

CONTRIBUTING TO A CIRCULAR ECONOMY: INSIGHTS AND INDICATORS FOR THE EVALUATION OF CIRCULAR REGIONAL POLICIES

A STUDY ON THE EVALUATION OF CIRCULAR POLICIES DEPLOYED BY REGIONAL GOVERNMENTS
TOWARDS ACHIEVING THE DUTCH CIRCULAR ECONOMY GOALS

Student: Eva Herrewijnen (5515947)

University: Utrecht University

Master: Sustainable Development

Track: Energy and Materials

Supervisor University: Dr. Ir. J. Rosales Carreon

Second Reader: Dr. B.C. Corona Bellostas

Host organisation: Royal HaskoningDHV

Supervisor host organisation: Guido Israëls

Date: 31-10-2020

Word count: 24.839



Utrecht University



**Royal
HaskoningDHV**
Enhancing Society Together

ABSTRACT

This study explores the evaluation of the deployment of policy instruments by regional governments in the Netherlands in the transition to a circular economy. The circular economy is a new policy field for Dutch regional governments (provinces, water authorities, environmental protection agencies, regional cooperation's and municipalities) which are now deploying a wide range of policy instruments to help the transition move forward. This raises the question how regional governments can evaluate their effort aimed at contributing to the Dutch Circular economy Goals: 100% circular in 2050 and 50% reduction of raw material input in 2030. Evaluation is important to steer and improve policies to contribute to a more effective intervention to help move away from our current linear economy system towards a circular economy. This study investigated how regional governments in the Netherlands are currently evaluating their circular policies and what indicators could be used to help with this evaluation. This was done by semi-structured interviews of nine policymakers on the regional level and the carrying out of an indicator assessment in which circular economy indicators from existing macro level frameworks were assessed to determine their relevance for circular regional policy evaluation. The results show that currently, not much emphasis is being placed on the evaluation of circular policies by regional governments. Evaluation is viewed as important, but complex. Furthermore, the indicators assessment provided 37 indicators that have been found that could help evaluate CE policies for regional governments. The results are an important step in creating an evaluation framework for circular policies on the regional level. However, more research is needed to find and/or create additional suitable indicators for the evaluation and test the practical application of such an evaluation system on the regional level.

Keywords: Circular Economy; Regional Government; Policy Instruments; Evaluation indicators

PREFACE

Ever since I started my academic journey at Utrecht University, I have been drawn to the field of sustainable development. During my Bachelor, Liberal Arts and Sciences, I took courses related to environmental ethics, environmental policy and I wrote my thesis on the potential of aquaponics, a sustainable and circular food production system. During my master's degree I felt the need to not only learn more regarding Sustainable Development but also see what a job in this field would look like. Hence, I applied for an internship at the sustainability team of Royal HaskoningDHV (RHDHV) and got accepted. I am extremely grateful for the opportunity which has gained me work experience in sustainable consulting and provided a link between the knowledge gathered from studying and its practical application. Part of my internship revolved around a study for Planbureau voor de leefomgeving (PBL) on what regional governments are currently doing to enhance the circular economy. It revealed the complexity of the circular economy concept, but simultaneously showed how many people are working hard to help unravel this complexity and work towards a better future. It was this study that provided the inspiration for writing the thesis which lies here in front of you.

There are a lot of people whom without, this thesis was not possible. So first, I want to thank my supervisor from Utrecht University, Jesus Rosales Carreon, and my supervisor from RHDHV, Guido Israëls, for all their support and help during my internship and thesis project. Second, I'd like to thank Paul Mul and Jan Bart Jutte for being able to work on their projects and their help in finding a thesis topic for me. Of course, everyone on the sustainability team for making me feel welcome and helping me whenever needed. Furthermore, I want to thank all the policymakers, consultants and other professionals that contributed their time and shared their knowledge to help me write this thesis. Finally, I want to thank my parents, sisters, boyfriend, in laws and friends for their continuous support anywhere and anytime, through this academic journey.

Eva Teuntje Marijke Winnifred Herrewijnen

Barendrecht, 30th of October 2020

TABLE OF CONTENTS

ABSTRACT	2
PREFACE.....	3
1. INTRODUCTION.....	6
1.1 Background.....	6
1.2 Problem Definition	8
1.3 Research Aim and Research Question.....	8
1.4 Societal and Scientific Relevance	9
1.5 Structure of the Study	9
2. THEORETICAL FOUNDATION.....	10
2.1 The Circular economy.....	10
2.1.1 The Circular Economy Concept	10
2.1.2 Implementation Levels of the Circular economy	12
2.2 The Regional Level.....	14
2.2.1 Regional Governments	14
2.2.2 CE Strategies on the Regional Level	15
2.3 Policy Instruments.....	18
2.3.1 Steps of Policy Making.....	18
2.3.2 Classification of Policy Instruments.....	19
2.3.3 Deployment of Policy Instrument by Regional Governments in the Netherlands.....	23
2.4 Indicators for Policy Evaluation.....	24
2.4.1 Monitoring the Circular Economy	24
2.4.2 Evaluation of Policy instruments.....	25
2.4.3 Transition indicators.....	26
2.4.4 Effect indicators.....	29
2.5 Conceptual Model	30
3. METHOD	31
3.1 Research Design	31
3.2 Phase 1: Semi-Structured Interviews	32
3.2.1 Sampling Interviews	32
3.2.2 Analysis of Semi-structured Interviews.....	33
3.3 Phase 2: Indicator Assessment.....	33
3.3.1 Data Collection of Assessment Frameworks	34
3.3.2 Analysis of CE Indicators.....	34
4. RESULTS AND DISCUSSION	37
4.1 Results and Discussion Phase One: Interviews	37

4.1.1	Selected Interviews	37
4.1.2	Policymaking: Definitions and Targets on the Regional Level.....	38
4.1.3	Policymaking: The role of Regional Governments	41
4.1.4	Policymaking: From Approach to CE- Strategy.....	44
4.1.5	Evaluation of Circular Policies	47
4.1.6	Final Reflection Phase One	50
4.2	Results and Discussion Phase Two: Indicator assessment	51
4.2.1	Selected Frameworks and Indicators	51
4.2.2	Circular Flow Indicators	53
4.2.3	Indicators for Circular Procurement and Spatial Domain	56
4.2.4	Indicators for the Provision of Information and Network & Information Exchange.....	58
4.2.5	Indicators for the (Financial) Support of Businesses	60
4.2.6	Indicators for Laws and Regulation	61
4.2.7	Indicators for Research and Education.....	63
4.2.8	Indicators for Operational Tasks	64
4.2.9	Final Reflection Phase Two.....	67
4.3	Final Reflection and Recommendations.....	68
5.	CONCLUSION	70
6.	REFERENCES.....	72
7.	APPENDIX.....	75
	Appendix 1: List of Policy Instruments and Operational tasks.....	75
	Appendix 2: Interview Guide.....	78
	Appendix 3: Informed Consent Form	79
	Appendix 4: Included Existing Assessment Frameworks	80
	Appendix 5: List of Indicators.....	81
	Appendix 6: Overview of Indicators	86

1. INTRODUCTION

1.1 BACKGROUND

The transition to a circular economy (CE) requires to be encouraged on multiple governmental levels. For example, on an international level, The United Nations (UN) recognize the unsustainable aspects of the current economic system within their 2030 Sustainable Agenda. The circular economy is an economic system in which materials are being kept within the system for as long as possible and waste and pollution are minimized. It is viewed as a possible solution or contribution to achieving multiple Sustainable Development Goals (SDGs) including SDG 12 (sustainable production and consumption), SDG 7 (affordable and clean energy) and 8 (decent work and economic growth) (Schroeder, Anggraeni & Weber, 2019).

