasi-Experimentation. Design & Analysis Issue for Field Settings* (Vol. 351).
- Copper8. (2018). Circulair Inkopen in 8 Stappen. Handreiking voor de Grond-, Weg- en Waterbouw. Retrieved from <https://www.copper8.com/handreikingen-circulair-inkopen/>
- Corona, B., Shen, L., Reike, D., Rosales Carreón, J., & Worrell, E. (2019). Towards sustainable development through the circular economy—A review and critical assessment on current circularity metrics. *Resources Conservation and Recycling*, 151. doi:10.1016/j.resconrec.2019.104498
- Coscia, C., & Curto, R. (2017). Valorising in the Absence of Public Resources and Weak Markets: The Case of “Ivrea, the 20th Century Industrial City”. In (pp. 79-99).
- Creswell, J. W., & Clark, V. L. P. (2006). *Designing and Conducting Mixed Methods Research*.
- Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into practice*, 39(3), 124-130.
- De Leeuw, M. (2018). Stijging bouwkosten: alles wat u moet weten. Cobouw. Retrieved from <https://www.cobouw.nl/bouwbreed/artikel/2018/05/stijging-bouwkosten-alles-wat-u-moet-weten-101261184>
- De Ridder, H. (2018). Naar een circulaire bouwsector. In *Circulariteit: op weg naar 2050?* (pp. 209-219). Delft: TU Delft Open voor TVVL.
- DeGroff, A., & Cargo, M. (2009). Policy implementation: Implications for evaluation. *New Directions for Evaluation*, 2009(124), 47-60. doi:<https://doi.org/10.1002/ev.313>
- Demand-side Innovation Policies*. (2011). Retrieved from
- Dijcker, R., Schepers, O., & Witteveen+Bos. (2018). *Circulair Ontwerpen in het MIRT-proces*. Retrieved from Deventer: https://puc.overheid.nl/rijkswaterstaat/doc/PUC_158440_31/
- Dijksma, S. A., & Kamp, H. (2016). *Nederland circulair in 2050*. Retrieved from
- Ditlopo, P., Blaauw, D., Rispel, L., Thomas, S., & Bidwell, P. (2013). Policy implementation and financial incentives for nurses in South Africa: a case study on the occupation-specific dispensation. *Global Health Action*, 6.
- Dobson, D., & Cook, T. J. (1980). Avoiding type III error in program evaluation: Results from a field experiment. *Evaluation and Program Planning*, 3(4), 269-276. doi:[https://doi.org/10.1016/0149-7189\(80\)90042-7](https://doi.org/10.1016/0149-7189(80)90042-7)
- Durlak, J. (1998). Why Program Implementation is Important. *Journal of Prevention & Intervention in The Community*, 17, 5-18. doi:10.1300/J005v17n02_02

- Durlak, J. (2015). Studying Program Implementation Is Not Easy but It Is Essential. *Prevention science : the official journal of the Society for Prevention Research*, 16. doi:10.1007/s11121-015-0606-3
- Durlak, J., & DuPre, E. (2008). Implementation Matters: A Review of Research on the Influence of Implementation on Program Outcomes and the Factors Affecting Implementation. *American journal of community psychology*, 41, 327-350. doi:10.1007/s10464-008-9165-0
- Dusenbury, L., Brannigan, R., Hansen, W. B., Walsh, J., & Falco, M. (2005). Quality of implementation: developing measures crucial to understanding the diffusion of preventive interventions. *Health education research*, 20(3), 308-313.
- E., B. T. (2001). *Finding the balance: Program fidelity and adaptation in substance abuse prevention: A state of the art review*. Rockville.
- EAA. (2017). *A Sustainable Industry for a Sustainable Europe*. Brussels: European Aggregate Association Retrieved from <http://www.uepg.eu/publications>
- Essers, M., & Lombert, C. (2017). *Aanbestedingsrecht voor overheden: naar een maatschappelijk verantwoord aanbestedingsbeleid*: Vakmedianet.
- European Commission. (2017a). *Public Procurement for a Circular Economy*. Retrieved from <http://ec.europa.eu/growth/single-market/public-procurement/>
- European Commission. (2017b). *Resource Efficient Use of Mixed Wastes Improving management of construction and demolition waste*. Brussels: European commission Retrieved from <https://ec.europa.eu/environment/waste/>
- European Commission. (2018). PUBLIC PROCUREMENT GUIDANCE FOR PRACTITIONERS. Directorate-General for Regional and Urban Policy Retrieved from <https://op.europa.eu/en/publication-detail/-/publication/1f1c8329-c2c8-11e8-9424-01aa75ed71a1/language-en>
- F. Mendoza, J. M., Sharmina, M., Gallego Schmid, A., Heyes, G., & Azapagic, A. (2017). Integrating Backcasting and Eco-Design for the Circular Economy: The BECE Framework. *Journal of Industrial Ecology, Special Issue*. doi:10.1111/jiec.12590
- Fagan, A., Hanson, K., Hawkins, J., & Arthur, M. (2008). Bridging Science to Practice: Achieving Prevention Program Implementation Fidelity in the Community Youth Development Study. *American journal of community psychology*, 41, 235-249. doi:10.1007/s10464-008-9176-x
- Falagario, M., Sciancalepore, F., Costantino, N., & Pietroforte, R. (2012). Using a DEA-cross efficiency approach in public procurement tenders. *European Journal of Operational Research*, 218, 523-529. doi:10.1016/j.ejor.2011.10.031
- Femke, N., Faculteit, R., Groningen, Arts, J., Wetenschappen, F., & Groningen, R. (2008). Effectrapportages en management van infrastructuurprojecten: Van risicobron tot risicobeheersing.
- Fieldman, G. (2014). Financialisation and ecological modernisation. *Environmental Politics*, 23(2), 224-242. doi:10.1080/09644016.2013.821826
- Gebremariam, A. T., Di Maio, F., Rem, P., & Vahidi, F. (2020). Innovative technologies for recycling End-of-Life concrete waste in the built environment. *Resources, Conservation and Recycling*, 163.
- Geels, F. (2004). From Sectoral Systems Of Innovation To Socio-Technical Systems: Insights About Dynamics And Change From Sociology And Institutional Theory. *Research Policy*, 33, 897-920. doi:10.1016/j.respol.2004.01.015
- Geels, F. (2019). Socio-technical transitions to sustainability: a review of criticisms and elaborations of the Multi-Level Perspective. *Current Opinion in Environmental Sustainability*, 39. doi:10.1016/j.cosust.2019.06.009
- Geissdoerfer, M., Morioka, S., Carvalho, M., & Evans, S. (2018). Business models and supply chains for the circular economy. *Journal of Cleaner Production*, 190. doi:10.1016/j.jclepro.2018.04.159
- Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The Circular Economy: A new sustainability paradigm? *Journal of Cleaner Production*, 143, 2017, 757-768.

- Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner Production*, *114*, 11-32.
- Godard, J. (2001). Beyond the High-Performance Paradigm? An Analysis of Variation in Canadian Managerial Perceptions of Reform Programme Effectiveness. *British Journal of Industrial Relations*, *39*, 25-52. doi:10.1111/1467-8543.00188
- Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The qualitative report*, *8*(4), 597-607.
- Govindan, K., & Hasanagic, M. (2018). A systematic review on drivers, barriers, and practices towards circular economy: a supply chain perspective. *International Journal of Production Research*, *56*, 1-34. doi:10.1080/00207543.2017.1402141
- Greene, J. C., Caracelli, V. J., & Graham, W. F. (1989). Toward a Conceptual Framework for Mixed-Method Evaluation Designs. *Educational Evaluation and Policy Analysis*, *11*(3), 255-274. doi:10.2307/1163620
- Greenhalgh, T., Robert, G., Bate, S., Kyriakidou, O., & Macfarlane, F. (2004). *How to spread good ideas: A systematic review of the literature on diffusion, spread and sustainability of innovations in health service delivery and organisation*.
- Guo, Y., Dynia, J., Logan, J., Justice, L., Breit-Smith, A., & Kaderavek, J. (2016). Fidelity of implementation for an early-literacy intervention: Dimensionality and contribution to children's intervention outcomes. *Early Childhood Research Quarterly*, *37*, 165-174. doi:10.1016/j.ecresq.2016.06.001
- Hahladakis, J., & Iacovidou, E. (2019). An overview of the challenges and trade-offs in closing the loop of post-consumer plastic waste (PCPW): Focus on recycling. *Journal of Hazardous Materials*, *380*, 120887. doi:10.1016/j.jhazmat.2019.120887
- Halle, T., Metz, A., & Martinez-Beck, I. (2013). *Applying implementation science in early childhood programs and systems*: Paul H. Brookes Publishing Company.
- Harachi, T., Abbott, R., Catalano, R., & Fleming, C. (1999). Opening the Black Box: Using Process Evaluation Measures to Assess Implementation and Theory Building. *American journal of community psychology*, *27*, 711-731. doi:10.1023/A:1022194005511
- Hart, J., Adams, K., Giesekam, J., Densley Tingley, D., & Pomponi, F. (2019). Barriers and drivers in a circular economy: the case of the built environment. *Procedia CIRP*, *80*, 619-624. doi:10.1016/j.procir.2018.12.015
- Healy, M., & Perry, C. (2000). Comprehensive criteria to judge validity and reliability of qualitative research within the realism paradigm. *Qualitative market research: An international journal*.
- Hinkin, T. R. (1998). A Brief Tutorial on the Development of Measures for Use in Survey Questionnaires. *Organizational Research Methods*, *1*(1), 104-121. doi:10.1177/109442819800100106
- Hoekman, B. (1998). Using International Institutions to Improve Public Procurement. *The World Bank Research Observer*, *13*(2), 249-269. doi:10.1093/wbro/13.2.249
- Hogwood, B. W., & Gunn, L. A. (1984). *Policy analysis for the real world*. Oxford [Oxfordshire]; New York: Oxford University Press.
- Hordern, J. (2013). Evaluation and implementation: Two regeneration programmes. *International Journal of Public Sector Management*, *26*. doi:10.1108/IJPSM-03-2012-0026
- Howes, M., Wortley, L., Potts, R., Dedekorkut-Howes, A., Serrao-Neumann, S., Davidson, J., . . . Nunn, P. (2017). Environmental Sustainability: A Case of Policy Implementation Failure? *Sustainability*, *9*. doi:10.3390/su9020165
- Iacovidou, E., Hahladakis, J., & Purnell, P. (2021). A systems thinking approach to understanding the challenges of achieving the circular economy. *Environmental Science and Pollution Research*, *28*, 1-22. doi:10.1007/s11356-020-11725-9
- Iacovidou, E., & Lovat, E. (2021). Chapter 13 - Approaches to monitoring and evaluation of resource recovery from waste towards a circular economy. In *The Routledge handbook of waste, resources and the circular economy*.

- Iacovidou, E., Martin, V., & Jobling, S. (2020). *Chapter 4 - Review of sources and pathways of marine plastic pollution, marine plastic pollution - evidence review*. London: Department for Environment, Food and Rural Affairs
- Iacovidou, E., Velenturf, A. P. M., & Purnell, P. (2018). Quality of resources: A typology for supporting transitions towards resource efficiency using the single-use plastic bottle as an example. *Science of the Total Environment*.
- IENW. (2021). *Commissioning with ambition, procuring with impact: National Plan on Sustainable Public Procurement for 2021-2025*. Retrieved from <https://www.government.nl/documents/publications/2021/01/29/commissioning-with-ambition-procuring-with-impact>
- IPCC. (2014). *Climate change 2014 synthesis report. contribution of working groups I, II, and III to the fifth assessment report of the Intergovernmental Panel on Climate Change*. Retrieved from Geneva:
- JBA. (2009). Measuring Implementation Fidelity. Retrieved from <https://www.acf.hhs.gov/media/12293>
- Jongh, P. D., & Morissette, L. (1996). *The Netherlands' approach to environmental policy integration: Integrated environmental policy planning as a step towards sustainable development*. Retrieved from
- Kamieniecki, S., & Kraft, M. (2012). The Oxford Handbook of U.S. Environmental Policy. *OUP Catalogue*.
- Kelly, J. A., Heckman, T. G., Stevenson, L. Y., & Williams, P. N. (2000). Transfer of research-based HIV prevention interventions to community service providers: fidelity and adaptation. *AIDS Education and Prevention*, 12, 87.
- Kendal, S. L. (2010). *Policy implementation through leadership : success for implementers / Stephen Kendal*. Saarbrücken, Germany: LAP Lambert Academic Publishing.
- Keyser, S. (2014). *Winner Takes All: The Seven-and-a-Half Principles for Winning Bids, Tenders and Proposals*.
- Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*(127(127)), 221–232.
- Kirkpatrick, D. L., & Craig, R. (1970). Evaluation of training. *Evaluation of short-term training in rehabilitation*, 35.
- Koenen, I. (2018). *Aantal mislukte aanbestedingen stijgt: Wie is de dupe? Cobouw*. Retrieved from <https://www.cobouw.nl/bouwbreed/artikel/2018/06/aantal-mislukte-aanbestedingen-stijgt-wie-is-de-dupe-101262481>
- Korhonen, J., Nuur, C., Feldmann, A., & Birkie, S. E. (2018). Circular economy as an essentially contested concept. *Journal of Cleaner Production*, 175, 544-552. doi:10.1016/j.jclepro.2017.12.111
- Kozik, R. (2014). Green Public Procurement criteria for construction contracts. *Czasopismo Techniczne*.
- Krausmann, F., Wiedenhofer, D., Lauk, C., Haas, W., Tanikawa, H., Fishman, T., . . . Haberl, H. (2017). *Global socioeconomic material stocks rise 23-fold over the 20th century and require half of annual resource use*. Paper presented at the Proceedings of the National Academy of Sciences.
- Lemire, C., Dionne, C., & Rousseau, M. (2020). Assessing the Implementation Fidelity of Early Interventions: Data Collection Methods. *Evaluation and Program Planning*, 83, 101870. doi:10.1016/j.evalprogplan.2020.101870
- Lenderink, B., Voordijk, H., & Halman, J. (2018). *Public procurement and innovation : A conceptual framework for analysing project- based procurement strategies for innovation*. Paper presented at the IPSERA 2018 Conference 'Purchasing & Supply Management: Fostering, Athens.
- Lenderink, B., Voordijk, H., & Halman, J. (2019). Innovation-Oriented Public Procurement Approaches in Civil Engineering and Construction. *International Civil Engineering and Architecture Conference*, 1, 1–9.