On a supranational level, the European Union is committed to the transition to a circular economy. International pledges have been made about increasing resource efficiency, including the Paris Climate Agreement and the G7- Alliance for resource efficiency. Furthermore, policy documents including the European Green Deal and action plans for the circular economy such as; 'Towards a Circular economy' and 'Closing the Loop', have been developed, (Avdiushchenko & Zając, 2019). The Netherlands, as a member of the European Union, shares the EUs commitment and in order to enhance the transition to a circular economy, several actions have taken place. In 2014, the Council for the Environment and Infrastructure (RLi) published the report: *Circular economy, from wish to practice* (2015) in which they advised the Dutch government regarding the circular economy transition. They stated three related reasons why the Netherlands should transition to a circular economy. First, the ongoing pressure on the earth's system due to an increasing demand for resources on a global level. This rising demand is already concerning, and it is likely to build up in the upcoming decades if no measures are being taken. This is closely related to the second reason; the Dutch dependency on the import of materials. Third, not moving to a circular economy will increase the Dutch dependency on other countries when it comes to raw materials. With the expected rise in demand, this can make the Netherlands and its citizens vulnerable to geo-political changes for their material usage and to fluctuations in resource prices, which negatively impacts the security of supply (RLi, 2015).

Additionally, transitioning to a circular economy will contribute to the climate targets. In 2013 The Dutch government committed to the Paris agreement to keep global warming within the critical two degrees scenario. Raw material extraction and manufacturing relates to extensive energy use and CO₂ emissions and thus, moving to a circular economy will help reduce those CO₂ emissions. However, climate targets can also conflict with the circular economy, for example in the usage of biomass for energy purposes (IenW, 2016).

In 2016, the Dutch government published 'Nederland Circular in 2050' (IenW, 2016). This policy document stated the ambition to achieve a circular economy in 2050. Additionally, a sub-target has been set, for 50% virgin material reduction by 2030. In order to move towards these aims, the Raw Materials Agreement (*Grondstoffenakkoord*) was signed in 2017. This covenant contains agreements for the transition to a circular economy between the Dutch government and 180 parties including governmental bodies as well as companies. In 2018, the signing parties of the Raw Materials Agreement have, in cooperation with the Dutch government, developed *transition agendas* for five important sets of sectors within the transition; construction, biomass and food, plastics, manufacturing and consuming goods (IenW, 2019). They describe how sectors should develop, and what action and knowledge is required at the local, regional, national and international level. In 2019, the Circular economy Implementation Program was presented, in which specific actions are linked to the transition agendas for the years 2019 – 2023 (IenW, 2019).

The development of the Raw Materials Agreement, transition agendas and the implementation program together are the fundamentals of the Dutch strategy to a circular economy. In order to keep an overview of the different developments aiming towards a circular economy, the Dutch Government assigned *Plan Bureau voor de leefomgeving* (PBL), a Dutch institution for strategic policy analysis regarding nature and the (living) environment, to monitor the transition. As part of their work program 'monitoring and steering Circular economy', PBL is responsible for showing the status-quo when it comes to the circular economy in the Netherlands and how far it is from reaching their aims (Rood & Kishna, 2019).

In order to achieve a circular economy, change is required in different segments; the behaviour of consumers, the practices of businesses and governmental action (Van Buren, Demmers, Van der Heijden & Witlox, 2016). Although, the recommendations made by Rli in 2015 mainly focus on the role of the national government in the CE transition, they do emphasize that local and regional governments have an important role and more attention should be paid towards creating a systematic approach for regional authorities (Rli, 2015). This is also mentioned by *The Association of Cities and Regions for Sustainable Resource Management* (ACR+) which state that moving to a circular economy should be connected to the development of territorial economies. Since territorial can be determined on different levels, the ACR+ opts for focussing smaller regional levels first and eventually the national and international level (ACR+, 2014). Several circular economy strategies have already been developed by regional governments (Salvatori, Holstein & Böhme, 2019). However, the regional perspective of transitioning to a circular economy, is one of the least explored perspectives (Walendowski, Roman & Miedzinski, 2014).

1.2 PROBLEM DEFINITION

Thus, apart from governmental action on an international, supranational and national level, more focus is needed on the role of regional and local governments and their contribution to help achieve a circular economy. The Association of Provinces of The Netherlands (IPO) as well as the Association of Dutch Municipalities (VNG) are signed parties of the Raw Material Agreement and share the ambition of transitioning to a circular economy. Water authorities are extracting raw materials from wastewater as part of their operational tasks and regional governments in general can stimulate the circular economy by adopting a circular procurement policy (Rijksoverheid, 2020).

Up until now, there was limited information available on what regional governments are doing to contribute to the circular economy transition in the Netherlands. As part of their work program, PBL worked on an overview of policy instruments used by five different types of regional governments (provinces, water authorities, regional bodies, environmental protection agencies and municipalities) to contribute to the Dutch CE goals. The intermediate results show that several regional governments are actively involved in the transition, using different policy instruments such as subsidies and network meetings, depending on the type of government and the region (PBL, 2020a).

Apart from insights on what policy instruments are used by regional governments, evaluation on the effectiveness of these policy instruments is necessary in order to improve and steer policies. Necessary, but problematic. On a broad level, among policy makers and academics, there is a need for indicators and metrics on the circular economy. However, on a European level, there is no unified system of indicators for the CE, making it difficult to compare the effects of policy measures (Avdiushchenko & Zajac, 2019). Furthermore, indicators that have been developed for the circular economy, by the European Committee, are focussed on the national and European level and are not always translatable to the regional and local level. This is due to some indicators only being relevant on a wider scale such as the trade in recyclable raw materials or data availability issues on smaller scales such as the city level (Paiho et al., 2020). This leads to discrepancies between the making of policy and the practical implementation in regional context (Avdiushchenko & Zajac, 2019).

1.3 RESEARCH AIM AND RESEARCH QUESTION

As explained in Section 1.2, more focus needs to be placed on the role of regional governments in the transition to a circular economy (ACR+, 2014). PBL shows that some regional Dutch governments are already active in using policy instruments to stimulate the transition towards a circular economy. Nevertheless, an assessment of these instruments is needed. This study aims to explore the evaluation of circular policies deployed by regional governments in the Netherlands. Thus, the research question of this study is:

RQ: How can regional governments evaluate their policy instruments deployed towards achieving the Dutch Circular economy goals?

In order to answer the main research question, two sub-questions have been developed. They are explained below as to how they contribute in answering the main research question:

SQ1: How are regional governments currently evaluating their deployment of circular policies?

The answer to this research question shows how policymakers on the regional level view the evaluation of their circular policies. Additionally, insights in possible indicators that regional governments for this evaluation are gathered.

SQ2: What indicators can be used to evaluate the circular policies deployed on the regional level?

In order to evaluate policy instruments, indicators are to be identified to consider when circular policies have been implemented successfully or have achieved their goal.

1.4 SOCIETAL AND SCIENTIFIC RELEVANCE

This study revolves around the concept of the circular economy. The transition to a circular economy is, in essence, a societal transition. Moving away from how the economy is currently structured will have an impact, not just on the planet but also on people and profit (Humbts-Steinbeck, 2017). The transition will go in line with the stimulation of innovation, the creation of jobs, the growth of the economy etc. (European Commission, 2018). Furthermore, it is strongly linked to topics such as waste management and creating a healthier living environment for people. Evaluating the policy instruments used by regional governments will create scientific knowledge on how significant the current role of regional governments is in contributing to achieving a circular economy. It will provide insights in effects that certain policy instruments have in enhancing the circular economy. Furthermore, these insights will help to identify more adequate steering of policies and stimulate the transition to a circular economy. This study also emphasizes an important link between the scientific approach of the CE concept and the more practical approach of the CE in governmental organizations.

1.5 STRUCTURE OF THE STUDY

This study is structured as follows. After the introduction provided in Chapter 1, Chapter 2 entails the theoretical foundation of this study. In Chapter 3 the research design is presented with the methodology used to answer the main research question. Chapter 4 entails both the result and discussion part of this study. In this Chapter the answers of the sub-questions are presented and discussed leading to the answering of the main research question and a critical reflection. Finally, Chapter 5 entails the conclusion part of this study.

2. THEORETICAL FOUNDATION

In order to assess the evaluation of the deployment of policy instruments for the enhancement of the circular economy on a regional level and to answer the main research question of this study, the following concepts need to be elaborated on. First, an analysis of the circular economy concept is provided as well as an explanation of the different implementation levels within the circular economy concept (Section 2.1). An exploration of how the circular economy relates to regional governments within Europe and in the Netherlands is included in Section 2.2. Furthermore, a description of policy instruments and how they can be classified is provided in Section 2.3. Finally, the evaluation aspect of CE policies and indicators applicable for the evaluation on a regional level are discussed in Section 2.4.

2.1 THE CIRCULAR ECONOMY

2.1.1 THE CIRCULAR ECONOMY CONCEPT

The circular economy is viewed as a possible solution to the increasing environmental pressure on the earth's system that originated from the current linear economic structure, leading to issues such as water- air and soil pollution, resource depletion, biodiversity loss etc. (Geissdoerfer, Savaget, Bocken, & Hultink, 2017). Though, there is no single origin known of the concept of the circular economy, the term can be traced back to the 1970s. During this period several academic authors mentioned the link between the linear characteristics of the economy system as well as the idea that the earth is a closed system (Geissdoerfer et al., 2017). Furthermore, it has most likely been inspired by the 'limits to growth' report from the Club of Rome in 1972 as well as other well-known sustainability theories (Winans, Kendall, & Deng, 2017).

The CE concept has been gaining more attention since the 1970s. This is partly because the concept is viewed as more accessible and proactive compared to the concept of Sustainable Development, especially among academics and practitioners (Kirchherr, Reike, & Hekkert, 2017). However, the concept of the Circular economy is also described by critics as being incoherent and unorganized (Korhonen, Honkasalo & Seppälä, 2018). This is because the CE concept has been evolving differently within diverse social, economic and political systems. For example, the Chinese depiction of the Circular economy is broad and includes dominant environmental issues relevant for China such as air pollution. It is seen as a response to rapid industrialization and the environmental issues that follow from this growth. In contrast, the CE concept of the EU is narrower, with a focus on waste and resource management and opportunities for businesses (Avdiushchenko & Zając, 2019). Hence this study will mainly focus on the CE concept within European boundaries.

However, even within the European scope, the CE concept remains broad. Avdiushchenko & Zajac (2019) divides the circular economy in seven dimensions: Economic prosperity, zero-waste, energy efficient and renewable energy-based, innovative, low carbon, smart and spatially effective. Additionally, a study for the monitoring of the circular economy in the Metropole Region Amsterdam in the Netherlands, distinguishes seven pillars within the circular economy concept: Materials, biodiversity, human society & culture, health & well-being, energy, societal value and water (Metabolic, 2018). Thus, varying segments are included within the CE concept leading to a variety of definitions of the circular economy being applied within scientific literature as well as by policy makers. This study will focus on the following definition by the European Commission:

“In a circular economy the value of products and materials is maintained for as long as possible; waste and resource use are minimised, and resources are kept within the economy when a product has reached the end of its life, to be used again and again to create further value.” (European Commission, 2015).

This definition is chosen since it merely focusses on the material aspect of the circular economy and less focus is being placed at other aspects such as energy, biodiversity etc. creating a clear scope and detaching it from the general sustainable development concept. Furthermore, the definition is derived from the European Commission and the Netherlands, being part of the European Union, relates to this definition. The relation between the circular economy and the use of materials is well depicted in various R-ladder strategies existing in scientific literature, one of them being the altered R-ladder of circular strategies by PBL (see Figure 1).

R-ladder of circularity strategies

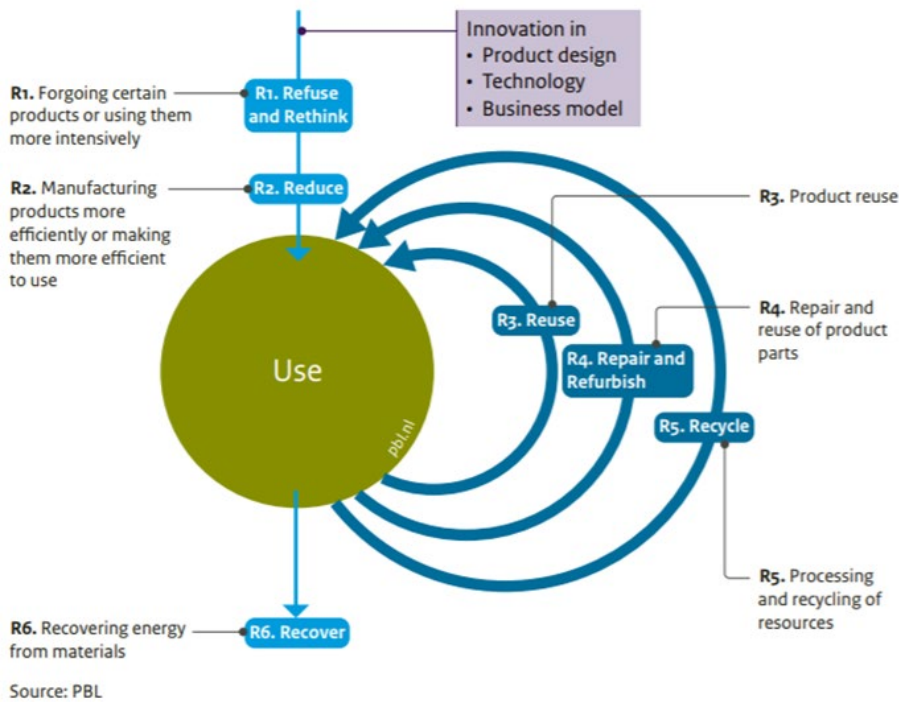


FIGURE 1 R-LADDER OF CIRCULARITY STRATEGIES (ROOD & KISHNA, 2019)