- Lewis, H. (2009). Bids, tenders & proposals : winning business through best practice. Retrieved from <http://site.ebrary.com/id/10288100>
- Lonca, G., Muggéo, R., Imbeault-Tétréault, H., Bernard, S., & Margni, M. (2018). Does material circularity rhyme with environmental efficiency? Case studies on used tires. *Journal of Cleaner Production*, 183, 424-435. doi:<https://doi.org/10.1016/j.jclepro.2018.02.108>
- Lüdeke-Freund, F., Gold, S., & Bocken, N. (2019). A Review and Typology of Circular Economy Business Model Patterns. *Journal of Industrial Ecology*, 23, 36-61. doi:10.1111/jiec.12763
- Malinauskaite, J., Jouhara, H., Czajczyńska, D., Stanchev, P., Katsou, E., Rostkowski, P., . . . Spencer, N. (2017). Municipal Solid Waste Management and Waste-to-Energy in the Context of a Circular Economy and Energy Recycling in Europe. *Energy*, 141. doi:10.1016/j.energy.2017.11.128
- Mangialardo, A., & Micelli, E. (2017). New Bottom-Up Approaches to Enhance Public Real/Estate Property. In (pp. 53-62).
- Mangialardo, A., & Micelli, E. (2018). Rethinking the Construction Industry Under the Circular Economy: Principles and Case Studies. In (pp. 333-344).
- Mangialardo, A., & Micelli, E. (2021). Grass-roots participation to enhance public real estate properties. Just a fad? *Land Use Policy*, 103, 105290. doi:10.1016/j.landusepol.2021.105290
- Maud, K., Gajendran, T., & Brewer, G. (2018). Key Issues for Implementation of Environmental Planning Policy: Construction Management Practice. *Sustainability*, 10(7). doi:10.3390/su10072156
- Mayer, A., Haas, W., Wiedenhofer, D., Krausmann, F., Nuss, P., & Blengini, G. (2018). Measuring Progress towards a Circular Economy. A Monitoring Framework for Economy-wide Material Loop Closing in the EU28. *Journal of Industrial Ecology*. doi:10.1111/jiec.12809
- McDonough, W., & Braungart, M. (2021). Cradle to Cradle : Remaking the Way We Make Things / W. McDonough, M. Braungart.
- Meehan, J., & Bryde, D. (2011). Sustainable procurement practice. *Business strategy and the environment*, 20(2), 94-106.
- Metabolic. (2021). *Spend- en Impactanalyse Gecombineerde Nederlandse Overheden*. Retrieved from www.conferentie-ce.nl/img/voorstelUploads/sia_graphic_financialimpact_v06_cb-0.pdf
- Mihalic, S. (2004). The importance of implementation fidelity. *Emotional and Behavioral Disorders in Youth*, 4(4), 83-105.
- Millward-Hopkins, J., & Purnell, P. (2019). Circulating Blame in the Circular Economy: The Case of Wood-Waste Biofuels and Coal Ash. *Energy Policy*, 129. doi:10.1016/j.enpol.2019.02.019
- Mohamed, J. (2021). The Circular Procurement Tool: Procurement method to stimulate circular facade systems in mid-rise residential buildings in the Netherlands. *Thesis for MSc Civil Engineering / Building Engineering at Delft University of Technology*.
- Moraga, G., Huysveld, S., Mathieux, F., Blengini, G., Alaerts, L., Van Acker, K., . . . Dewulf, J. (2019). Circular economy indicators: What do they measure? *Resources Conservation and Recycling*, 146, 452-461. doi:10.1016/j.resconrec.2019.03.045
- Morseletto, P. (2019). Targets for a circular economy. *Resources Conservation and Recycling*, 153. doi:10.1016/j.resconrec.2019.104553
- Mowbray, C. T., Holter, M. C., Teague, G. B., & Bybee, D. (2003). Fidelity Criteria: Development, Measurement, and Validation. *American Journal of Evaluation*, 24(3), 315-340. doi:10.1177/109821400302400303
- Naoom, S., Blase, K., Friedman, R., Wallace, F., & Fixsen, D. (2005). Implementation Research: A Synthesis of the Literature Dean L. Fixsen. *The National Implementation Research Network*, 97.
- Nasir, M. H. A., Genovese, A., Acquaye, A. A., Koh, S., & Yamoah, F. (2017). Comparing linear and circular supply chains: A case study from the construction industry. *International Journal of Production Economics*, 183, 443-457.

- Nelissen, E., Griendt, B. v. d., Oppen, C. v., Pallada, I., Wiedenhoff, J., Waal, J. v. d., . . . Bögl, T. (2018). Transitie-agenda circulaire bouweconomie. *Circulaire Bouweconomie*. Retrieved from <https://edepot.wur.nl/440495>
- Nickson, D. (2012). *Bids, Proposals and Tenders: Succeeding with effective writing*: BCS, The Chartered Institute.
- Nilsen, P., Ståhl, C., Roback, K., & Cairney, P. (2013). Never the Twain Shall Meet?—A Comparison of Implementation Science and Policy Implementation Research. *Implementation science : IS*, 8, 63. doi:10.1186/1748-5908-8-63
- Nurmandi, A., & Jovita, H. (2017). Putting Public Values in Public Procurement Agenda. In.
- Padding, T., Croon, G., Haastrecht, D. V., & Dijkstra, R. (2015). *Een kader voor circulair inkopen*. Retrieved from <https://www.pianoo.nl/sites/default/files/documents/documents/kadercirculairinkopen-20april2015.pdf>
- Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and policy in mental health and mental health services research*, 42(5), 533-544.
- Patton, C., Sawicki, D., & Clark, J. (2012). *Basic Methods of Policy Analysis and Planning*.
- Patton, M. Q. (1990). *Qualitative evaluation and research methods*: SAGE Publications, inc.
- Phelan, L., McGee, J., & Gordon, R. (2012). Cooperative governance: One pathway to a stable-state economy. *Environmental Politics*, 21, 412-431. doi:10.1080/09644016.2012.671572
- PIANOO. (2019). Stappenplan: Inkopen met de milieukostenindicator. Retrieved from www.pianoo.nl/sites/default/files/media/documents/Inkopen met de milieukostenindicator-december2019.pdf
- PIANOO. (n.d.-a). Circulair inkopen. Retrieved from <https://www.pianoo.nl/nl/themas/maatschappelijk-verantwoord-inkopen/mvi-themas/circulair-inkopen>
- PIANOO. (n.d.-b). Inkopen in het kort - metrokaart. Retrieved from <https://www.pianoo.nl/nl/inkopen-het-kort-metrokaart>
- PIANOO. (n.d.-c). Maatschappelijk Verantwoord Inkopen. PIANOO Expertisecentrum Aanbesteden. Retrieved from [https://www.pianoo.nl/nl/themas/maatschappelijk-verantwoord-inkopen-mvi-duurzaam-inkopen/mvi-thema-s](https://www.pianoo.nl/nl/themas/maatschappelijk-verantwoord-inkopen/mvi-duurzaam-inkopen/mvi-thema-s)
- PIANOO. (n.d.-d). Markt betrekken bij specificatie - marktkennis. Retrieved from <https://www.pianoo.nl/inkoopproces/fase-1-voorbereiden-inkoopopdracht/markt-betrekken-bij-specificatie-marktkennis>
- Pijnacker-Hordijk, E., van der Bend, G., & Van Nouhuys, J. (2009). Aanbestedingsrecht: handboek van het Europese en Nederlandse aanbestedingsrecht. In: Den Haag: Sdu Uitgevers Juridisch en Fiscaal.
- Platform CB'23. (2020). Leidraad Meten van circulariteit. *Platform CB'23*. Retrieved from <https://platformcb23.nl/aan-de-slag/2020>
- Platform CB'23. (2021). Circulair inkopen in de bouw Leidende principes voor een circulaire bouw. *Platform CB'23*. Retrieved from https://platformcb23.nl/images/consultatie/leidraden/2021/PlatformCB23_Conceptleidraad_Circulair-Inkopen_17032021.pdf
- Pomponi, F., & Moncaster, A. (2017). Circular economy for the built environment: A research framework. *Journal of Cleaner Production*, 143, 710-718. doi:<https://doi.org/10.1016/j.jclepro.2016.12.055>
- Potting, J., & Hanemaaijer, A. (2018). *Circular Economy: what we want to know and can measure. Framework and baseline assessment for monitoring the progress of the circular economy in the Netherlands*. Retrieved from The Hague:

- Pouikli, K. (2021). *Towards mandatory Green Public Procurement (GPP) requirements under the EU Green Deal: reconsidering the role of public procurement as an environmental policy tool*. Paper presented at the ERA Forum.
- Powell, D. R., & Diamond, K. E. (2013). Implementation Fidelity of a Coaching-Based Professional Development Program for Improving Head Start Teachers' Literacy and Language Instruction. *Journal of Early Intervention, 35*(2), 102-128. doi:10.1177/1053815113516678
- Pressman, J. L., & Wildavsky, A. (1984). *Implementation* (Vol. 708): Univ of California Press.
- REBus. (2017). *Harnessing Procurement to Deliver Circular Economy Benefits*. Retrieved from <https://www.pianoo.nl/sites/default/files/documents/documents/rebusharnessingprocurementodelivercirculareconomybenefits-dec2017.pdf>
- Reike, D., Vermeulen, W. J. V., & Witjes, S. (2018). The circular economy: New or Refurbished as CE 3.0? — Exploring Controversies in the Conceptualization of the Circular Economy through a Focus on History and Resource Value Retention Options. *Resources, Conservation and Recycling, 135*, 246-264. doi:<https://doi.org/10.1016/j.resconrec.2017.08.027>
- Rijksoverheid. (2016). *Nederland circulair in 2050: Rijksbreed programma Circulaire Economie*. Het ministerie van Infrastructuur en Milieu en het ministerie van Economische Zaken, mede namens het ministerie van Buitenlandse Zaken en het ministerie van Binnenlandse Zaken en oninkrijksrelaties. Retrieved from www.rijksoverheid.nl/circulaire-economie
- Rijksoverheid. (2018). *Transitieagenda Bouw Samen Bouwen aan de Circulaire Economie voor Nederland in 2050*. Retrieved from <https://www.rijksoverheid.nl/documenten/rapporten/2018/01/15/bijlage-4-transitieagenda-bouw>
- Rijksoverheid. (2021). *Regels voor aanbesteden door de overheid*. Retrieved from www.rijksoverheid.nl/onderwerpen/aanbesteden/aanbestedingsregels
- Rijksvastgoedbedrijf. (2018). Platform CB'23: circulair bouwen concreet maken. Retrieved from <https://www.rijksvastgoedbedrijf.nl/actueel/nieuws/2018/01/18/platform-cb%E2%80%9923-circulair-bouwen-concreet-maken>
- Rijkswaterstaat. (2008). *Werkwijzer aanleg, Directie Projecten*. Utrecht
- Rijkswaterstaat. (2014). *Invulling programma van afval naar grondstof. Kamerstuk 33 043 nr.28*. Retrieved from
- Rijkswaterstaat. (2017). *Vrijkomen en verwerking uit de doelgroep Bouw (1990-2014.24)*. Retrieved from
- Rijkswaterstaat. (n.d.). *Werkwijze in de Grond-, Weg- en Waterbouw (GWW)*. Retrieved from <https://www.rijkswaterstaat.nl/zakelijk/zakendoen-met-rijkswaterstaat/werkwijzen/werkwijze-in-gww>
- Rogers, E. M. (2010). *Diffusion of innovations*: Simon and Schuster.
- Rood, T., & Kishna, M. (2019). *Outline of the circular economy PBL Netherlands Environmental Assessment Agency*. Retrieved from Den Haag:
- Rotmans, J., Kemp, R., & Asselt, M. (2001). More Evolution Than Revolution: Transition Management in Public Policy. *foresight, 3*, 15-31. doi:10.1108/14636680110803003
- Schandl, H., Hatfield-Dodds, S., Wiedmann, T., Geschke, A., Cai, Y., West, J., . . . Owen, A. (2015). Decoupling global environmental pressure and economic growth: Scenarios for energy use, materials use and carbon emissions. *Journal of Cleaner Production*. doi:10.1016/j.jclepro.2015.06.100
- Schoonenboom, J., & Johnson, R. B. (2017). How to Construct a Mixed Methods Research Design. *KZfSS Kölner Zeitschrift für Soziologie und Sozialpsychologie, 69*(2), 107-131. doi:10.1007/s11577-017-0454-1
- Slockers, A. (2019). *To Bid or not to Bid: that is the Question: Relating Contractor Bid Decisions to Tender Design Related Attributes*. (Master of science Master thesis). Delft University of Technology, Delft Retrieved from <http://resolver.tudelft.nl/uuid:885e8b19-a4f7-490c-88d8-8f79aa708e24>

- Snyder, P., Crowe, C., Hemmeter, M., Sandall, S., McLean, M., & Crow, R. Embedded Instruction for Early Learning Projects.(2009). EIOS: Embedded instruction for early learning observation system.[Manual and training videos]. *Unpublished instrument. College of Education, University of Florida, Gainesville, FL.*
- Stoker, G. (2006). Public value management: a new narrative for networked governance? *American Review of Public Administration*, 36.
- Ten Haaf, W. B. (2017). *Aanbestedingsrecht en Staatssteun - Circulair aanbesteden.*
- The Ellen MacArthur Foundation. (2015a). *Growth within: A circular economy vision for a competitive Europe.* Retrieved from New York: McKinsey & Company:
- The Ellen MacArthur Foundation. (2015b). *Towards a Circular Economy: Business rationale for an accelerated transition.* Retrieved from
- UN. (2019). *World Population Prospects 2019: Highlights.* Retrieved from
- UNEP. (2017). *Resource Efficiency: Potential and Economic Implications. A report of the International Resource Panel.* Retrieved from Berlin
- Van de Rijt, J., & Santema, S. C. (2013). *Prestatieinkoop: met Best Value naar succesvolle projecten:* Graphicom International.
- Van Duren, J., & Dorée, A. (2008). *An evaluation of performance information procurement system (PIPS).* Paper presented at the 3rd International IPPC conference.
- van Haagen, F. (2018). *Circulair aanbesteden: DNA-match: het geheim achter een spraakmakende circulaire aanbesteding.* (master thesis). Delft University of Technology, Retrieved from <http://resolver.tudelft.nl/uuid:5c297398-efc5-45f9-a1fe-c29c8f2d2184>
- van Veenen, A. (2018). *A BEST VALUE APPROACH TO PUBLIC PROCUREMENT - Stimulating the transition towards a circular infrastructure sector in the Netherlands* (Master of Science). Delft University of Technology, Retrieved from <https://repository.tudelft.nl/islandora/object/uuid:59b44695-1e85-44ea-b2c4-868d85377732/datastream/OBJ/download>
- Velenturf, A., & Purnell, P. (2017). Resource Recovery from Waste: Restoring the Balance between Resource Scarcity and Waste Overload. *Sustainability*, 9, 1-17. doi:10.3390/su9091603
- Verschuren, P. J. M., Doorewaard, H., Poper, R., & Mellion, M. J. (2010). *Designing a research project.* The Hague: Eleven International Publishing.
- Voisey, H., & O'Riordan, T. (1997). Governing institutions for sustainable development: The United Kingdom's national level approach. *Environmental Politics*, 6(1), 24-53. doi:10.1080/09644019708414310
- Wijdoogen, C. (2020). *7 Roles to Create Sustainable Success:* Amsterdam University Press.
- Williams, J. (2019). Circular Cities: Challenges to Implementing Looping Actions. *Sustainability*, 11, 423. doi:10.3390/su11020423
- Yanarella, E. J., & Bartilow, H. (2000). Beyond environmental moralism and policy incrementalism in the global sustainability debate: case studies and an alternative framework. *Sustainable Development*, 8(3), 123. doi:[http://dx.doi.org/10.1002/1099-1719\(200008\)8:3<123::AID-SD137>3.0.CO;2-S](http://dx.doi.org/10.1002/1099-1719(200008)8:3<123::AID-SD137>3.0.CO;2-S)
- Yin, R. (2009). *Case study research: design and methods.*
- Zhang, J., & Liang, X.-j. (2012). Promoting green ICT in China: A framework based on innovation system approaches. *Telecommunications Policy*, 36(10), 997-1013. doi:<https://doi.org/10.1016/j.telpol.2012.09.001>