The R-ladder shows strategies that contribute to the reduction of primary abiotic materials. The R-strategies are hierarchically structured and are derived from several R-ladders in literature. The following rule of thumb applies; The higher the R-strategy, the less material use needed. The highest R-strategy, R1 entails avoiding the production of a product or producing the product in a radically different way. R2 entails less material use by increasing the efficiency of production processes. R1 and R2 are principles that avoid or reduce the amount of raw materials being put into the economy. R3, R4 and R5 are principles used to keep materials once they have entered in the economic system, for as long as possible. R3 entails the reusing of products and R4 the repairing/remanufacturing of products so they can be used again while R5 recycles material from products to be applied to new products. Finally, R6 is the lowest R-principle and entails the production of energy from incineration of materials that are not suited for recycling (Rood & Kishna, 2019). The R-strategies can also be allocated to three main strategies. The three main categories are smarter product use and manufacture (R0-R2), extended lifespan of product and its parts (R3-R4) and useful application of materials (R5-R6) (Potting et al., 2018).

2.1.2 IMPLEMENTATION LEVELS OF THE CIRCULAR ECONOMY

The scope of the “use” element as depicted in Figure 1, can be interpreted on product level but is also applicable to other levels. On a broad level PBL distinguishes four different levels of aggregation within the transition to a circular economy and includes the national level, prioritized themes, regions and

groups of products and services (Potting et al., 2018). The prioritized themes relate to the development of the transition agendas by the Dutch government in which multiple sectors are included (see Section 1.1)

Ghiselinni, Cialani and Ulgiati (2016) distinguish between three levels of implementation considering the circular economy: The micro, meso and macro level (see Figure 2). The micro level consists of products or companies. The meso level consists of industrial parks. The macro level entails all bigger levels from cities to (inter)national economies. Even though regions are mentioned by Ghiselinni et al. (2016) as being a macro implementation level, the line between macro and meso comes across as vague. According to Kalmykova, Sadagopan and Rosado (2018), examples of implementation of the circular economy on a regional or local level are eco-industrial parks. Eco-industrial parks entail the sharing of waste flows and resources among industries. China has numerous of these parks in existence, but these are acknowledged as the meso implementation level instead of the macro implementation level. Since the regional level within the Netherlands depicted in this study does not resemble the eco-industrial parks often found in China, this study focusses merely on the implementation of the circular economy within regions at the macro level.

However, the macro level has been depicted as too broad in literature (Vanhamaki et al., 2019). Policies and their implementation differ between the national, regional and local level policies in scale and accuracy (2019). Hence, because the regional and local level are appointed to the macro level of implementation, it does not inherently mean that all indicators used for the macro level also apply to the regional and lower levels (see Section 1.2).

Circular Economy - System Level Approach



FIGURE 2 CIRCULAR ECONOMY: SYSTEM LEVEL APPROACH RETRIEVED FROM (VANHAMAKI ET AL., 2019)

2.2 THE REGIONAL LEVEL

2.2.1 REGIONAL GOVERNMENTS

It has been stated in Section 1.1, that the Dutch government aims for a circular economy in 2050. This national, macro level aim is ambiguous because no uniform circular economy definition has been adopted and no indicators have been developed. The official website of the Dutch government states that the circular economy in 2050 means to be 'waste-free' and; "*In the circular economy there is no waste and raw materials are used again*" (Ministerie van Algemene Zaken, n.d). This description focusses on the material aspect which is also seen in the definition of the European Commission mentioned in Section 2.1.1. However, some of the five transition agendas (Section 1.1) that have been published have adopted their own definitions. Thus, there is not one overarching definition in place now. The sub-target of 50% reduction of raw materials in 2030 is more precise but there is no indicator framework in place yet to measure the circularity of the Netherlands (Prins & Rood, 2020).

Second, it is unclear how the national targets of 2050 and 2030 translate to the regional level. Multiple national policy documents such as *Nederland Circulair in 2050* do mention the importance of regional and local governments in achieving a circular economy (IenW, 2016). Yet, it is uncertain if this effort is to be distributed equally amongst all governmental institutions. There are some targets present on the regional level. For instance, all governmental procurement must be circular in 2030 and all tenders towards the construction and building sector must be circular from 2030, which can be found in the transition agenda construction (Rijksoverheid, 2018). Apart from this, an explanation on the regional level is lacking. Nonetheless, regional and especially local governments must abide to policies from higher levels. One of the simplest ways to tackle this, is stating that every regional government has the same aim as the national aim. Thus, 50% material reduction on the national level suggest that each regional government must abide the same 50% material reduction target. This study will follow this line of reasoning.

In order to investigate the transition to a circular economy on a regional level, an explanation of how regional governments are defined is needed. Terminology wise, a distinction is often made between local and regional governments. Cities and municipalities are classified as local governments while other types of governments such as provinces are defined as regional governments (Romano, 2018). In the Netherlands, there are three different layers of governments. The national government followed by regional governments including provinces and water authorities and finally; local governments, which are municipalities. Furthermore, cooperation between different types of regional governments exists in regional bodies and environmental protection agencies (see Figure 3).

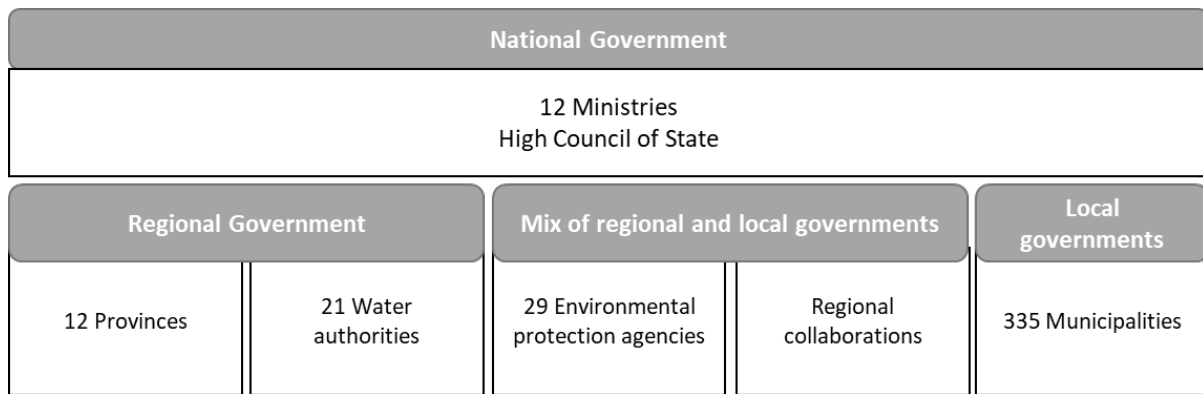


FIGURE 3 Overview of governmental bodies on a national, regional and local level in the Netherlands (Own Authorship) Information retrieved from (Rijksoverheid, n-d)

As can be noted from Figure 3, five main governmental bodies on the regional and local level can be identified in the Netherlands. Provinces are authorities between the national and local government. They are responsible for matters within this administrative layer. Water authorities are responsible for regional water management as well as water purification and flood defense. Environmental protection agencies are also partnerships between different governments. They are often commissioned by regional governments and municipalities and are responsible for monitoring and enforcement in the context of the environment. Regional bodies are partnerships between different regional and local governments. Examples within the Netherlands are Foodvalley, or the MRA (Metropole Region Amsterdam). Finally, municipalities are local governments; terminology wise they can be intertwined with cities, which is a more common term in international literature. Local governments do not come up with legal frameworks themselves but are often the executing party of legal frameworks made on higher levels such as the provincial level (Gerritsen, 2011). Nevertheless, to avoid unnecessary complexity, this thesis will not focus on the discrepancy between local and regional and refer to all five governments as regional governments.

2.2.2 CE STRATEGIES ON THE REGIONAL LEVEL

Although, it is unclear how the national aims are to be translated to the regional level, this is not to say that regional governments are not important in enhancing the circular economy within the Netherlands and on an international level. In 2018, the Organisation for Economic Co-operation and Development (OECD) held a survey on the circular economy in cities and regions. According to the OECD, regions have a crucial role to play because they can act as ‘testing rooms’ for innovation (Romano, 2018). The survey showed that the main objectives of regions to transition to a circular economy are to create new business models, rethink production and consumption and to improve the environmental quality. Furthermore, the main obstacles for regional governments according to this survey, are cultural barriers, regulatory frameworks and financial resources (Romano, 2018). Kirchherr

et al. (2018) also finds that cultural barriers are the most common barriers. These cultural barriers are initiated by market barriers that are caused by a lack of governmental intervention.

Despite the obstacles being faced by regional governments, some governments are already active in forming and implementing a CE strategy. However, the transition to a circular economy will have different implications for different regions (Walendowski, Roman, & Miedzinski, 2014). Thus, it is important for regional governments to gain insights into the specific qualities of the region and the parties within this region in order to define a strong circular strategy (RLi, 2015). Within Europe, examples of circular strategies are London's Circular economy Route Map¹, Strategy of the Government of Catalonia: Promoting Green and Circular economy in Catalonia² and Circular Amsterdam³ (Avdiushchenko & Zajac, 2019). CE strategies or roadmaps are programs or plans with the aim to enhance the transition to a circular economy. They consist of a strategic plan including objectives, desired outcomes and key steps. They focus on multiple aspects of the transition and are inclusive of all phases of the value chain such as production, consumption and disposal (Salvatori, Holstein, & Böhme, 2019). Salvatori et al. (2019) reviewed several of these existing and planned CE strategies on multiple levels within Europe (see Figure 4).

¹ London Waste and Recycling Board. (2017). London's circular economy route map. Retrieved from https://www.lwarb.gov.uk/wp-content/uploads/2015/04/LWARB-London%E2%80%99s-CE-route-map_16.6.17a_singlepages_sml.pdf

² GENERALITAT DE CATALUNYA. (2015). *IMPULS A L'ECONOMIA VERDA I A L'ECONOMIA CIRCULAR*. Retrieved from http://mediambient.gencat.cat/ca/05_ambits_dactuacio/empresa_i_produccio_sostenible/economia_verda/impuls_economia_verda/

³ Gemeente Amsterdam. (2020). *Amsterdam Circulair 2020-2025 Strategie*. Retrieved from https://www.amsterdam.nl/wonen-leefomgeving/duurzaam-amsterdam/publicaties/amsterdam-circulair-2020-2025-strategie-0/?PagClsIdt=15523636#PagCls_15523636