Appendix A

IFA form

The Implementation Fidelity assessment form:

Introduction page

Implementation Fidelity Assessment (IFA) Form

Dit beoordelingsinstrument is gemaakt om implementatiegetrouwheid te evalueren bij implementaties van circulariteit in het aanbestedingsproces van projecten in de GWW-sector (grond-, weg- en waterbouw). **Implementatiegetrouwheid van circulariteit bij aanbestedingen is de mate waarin de implementatie het beoogde resultaat oplevert.**

Hiervoor kijkt het onderzoek naar de manier waarop circulariteit in het aanbestedingsproces is opgenomen. De resultaten bieden relevante inzichten voor een betere implementatie aansluitend op de belangen van de verschillende partijen.

De informatie die in dit interview wordt verkregen, zal vertrouwelijk worden behandeld en anoniem worden gerapporteerd in het onderzoek. Er zal een opname van dit interview worden gemaakt, zodat er geen informatie verloren gaat.

Als u akkoord gaat, gelieve verder te gaan met de beoordeling.

Gegevens van de deelnemers

Beantwoord de volgende vragen.

Participant information

Naam	
Voor welke organisatie/onderneming werkt u?	
Wat is uw functie?	
Welke afdeling?	

De beoordeling

1/5 Eerste Deel: De Behoefte Definitie

Behoefte definitie:

De definitie van de behoefte vindt plaats in alle inkoopdocumenten waarin de opdracht, de doelstellingen en de scope worden beschreven.

Circulaire aspecten zijn alle aspecten die worden overwogen en opgenomen in de inkoopdocumenten en die leiden tot een van de volgende circulaire strategieën: Het vermijden van afval, circulair denken in ontwerpe, materiaalkeuze, en regeneratief gebruik (inzet voor hergebruik en recycling) van natuurlijke grondstoffen.

Instructies:

- De beoordeling is gericht op het betrokken project en het doorlopen aanbestedingsproces. Houd bij de beoordeling van stellingen rekening met de context van dit proces.
- Geef bij elke stelling aan in hoeverre dit van toepassing was bij de aanbesteding waarbij je betrokken was (1 = nauwelijks van toepassing tot 5 = volledig van toepassing, NR=Niet relevant, WN=Ik weet het niet). Kies NR als de beoordeelde stelling niet van toepassing is op de case. Kies WN als de verklaring buiten uw expertise valt.
- De rating die u geeft, moet gebaseerd zijn op uw eigen perceptie die de werkelijke situatie in het project het best beschrijft.

Behoeftedefinitie	Nummer tussen (1-5)	NA	DK
De circulaire aspecten in de opdracht, de doelstellingen en de scope streefden naar volledig circulaire inkoop.			
De opdracht, de doelstellingen en de scope boden ruimte voor innovatieve oplossingen.			
De opdracht, de doelstellingen en de scope stimuleerden de samenwerking tussen opdrachtgever en opdrachtnemer.			
Circulaire aspecten en gerelateerde beslissingen bij het bepalen van de opdracht, de doelstellingen en de scope waren duidelijk omschreven.			
Circulaire aspecten in de opdracht, de doelstellingen en de scope waren eenduidig te interpreteren door opdrachtnemers.			
Er vond open communicatie plaats tussen opdrachtgever en opdrachtnemers bij (mogelijke) onduidelijkheden over de circulaire aspecten binnen de opdracht, de doelstellingen en de scope.			
Circulaire aspecten in de opdracht, de doelstellingen en de scope schiepen ruimte voor opdrachtnemers om een 'concurrentievoordeel' te behalen (Concurrentievoordeel is een voordeel dat ontstaat wanneer een opdrachtnemer zich op een positieve manier onderscheidt van concurrenten).			
De opdracht, de doelstellingen en de scope hebben maximaal effect gehad op het bereiken van circulariteit in de inschrijving(en) (Doeltreffendheid of effectiviteit geeft aan dat het doel van een activiteit gerealiseerd wordt).			
De opdracht, de doelstellingen en de scope stimuleerden het bereiken van circulariteit in de inschrijving(en) op de meest efficiënt manier (Doelmatigheid of efficiëntie is het bereiken van een doel met gebruik van zo weinig mogelijk middelen).			
Toepassing van circulaire aspecten in de opdracht, de doelstellingen en de scope was van strategisch belang voor het opstellen van de inschrijving(en).			
Circulaire aspecten in de opdracht, de doelstellingen en de scope zijn van grote invloed op het besluit om een inschrijving te doen.			

Door de geformuleerde opdracht, de doelstellingen en de scope heeft de inschrijving(en) invulling gegeven aan circulaire ambities.

2/5 Tweede Deel: De Specificaties

De specificaties:

De specificaties omvatten technische en functionele specificaties.

Circulaire aspecten zijn alle aspecten die worden overwogen en opgenomen in de inkoopdocumenten en die leiden tot een van de volgende circulaire strategieën: Het vermijden van afval, circulair denken in ontwerpen, materiaalkeuze, en regeneratief gebruik (inzet voor hergebruik en recycling) van natuurlijke grondstoffen.

Voorbeelden hiervan: De losmaakbaarheidsindex of een materialenpaspoort.

Instructies:

- De beoordeling is gericht op het betrokken project en het doorlopen aanbestedingsproces. Houd bij de beoordeling van stellingen rekening met de context van dit proces.
- Geef bij elke stelling aan in hoeverre dit van toepassing was bij de aanbesteding waarbij je betrokken was (1 = nauwelijks van toepassing tot 5 = volledig van toepassing, NR=Niet relevant, WN=Ik weet het niet). Kies NR als de beoordeelde stelling niet van toepassing is op de case. Kies WN als de verklaring buiten uw expertise valt.
- De rating die u geeft, moet gebaseerd zijn op uw eigen perceptie die de werkelijke situatie in het project het best beschrijft.

Specificaties	Nummer tussen (1-5)	NA	DK
Circulaire aspecten in de specificaties streefden naar volledig circulaire inkoop.			
De specificaties boden ruimte voor innovatieve oplossingen.			
De specificaties stimuleerden de samenwerking tussen opdrachtgever en opdrachtnemer.			
Circulaire aspecten en gerelateerde beslissingen bij de specificaties waren duidelijk omschreven.			
Circulaire aspecten in de specificaties waren eenduidig te interpreteren door opdrachtnemers.			
Er vond open communicatie plaats tussen opdrachtgever en opdrachtnemers bij (mogelijke) onduidelijkheden over de circulaire aspecten van de specificaties.			
Circulaire aspecten in de specificaties schiepen ruimte voor opdrachtnemers om een 'Concurrentievoordeel' te behalen (Concurrentievoordeel is een voordeel dat ontstaat wanneer een opdrachtnemer zich op een positieve manier onderscheidt van concurrenten).			
De specificaties hebben maximaal effect gehad op het bereiken van circulariteit in de inschrijving(en) (Doeltreffendheid of effectiviteit geeft aan dat het doel van een activiteit gerealiseerd wordt).			
De specificaties stimuleerden het bereiken van circulariteit in de inschrijvingen op de meest efficiënt manier (Doelmatigheid of efficiëntie is het bereiken van een doel met gebruik van zo weinig mogelijk middelen).			