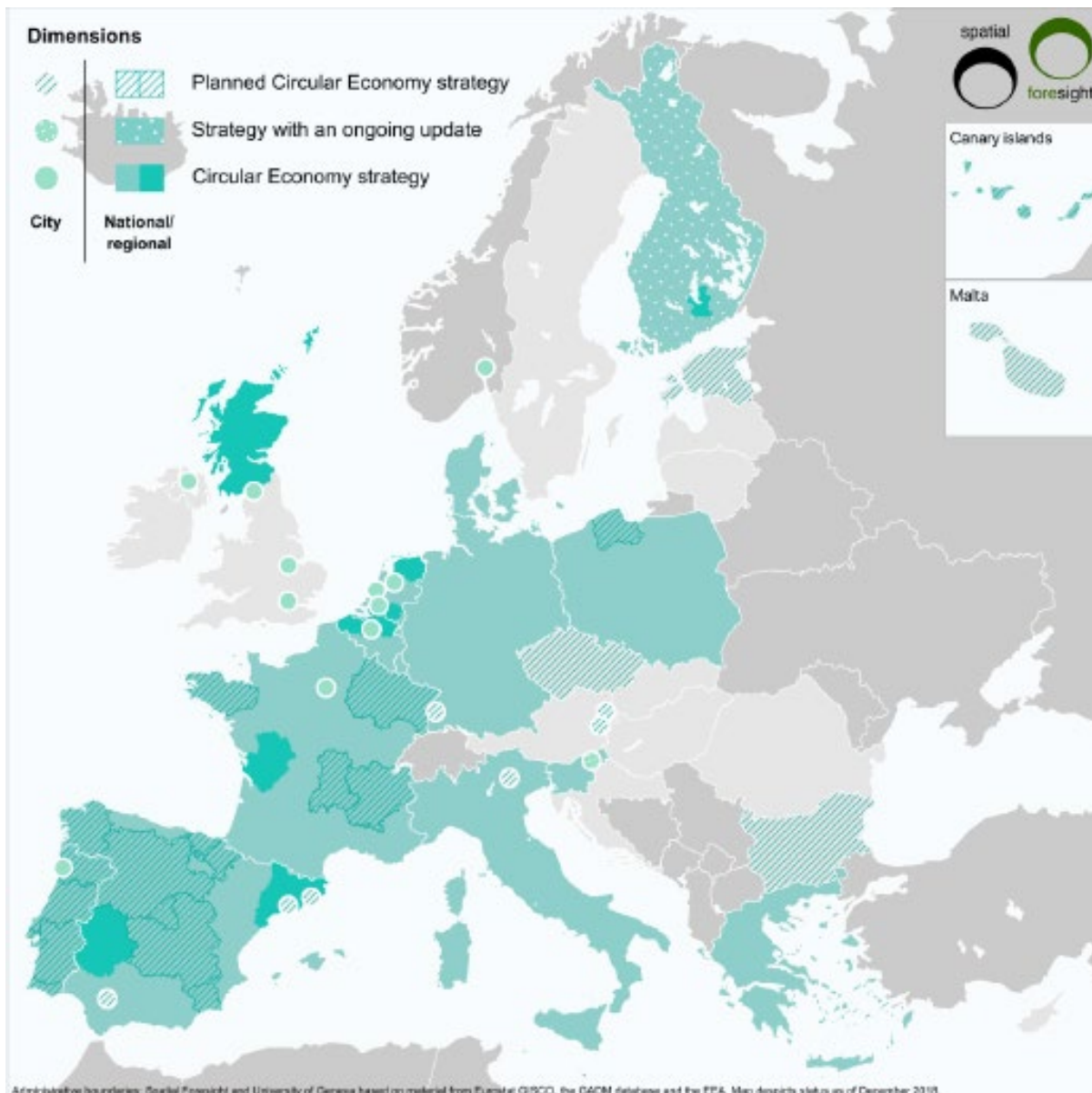


FIGURE 4 Overview of Existing and planned CE strategies on a national/regional level in Europe (Salvatori, Holstein, & Böhme, 2019)

Figure 4 shows 33 different CE strategies within Europe. Even though most CE strategies were found on a national level, several regional CE strategies can be noted as well. Spain has multiple regional CE strategies such as: Promoting Green and Circular economy in Catalonia. Within France, several regional strategies can be found as well (e.g. The circular economy in Poitou- Charentes). Furthermore, multiple cities have their own CE strategy including Paris, London and Amsterdam.

Vanhamaki et al. (2019) qualitatively assessed national and regional bio-based circular economy strategies within Finland, Spain, Slovakia, Greece, Romania and France. They concluded that waste management is a key factor in CE strategies. Additionally, Salvatori et al. (2019), differentiated between three different types of strategies at the national and regional level. First, integrated strategies with a focus on steering the public opinion towards the circular economy. Examples are the CE strategies of Catalonia and Paris. Second, strategies with a confined focus. Only stakeholders linked

to the specified sectors are actively involved. Not much emphasis is being placed on other sectors and stakeholders. Amsterdam's strategy: Amsterdam circular – A Vision and Route Map for the City and Region, is in this category. Third, all-encompassing strategies with clear priorities. CE strategies of Brabant (Steppingstones to a Circular economy 2019-2028 Brabant) and Northern Netherlands (Roadmap to a Circular North Netherlands) are examples of this combination of the first and second types of strategies. They entail inclusive partnerships as well as broad material loops.

In total more than 40 CE strategies were investigated by Vanhamaki et al. (2019) and Salvatori et al (2019). All the CE strategies were either formed by national governments or provinces, municipalities/ cities. There were no CE strategies identified from other types of regional governments such as water authorities. This is most likely because not all European countries have specific regional governments such as water authorities or environmental protection agencies. Of the 33 investigated CE strategies from Salvatori et al. (2019) which included the Netherlands, 21 were on the regional/local level and five of those were from Dutch regions. This shows that regional governments in the Netherlands are quite active in forming a CE strategy compared to other regions in Europe.

2.3 POLICY INSTRUMENTS

2.3.1 STEPS OF POLICY MAKING

Whether it is related to the circular economy or just public policy in general, regional governments stimulate, navigate and steer to reach goals within the region, by using policy. The process of the making and implementation of policies is covered in the concept of the policy-cycle. Policy-cycles are a process showing how policies can be implemented and evaluated. Although on one hand, the cycle approach is no longer pivotal to policy studies since it is seen as an oversimplification, neglecting the complexity of policy making and lacking information, it is also seen as a useful tool that highlights the fluidity of policy making while making the process less complex and more comprehensible (Cairney, 2016). Multiple policy cycles exist, but often four to six different steps can be identified including agenda building, formulation and adaptation, implementation and evaluation. CE strategies entail the targets that governments want to achieve within a certain period and the policy instruments they deploy to achieve their objectives, thus covering the agenda setting, formulation and adaptation steps. The next step is the actual implementation of these instruments, thus what CE action is derived from this strategy? Finally, the policies can be evaluated. In the case of the circular economy transition, policies are deployed with the aim to intervene in the current system and change it to become more circular (see Figure 5). Whether a policy is effective relates in this case to the ability of the policy instrument to intervene and create more circularity on a regional level. The evaluation step will be elaborated on in Section 2.4.2

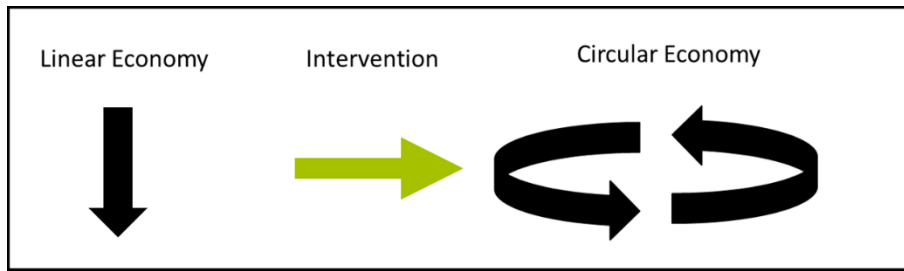


FIGURE 5 From a linear Economy to a circular economy (Own Authorship)

2.3.2 CLASSIFICATION OF POLICY INSTRUMENTS

Thus, CE strategies entail targets to be achieved and instruments to be deployed. Cairney (2019) defines a policy instrument as; *“a device used to help turn a broad policy aim into specific action”*. Mees et al. (2014) defines policy instruments as *“tools of government”*. They are instruments (e.g. regulatory and economic) that are enforced to achieve an aim or goal that would not have been achieved without governmental intervention (Winans, Kendall, & Deng, 2017). Considering policy instruments, different classifications can be detected. However, policy instruments are not just implemented for circular economy purposes. They are deployed to achieve other goals as well. Within sustainability this includes several areas such as the deployment of policy instruments to enhance climate adaptation or the energy transition. Cairney (2019) states that the terms policy instruments and policy tools are often interchangeable within literature. However, he differentiates between the two stating that ‘instruments’ are a range of measures while he uses the term ‘tools’ to different key categories of public policy instruments. The same differentiation will apply in this study, but tools will be referred to as ‘types of policy instrument’. Cairney (2019) provides a list of 17 different policy instruments which can be found Table 1.