	Toepassing van circulaire aspecten in de specificaties was van strategisch belang voor het opstellen van de inschrijving.			
	Circulaire aspecten in de specificaties waren van grote invloed op het besluit om een inschrijving te doen.			
	Alle circulaire aspecten die in de specificaties worden aangegeven, zijn volledig in de inschrijving(en) verwerkt.			

3/5 Derde Deel: Voorselectie

Voorselectie:

Voorselectie omvat geschiktheidseisen en/of selectiecriteria.

Circulaire aspecten zijn alle aspecten die worden overwogen en opgenomen in de inkoopdocumenten en die leiden tot een van de volgende circulaire strategieën: Het vermijden van afval, circulair denken in ontwerpen, materiaalkeuze, en regeneratief gebruik (inzet voor hergebruik en recycling) van natuurlijke grondstoffen.

Een voorbeeld hiervan is het eisen van een certificaat dat aantoonst dat een gegadigde circulaire of duurzame bedrijfsvoering heeft ingebed in de eigen organisatie of het vragen van een visie op circulariteit vanuit gegadigden

Instructies:

- De beoordeling is gericht op het betrokken project en het doorlopen aanbestedingsproces. Houd bij de beoordeling van stellingen rekening met de context van dit proces.
- Geef bij elke stelling aan in hoeverre dit van toepassing was bij de aanbesteding waarbij je betrokken was (1 = nauwelijks van toepassing tot 5 = volledig van toepassing, NR=Niet relevant, WN=Ik weet het niet). Kies NR als de beoordeelde stelling niet van toepassing is op de case. Kies WN als de verklaring buiten uw expertise valt.
- De rating die u geeft, moet gebaseerd zijn op uw eigen perceptie die de werkelijke situatie in het project het best beschrijft.

Voorselectie		Nummer tussen (1-5) NA DK		
	De voorselectie ondersteunde volledig circulaire inkoop.			
	De voorselectie maakte ruimte voor innovatieve opdrachtnemers.			
	De voorselectie stimuleerde de samenwerking tussen opdrachtgever en opdrachtnemer.			
	Circulaire aspecten en gerelateerde beslissingen bij geschiktheidseisen en selectiecriteria waren duidelijk omschreven.			
	Naleving van circulaire-aspecten bij de prequalificatie was redelijk voor aannemers.			
	Er vond open communicatie plaats tussen opdrachtgever en opdrachtnemers bij (mogelijke) onduidelijkheden over de circulaire aspecten van de voorselectie.			
	Circulaire aspecten bij de voorselectie schiepen ruimte voor opdrachtnemers om een 'Concurrentievoordeel' te behalen (Concurrentievoordeel is een voordeel dat ontstaat wanneer			

	een opdrachtnemer zich op een positieve manier onderscheidt van concurrenten).			
	De voorselectie heeft maximaal effect gehad op het bereiken van circulariteit in de inschrijving(en) (Doeltreffendheid of effectiviteit geeft aan dat het doel van een activiteit gerealiseerd wordt).			
	De voorselectie stimuleerde het bereiken van circulariteit in de inschrijvingen(en) op de meest efficiënt manier (Doelmatigheid of efficiëntie is het bereiken van een doel met gebruik van zo weinig mogelijk middelen).			
	Voor opdrachtnemers was het van strategisch belang in aanmerking te komen voor deelname aan circulaire aanbestedingen.			
	Circulaire aspecten in de voorselectie waren van grote invloed op het besluit om een inschrijving te doen.			
	Door de voorselectie heeft de inschrijving(en) invulling gegeven aan circulaire ambities.			

4/5 Vierde Deel: Gunnings Kwaliteitscriteria

Kwaliteitscriteria:

Dit omvat binnen een aanbesteding op basis van prijs-kwaliteitsverhouding (BPKV/EMVI) de criteria op het gebied van kwaliteit zoals inclusief het gewicht ervan en het beoordelingskader.

Circulaire aspecten zijn alle aspecten die worden overwogen en opgenomen in de inkoopdocumenten en die leiden tot een van de volgende circulaire strategieën: Het vermijden van afval, circulair denken in ontwerpen, materiaalkeuze, en regeneratief gebruik (inzet voor hergebruik en recycling) van natuurlijke grondstoffen.

Bijvoorbeeld:

o kwantitatieve onderdelen, zoals MKI-waarde en percentage hergebruikt materiaal van een standaardproduct

o kwalitatieve onderdelen, zoals een plan van aanpak gericht op maatregelen op het vergroten van de circulariteit in het project

Instructies:

- De beoordeling is gericht op het betrokken project en het doorlopen aanbestedingsproces. Houd bij de beoordeling van stellingen rekening met de context van dit proces.
- Geef bij elke stelling aan in hoeverre dit van toepassing was bij de aanbesteding waarbij je betrokken was (1 = nauwelijks van toepassing tot 5 = volledig van toepassing, NR=Niet relevant, WN=Ik weet het niet). Kies NR als de beoordeelde stelling niet van toepassing is op de case. Kies WN als de verklaring buiten uw expertise valt.
- De rating die u geeft, moet gebaseerd zijn op uw eigen perceptie die de werkelijke situatie in het project het best beschrijft.

Kwaliteitscriteria	Nummer tussen (1-5)	NA	DK
Circulaire kwaliteitscriteria streefden naar volledig circulaire inkoop.			
Het beoordelingskader bood ruimte voor innovatieve oplossingen.			

Het beoordelingskader stimuleerde de samenwerking tussen opdrachtgever en opdrachtnemer.			
Circulaire aspecten en gerelateerde beslissingen bij het beoordelingskader waren duidelijk omschreven.			
Circulaire kwaliteitscriteria waren eenduidig te interpreteren door opdrachtnemers.			
Er vond open communicatie plaats tussen opdrachtgever en opdrachtnemers bij (mogelijke) onduidelijkheden over circulaire kwaliteitscriteria.			
Circulaire kwaliteitscriteria schiepen ruimte voor opdrachtnemers om een 'Concurrentievoordeel' te behalen (Concurrentievoordeel is een voordeel dat ontstaat wanneer een opdrachtnemer zich op een positieve manier onderscheidt van concurrenten).			
Circulaire kwaliteitscriteria hebben maximaal effect gehad op het bereiken van circulariteit in de inschrijving(en) (Doeltreffendheid of effectiviteit geeft aan dat het doel van een activiteit gerealiseerd wordt).			
Circulaire kwaliteitscriteria stimuleren het bereiken van circulariteit in de inschrijvingen op de meest efficiënt manier (Doelmatigheid of efficiëntie is het bereiken van een doel met gebruik van zo weinig mogelijk middelen).			
Toepassing van circulaire aspecten in het beoordelingskader was van strategisch belang voor het opstellen van de inschrijving.			
Circulaire aspecten in het beoordelingskader waren van grote invloed op het besluit om een inschrijving te doen.			
Alle circulaire aspecten die in het beoordelingskader worden aangegeven, zijn volledig in de inschrijving(en) verwerkt.			

5/5 Vijfde Deel: Algemeen

Algemeen:

- Algemene aspecten zijn gericht op uw eigen perceptie van circulariteit in de sector.

Instructies:

- De beoordeling is gericht op het betrokken project en het doorlopen aanbestedingsproces. Houd bij de beoordeling van stellingen rekening met de context van dit proces.
- Geef bij elke stelling aan in hoeverre dit van toepassing was bij de aanbesteding waarbij je betrokken was (1 = nauwelijks van toepassing tot 5 = volledig van toepassing, NR=Niet relevant, WN=Ik weet het niet). Kies NR als de beoordeelde stelling niet van toepassing is op de case. Kies WN als de verklaring buiten uw expertise valt.
- De rating die u geeft, moet gebaseerd zijn op uw eigen perceptie die de werkelijke situatie in het project het best beschrijft.

Algemeen

Nummer tussen (1-5) NA DK

	De huidige circulaire ambitie is verenigbaar met de aard van de GWW-sector (grond-, weg- en waterbouw) projecten.			
	Elke opdrachtnemer moet circulaire projecten in zijn portfolio hebben.			

Inzicht in de resultaten en conclusie

Vragen over de resultaten van deze beoordeling van de voornaamste indicatoren.

Participant Insight		
Indicators	Denkt u dat implementatie van circulariteit via () de meest/minst impactvolle methode is? - Kunt u een voorbeeld bedenken? Of uw antwoord motiveren?	
	Welke van de vier methoden om circulariteit in aanbesteding op te nemen beschouwt u als het meest invloedrijk?	
	Wat zou u het meest problematische/belovende aspect vinden van het implementeren van circulariteit via inkoop in de bouw- en infrasector? - Zou u kort willen toelichten waarom?	
Assessment	Zijn er aspecten die volgens u in dit onderzoek moeten worden opgenomen en die u naar voren wilt brengen?	
	Wilt u persoonlijke notities of suggesties toevoegen?	

Appendix B

Case Results

The results of the cases are presented here individually then in combination. The numbers used to the left of each table refer to the interviewee are listed in Appendix C.

CASE ONE RESULTS

Table 1 Case one: Fidelity scores

	Case fidelity	IFA scores					Differentiation			
		Exposure	Quality of delivery	Method efficacy	Participation	Adherence	Need definition	Specs	Pre-selection	Awarding Framework
1 Co	4,13	4,25	3,75	4,42	3,75	4,50	4,12	3,90	3,58	4,33
2 CA	4,15	4,33	4,31	4,08	4,00	4,00	4,23	4,12	4,12	4,12
3 CA'	3,82	3,67	3,69	3,83	4,25	3,67	4,10	3,50	3,43	3,92
4 Co	3,33	3,08	4,00	3,00	4,00	3,50	3,65	3,38	2,58	3,70
5 CA	4,32	4,56	4,92	4,11	3,00	5,00	4,13	4,67	-	4,60
6 CA'	4,13	3,92	3,75	4,00	4,75	4,25	4,27	4,02	4,62	3,83
7 CA	4,12	4,33	3,94	3,83	4,50	4,00	4,33	4,02	3,50	4,63
8 CA'	3,83	3,17	3,69	3,92	4,38	4,00	4,38	3,82	3,15	3,87
All	3,98	3,91	4,01	3,90	4,08	4,11	4,15	3,93	3,57	4,13

	Case fidelity	IFA scores					Differentiation			
		Exposure	Quality of delivery	Method efficacy	Participation	Adherence	Need definition	Specs	Pre-selection	Awarding Framework
CA	4,19	4,41	4,39	4,01	3,83	4,33	4,23	4,27	3,81	4,45
CA'	3,93	3,58	3,71	3,92	4,46	3,97	4,25	3,78	3,73	3,87
Co	3,73	3,67	3,88	3,71	3,88	4,00	3,88	3,64	3,08	4,02

*CO: Contractor, CA: contracting authority, CA': Contracting authority consultant

Table 2 Case one: Issues identification

n.	Co/CA	Structural		Implementation traps					Policy Related		Link between cause and effect		
		External Constraints	Time and Resources	Compliance	Understanding and consenting over objectives	Dependency relationships	Model and procedure	Communication and Coordination	Organizational position and collaboration	Operationalization		Professional Believe	Specialist knowledge and understanding
1	CA									No uniform frameworks of circularity implementation		Inadvertent effect of the different ambitions on each other	
2	Co	Project's technical Complexity, and required functionality during construction					The tendering period was longer than needed	- Communication between Co and Ca - Coordination between departments(CA) to provide answers (slowed communications)	Lack of trust, orderliness and accountability.	- Need for transparency limits the dialogue - Responsibilities and insurances in the contract model		Technical requirements limited innovation	
3	CA'						The tendering period was longer than needed					Technical requirements limited innovation	
4	Co	Project's technical Complexity					The tendering period was longer than needed			Responsibilities and contractual obligations	Intrinsic motivation of personnel	Technical requirements limited circular ambition	Inadvertent effect of the different ambitions on each other
5	CA	- Big project, long period of preparation makes it difficult to keep updating requirements								- No instruments that prioritise materials and methods - No reliable measure for infrastructure		- Novelty of circularity requirements - Scope of requirements lead to false results	
6	CA'			The awarding framework relation to actual later implementation	Requiring the IFD and the room left for innovative solutions					- Measures of circular methods - Annbestedingsregelen require defined expectation that limit potential			Inadvertent effect of the different ambitions on each other
7	CA	One of the bridges required huge maintenance limiting circular potential.		Insufficient incentive to take on risks			The tendering period was longer than needed			Annbestedingsregelen (transparency) require defined expectations that limit potential			Circular innovations are still in preliminary phases
8	CA'				Requiring the IFD and the room left for innovative solutions							Technical requirements limited innovation	

*CO: Contractor, CA: contracting authority, CA': Contracting authority consultant

CASE TWO RESULTS

Table 3 case two: Fidelity scores

	Case fidelity	IFA scores					Differentiation			
		Exposure	Quality of delivery	Method efficacy	Participation	Adherence	Need definition	Specs	Pre-selection	Awarding Framework
1 Co	3,73	4,00	3,63	3,50	3,75	3,75	3,88	3,77	2,98	3,67
2 CA	4,14	4,25	3,19	4,33	4,25	4,67	4,57	3,98	3,00	4,00
3 CA	3,63	4,08	3,56	3,00	3,75	3,75	3,57	3,65	3,92	3,38
4 CA	4,29	4,58	4,33	4,50	3,88	4,50	4,40	3,95	4,27	4,45
5 Co	4,25	4,83	3,88	4,29	4,50	3,75	4,42	3,80	4,77	4,02
6 CA	4,42	4,58	4,00	4,25	5,00	4,25	4,52	4,33	4,48	4,33
All	4,08	4,39	3,76	3,98	4,19	4,11	4,23	3,91	3,90	3,97
CA	4,12	4,38	3,77	4,02	4,22	4,29	4,26	3,98	3,92	4,04
Co	3,99	4,42	3,75	3,90	4,13	3,75	4,15	3,78	3,88	3,84

*CO: Contractor, CA: contracting authority, CA': Contracting authority consultant

Table 4 Case two: Issues identification

n.	Co/CA	Structural		Implementation traps				Policy Related				
		External Constraints	Time and Resources	Compliance	Understanding and consenting over objectives	Dependency relationships	Model and procedure	Communication and Coordination	Organizational position and collaboration	Operationalization	Professional Believe	Specialist knowledge and understanding
1	CA				Open design freedom left big room for interpretations				Measure frameworks of the different environmental effects of design choices	Need for a cooperative attitude from the client for the longer term		
2	Co				Open design freedom left big room for interpretations			Documentation	Participation of the maintenance department		Defining the rewarding criteria	
3	CA				- Open design freedom left big room for interpretations - Confusion over bidding for the two bridges						Framing the circular aspects in the need, specs and the rewarding framework	
4	Co				Understanding the directive behind the specs						Estimations of relevant aspects (maintenance, permits, extra linked costs)	Comparability of different circular solutions
5	CA				Open design freedom left big room for interpretations					Tolerance of reused materials in the design		- Comparability of different circular solutions - impact of image design on circular aspects
6	CA				Open design freedom left big room for interpretations			Better communication between the involved parties	Cooperation of the licencing authority, and other departments		Lack of experience with innovation in contracts	