TABLE 1: CLASSIFICATION OF POLICY INSTRUMENTS WITHIN PUBLIC POLICY (CAIRNEY, 2019)

Types of policy instruments
1. Public expenditure. This includes deciding how to tax, how much money to raise, on which policy areas (crime, health, education) to spend and the balance between current (e.g. the wages of doctors) and capital (building a new hospital) spending.
2. Economic penalties, such as taxation on the sale of certain products, or charges to use services.
3. Economic incentives, such as subsidies to farmers or tax expenditure on certain spending (giving to charity, buying services such as health insurance).
4. Linking government-controlled benefits to behaviour (e.g. seeking work to qualify for unemployment benefits) or a means test.
5. The use of formal regulations or legislation to control behaviour.
6. Voluntary regulations, such as agreements between governments and other actors such as unions and business.
7. Linking the provision of public services to behaviour (e.g. restricting the ability of smokers to foster children).
8. Legal penalties, such as when the courts approve restrictions on, or economic sanctions against, organizations.
9. Public education and advertising to highlight the risks to certain behaviours.
10. Providing services and resources to help change behaviour.
11. Providing resources to tackle illegal behaviour.
12. Funding organizations to influence public, media and government attitudes.
13. Funding scientific research or advisory committee work.
14. Organizational change, such as the establishment of a new unit within a government department or a reform of local government structures.
15. Providing services directly or via non-governmental organizations.
16. Providing a single service or setting up quasi-markets.
17. Providing a state service for free, charging, or expecting the market to deliver

Table 1 shows how many different policy instruments are to be deployed by governments. PBL even distinguishes between close to 60 different policy instruments (see Appendix 1). According to Cairney (2019), there is no strict definition of what public policy entails. In order to contribute to unravelling the definition he suggests identifying between different types of measures. However, different classifications of policy instruments exist within policy making as well as in scientific literature. An example from scientific literature on sustainable policy instruments is provided by, Mees et al. (2014) who researched policy instruments aimed at climate adaptation. They make a distinction between legal (zoning, performance standards etc.), economic (subsidies and taxes) and communicative instruments (public information campaigns). On the other hand, Shen, Jiao, Song & Zhang (2016) investigated the development of policy instruments used for improving building energy efficiency (BEE). They identified and classified multiple policy instruments used in BEE, based on their form and made a distinction between mandatory administration instruments, economic incentive instruments and voluntary scheme instruments (see Table 2).

TABLE 2: A CLASSIFICATION FRAMEWORK OF BEE POLICY INSTRUMENTS (SHEN ET AL., 2016)

A classification framework of BEE policy instrument.

Policy instrument		Specific measures	
PI-A	Mandatory Administration Instrument	PI-A ₁	Law
		PI-A ₂	Regulation
		PI-A ₃	Code and Standard
PI-B	Economic Incentive Instrument	PI-B ₁	Subsidy
		PI-B ₂	Tax
		PI-B ₃	Loan Incentive
PI-C	Voluntary Scheme Instrument	PI-C ₁	R&D
		PI-C ₂	Certification and label
		PI-C ₃	Governmental service

Considering policy instruments used to enhance the circular economy there are little scientific studies classifying circular policies within Europe. Policy documents itself and organizations linked to the circular economy however show a differing way of classifying their circular policies. Amsterdam’s circular strategy 2020-2025, classifies CE policy instruments, in a similar, but slightly different framework as Shen et al. (2016). In this case a distinction is made between regulatory & legislative instruments, economic instruments and soft instruments. These instruments are subdivided into two or three types of instruments e.g. regulations and legislation. Finally, another sub-division is made of specific instruments such as prohibitive provision as part of legislation policy (see Figure 6) (City of Amsterdam, 2020). This type of classification (regulatory & legislative, economic and soft instruments) is also used by circle-lab; an online platform for cities, companies and inhabitants to examine circular business models and strategies (Circle Lab, n-d).



FIGURE 6 Classification of policy instruments according to Amsterdam’s roadmap to a circular economy (City of Amsterdam, 2020)

The C40 Climate Leadership Group investigated several policy documents on Amsterdam’s circular strategy and have structured the types of policy instruments differently. Instead, eight different types of policy instruments are identified: Land issue (land tendering), spatial planning

(development of an area in all facets), procurement (applying circular principles in procurement of physical products), education & information provision (involving new stakeholders and organisations and providing knowledge), research (diminishing uncertainties), network & information exchange (sharing information and experiences), legislation and regulations (deploying legislative or regulatory means such as signing covenants), businesses and financial support (facilitating business either financially or in other ways, such as providing work places) (C40, 2018). PBL uses a similar format, except for counting land issue and spatial planning as one and differentiating between network & information exchange and the provision of information to the public.

Thus, there are numerous ways of organising policy instruments. This shows that there is complexity in distinguishing different types of policy instruments and creating a classification. Furthermore, even though different goals outside or within sustainable development can be targeted, identical policy instruments are being used to achieve their respective goals. According to Cairney (2019) there is not one satisfactory way to characterise all the instruments. However, a choice must be made. Since PBL is responsible for the monitoring of the circular economy in the Netherlands, this thesis will abide to the classification of policies used by PBL (see Figure 7).

Research	Research can provide direction and take away uncertainties. It can be applied in different
(Financial) support of businesses	Helping businesses and organisations by providing (financial) support, taking away risks or providing incentives to invest etc.
Circular procurement	Procuring of ground-, road- and water works. Buildings, facilities etc. A way for regional governments to “practice what they preach”.
Provision of information	This type of policy instrument is aimed at providing information and creating awareness among residents or companies about their own raw material consumption and to (indirectly) influence behaviour.
Education	Education entails the involvement of educational institutions as the link between learning and performing.
Network- & Information exchange	This type of instrument brings stakeholders together to encourage the exchange of knowledge.
Laws and Regulation	Laws and regulations can be deployed to stimulate desirable development and to encourage circular practices
Area Development	Regional governments can encourage the use of circular materials in the case of spatial planning and facilitate the storage of released (construction) materials.
Operational tasks	Regional governments are responsible for municipal waste management and water authorities for the extraction of raw materials. However, within the execution of these operational tasks, regional governments can contribute to a circular economy

FIGURE 7 CLASSIFICATION OF POLICY INSTRUMENTS ACCORDING TO PBL (RHDHV & PBL, 2020) (OWN AUTHORSHIP)

2.3.3 DEPLOYMENT OF POLICY INSTRUMENT BY REGIONAL GOVERNMENTS IN THE NETHERLANDS

Apart from policy instruments embedded in a CE strategy, many initiatives on the city and municipal level without a CE strategy, have been identified as well (Paiho et al., 2020). For example, even if water authorities do not have a written circular strategy, they might still participate in recovering raw materials, due to their sustainable ambitions and the nature of their operational tasks. However, one main factor that determines the success of the CE transition is the design and implementation of policy instruments as part of a robust strategy (Walendowski, Roman & Miedzinski, 2014). Within this study a policy instrument is described as initiative in which an action is employed by a regional government with the aim of contributing to a circular economy. An example is the granting of a permit for a circular business activity.

In the Netherlands a wide variety of policy instruments are already being deployed on a regional level to enhance the CE transition (PBL, 2020a). Examples are a study to explore circularity within environmental permits by environmental protection agency DCMR⁴, the support of knowledge network NICE (Noordelijk Innovatielab Circulaire Economie) by the province of Drenthe⁵ or the circular housing construction project Puraverde by the municipality of Venlo⁶. Figure 8 shows PBL's intermediate results of policy instruments used by regional governments in the Netherlands to enhance the transition to a circular economy. The eight types of instruments in Figure 7 are sub-divided into ca. 60 policy instruments of which knowledge networks, subsidies and facilitation are most often deployed amongst regional governments in the Netherlands.