*CO: Contractor, CA: contracting authority, CA': Contracting authority consultant

CASE THREE RESULTS

Table 5 case three: Fidelity scores

	Case fidelity	IFA scores					Differentiation			
		Exposure	Quality of delivery	Method efficacy	Participation	Adherence	Need definition	Specs	Pre-selection	Awarding Framework
1 CA	3,25	3,00	2,94	3,67	2,88	3,75	2,58	3,32	3,13	3,45
2 Co	4,07	3,92	4,06	3,79	-	4,50	4,38	4,29	3,38	4,23
3 Co	3,49	3,00	3,25	2,78	4,42	4,00	3,68	3,65	-	3,08
4 Co	3,63	3,56	3,33	4,11	3,08	4,00	3,23	3,20	-	3,62
5 CA	3,42	2,78	2,86	2,56	4,25	4,67	3,52	3,00	-	3,25
6 CA	4,60	4,75	4,50	4,75	4,50	4,50	4,50	4,37	4,83	4,70
7 CA	3,85	3,42	3,67	3,92	4,00	4,25	3,23	3,38	4,67	4,23
8 CA	3,75	2,75	3,33	3,67	4,00	5,00	3,65	3,58	3,67	3,90
9 CA	4,01	3,44	4,25	3,33	4,00	5,00	3,88	3,52	-	4,38
10 Ca	3,10	2,42	3,00	3,83	3,00	3,25	3,85	2,67	2,17	3,81
11 Co	3,45	2,42	3,06	2,92	4,38	4,50	3,50	3,47	3,62	3,13
All	3,69	3,22	3,48	3,57	3,85	4,31	3,64	3,49	3,64	3,80
CA	3,76	3,41	3,67	3,90	3,68	4,15	3,61	3,45	3,70	4,11
Co	3,64	3,07	3,32	3,30	4,03	4,44	3,66	3,53	3,55	3,54

Table 6 case three: Issues identification

n.	Co/CA	External Constraints	Time and Resources	Compliance	Understanding and consenting over objectives	Dependency relationships	Model and procedure	Communication and Coordination	Organizational position and collaboration	Operationalization	Professional Believe	Specialist knowledge and understanding	Link between cause and effect
1	CA	- Client prioritising image quality	- Time constraints - Budget restrictions	- Prioritising image aspects			- Process didn't accommodate discussions over circular opportunities - Awarding framework lessend the significance of circular ambition		- Restricting requirements from the maintenance department				
2	Co		- Budget eliminates many circular options	- Prioritising image aspects - Company supportive mechanism			- Process didn't accommodate discussions over circular opportunities						
3	Co	- Market materials prices going up	- Budget eliminates many circular options	- Prioritising image aspects			- Process and contract type didn't accommodate discussions over circular opportunities						- Comparability of different circular solutions
4	Co	- Area context on image requirement	- Budget is restricting	- Prioritising image aspects			- Process and contract type didn't accommodate discussions over circular opportunities		- Involving the maintenance department to enable innovative solutions				
5	Co		- Budget eliminates many circular options				- Process and contract type didn't accommodate discussions over circular opportunities					- Some technical requirements were restricting	- Comparability of different circular solutions
6	CA	- Area context on image requirement										- Difficulty assigning specifications on first experience.	
7	CA	- Client prioritising image quality - Market materials prices going up	- Time constraints - Limited budget						- Restricting requirements from the maintenance department				
8	Co		- Budget eliminates many circular options	- Prioritising image aspects and price			- Process and contract type didn't accommodate discussions over circular opportunities		- Restricting requirements from the maintenance department	- Procurement law restricts collaboration potential			
9	CA	- Client prioritising image quality					- Process and contract type didn't accommodate discussions over circular opportunities			- No guidelines from the municipality for policy implementations - Client preference of procedure types		- Road map over policy goals in progress	
10	CA'						- Process didn't accommodate discussions over circular opportunities - Awarding Framework lessend the significance of circular ambition		- Restricting requirements from the maintenance department	- Measures of circular methods - Client preference of procedure types			- Impact of image design on circular aspects
11	Co			- Prioritising image aspects and price					- Restricting norms			- Some technical requirements were restricting	

*CO: Contractor, CA: contracting authority, CA': Contracting authority consultant

CROSS-CASE RESULTS

Table 7 Dimensions and differentiation scores for study cases

	First Case: Cruquiusbrug	Second Case: Floriade bridges	Third case: Fietsbrug Groote Wielenplas
Case over all scores	3,97	4,08	3,69
Exposure	3,89	4,39	3,23
Quality of delivery	3,84	3,73	3,51
Methods efficacy	3,89	4,01	3,61
Participation	4,18	4,16	3,88
Adherence	4,08	4,09	4,18
Differentiation scores: Need definition	4,15	4,23	3,59
Exposure	4,17	4,56	3,06
Quality of delivery	4,13	3,79	3,55
Method efficacy	3,96	4,28	3,45

Participation	4,00	4,17	3,57
Adherence	4,50	4,33	4,33

Differentiation scores: Specification	3,95	3,91	3,53
Exposure	3,79	4,56	3,06
Quality of delivery	3,84	3,54	3,36
Method efficacy	3,78	3,65	3,48
Participation	4,17	3,80	3,43
Adherence	4,14	4,00	4,30

Differentiation scores: Pre- Selection	3,57	4,03	3,67
Exposure	3,50	4,06	3,43
Quality of delivery	3,32	3,82	3,42
Method efficacy	3,76	4,07	3,67
Participation	3,86	4,00	4,00
Adherence	3,43	4,20	3,83

Differentiation scores: Awarding framework	4,12	4,05	3,75
Exposure	4,08	4,41	3,39
Quality of delivery	4,06	3,75	3,73
Method efficacy	4,04	4,06	3,85
Participation	4,17	4,20	3,50
Adherence	4,25	3,83	4,27

	First Case: Cruquiusbrug	Second Case: Floriade bridges	Third case: Fietsbrug Groote Wielenplas
Need definition	4,15	4,23	3,59
Specification	3,95	3,91	3,53
Pre- Selection	3,57	4,03	3,67
Awarding framework	4,12	4,05	3,75

Exposure	3,89	4,39	3,23
Adherence	4,08	4,09	4,18
Implementation in the outcome relative to policy ambition	3,17	3,60	2,71

Table 8 Cross-case results per group of participants

		Case fidelity	IFA scores					Differentiation			
			Exposure	Quality of delivery	Method efficacy	Participation	Adherence	Need definition	Specs	Pre-selection	Awarding Frame work
Case one	CA	4,19	4,41	4,39	4,01	3,83	4,33	4,23	4,27	3,81	4,45
	CA'	3,93	3,58	3,71	3,92	4,46	3,97	4,25	3,78	3,73	3,87
	Co	3,73	3,67	3,88	3,71	3,88	4,00	3,88	3,64	3,08	4,02
Case two	CA	4,12	4,38	3,77	4,02	4,22	4,29	4,26	3,98	3,92	4,04
	Co	3,99	4,42	3,75	3,90	4,13	3,75	4,15	3,78	3,88	3,84
Case three	CA	3,76	3,41	3,67	3,90	3,68	4,15	3,61	3,45	3,70	4,11
	Co	3,64	3,07	3,32	3,30	4,03	4,44	3,66	3,53	3,55	3,54
Cross case	CA	4,00	3,94	3,88	3,96	4,05	4,19	4,09	3,87	3,79	4,12
	Co	3,78	3,72	3,65	3,64	4,01	4,06	3,90	3,65	3,50	3,80

*CO: Contractor, CA: contracting authority, CA': Contracting authority consultant

Appendix C

Interview transcripts

Check extra appendix