⁴ https://staten.zuid-holland.nl/DMS_Import/Statencommissie_Ruimte_Wonen_en_Economie_RWE/2020/Agenda_RWE_15_januari_2020/Bespreekstukken/Statenvoorstel_Strategie_om_te_komen_tot_een_Circulair_Zuid_Holland/Stuknr_720390252.org

⁵ <https://www.wearenice.org/>

⁶ <https://www.platform31.nl/thema-s/energietransitie/circulaire-woningbouw/praktijkvoorbeelden-circulaire-woningbouw/circulaire-woningbouw-puraverde>

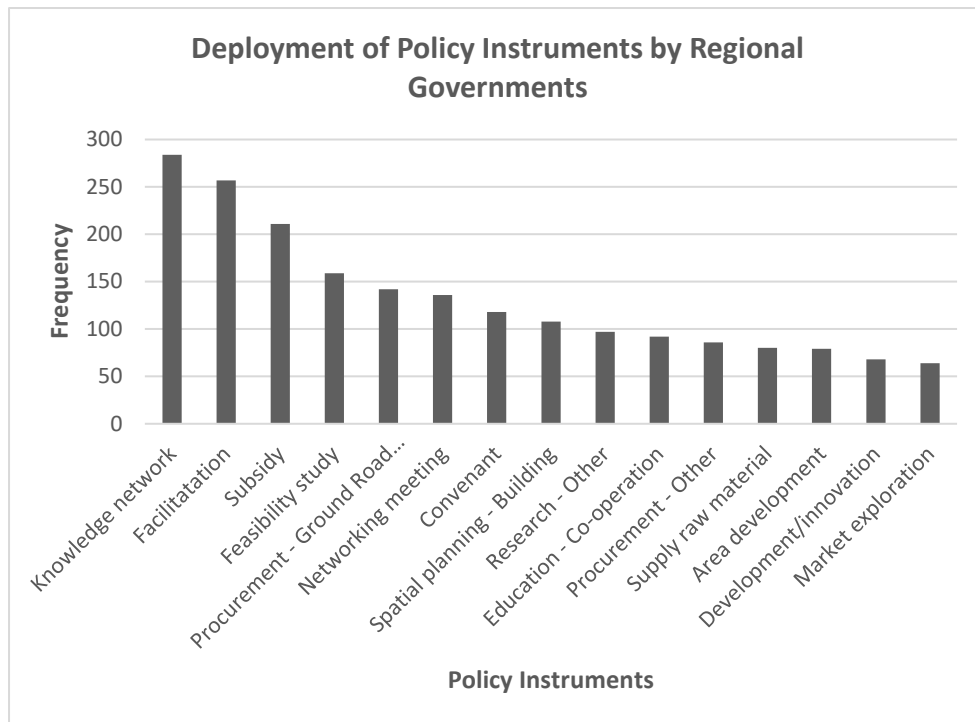


Figure 8 FREQUENCY OF THE 15 MOST DEPLOYED POLICY INSTRUMENTS OUT OF CIRCA 60 DIFFERENT POLICY INSTRUMENTS AMONG 75 DIFFERENT GOVERNMENTAL BODIES IN THE NETHERLANDS, INTERMEDIATE RESULTS (PBL, 2020A)

Another finding is that the deployment of policy instruments differentiates between types of regional governments. The intermediate results show that provinces are using a wide variety of instruments to enhance the circular economy. Their focus is on the (financial) support of businesses. Water authorities are mainly active in research. Furthermore, due to their tasks, they can supply raw materials extracted from water. Regional bodies mainly focus on exchanging knowledge and creating networks. Environmental protection agencies focus on granting permits and being a knowledge partner related to legislation and regulation of transformation of waste to resources (PBL, 2020a).

2.4 INDICATORS FOR POLICY EVALUATION

2.4.1 MONITORING THE CIRCULAR ECONOMY

The evaluation of policies used to enhance the circular economy is part of the monitoring and evaluation of the transition to the circular economy in general. As stated in Section 1.1, in the Netherlands, PBL is responsible for the monitoring of the circular economy. Having one indicator to measure the circularity of a country, region etc. would be ideal, however unrealistic. Thus, indicators are still being developed and researched in order to create a monitoring manner (Trudy & Rood). The lack of a clear monitoring framework is partly due to the unorganized definition of the circular economy concept (see Section 2.1.1) adding to the complexity of finding suited indicator systems.

However, this thesis does not aim to find indicators for the evaluation of every aspect of the circular economy in the Netherlands but merely focusses on the evaluation of policy instruments aimed at enhancing the circular economy from a regional point of view. Indicators for policy evaluation and monitoring in general are closely related. In order to effectively steer policies and move towards achieving the national circular economy goals, knowledge is needed on the effectiveness of policy instruments (Prins & Rood, 2020). That is why PBL works, with partners, on creating a monitoring system aimed at observing the efforts of governmental bodies and social parties. Thus, the monitoring system is also a steering system. According to Prins and Rood (2020), in order to come to a robust monitoring and steering system in the Netherlands, a lot of information and data is needed. This includes information on the current use of materials in the Netherlands.

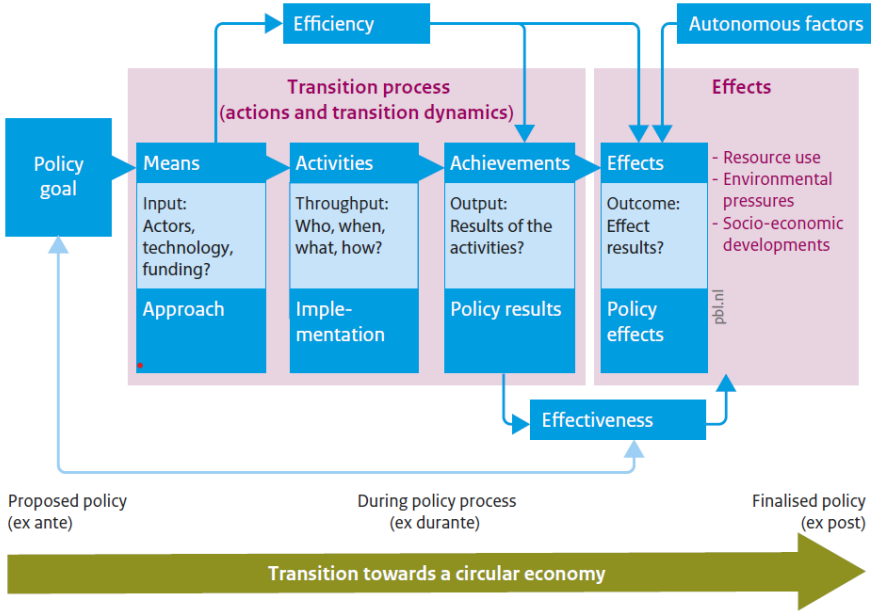
The need for frameworks and indicators to steer policies on the regional level can be noted amongst scholars and practitioners worldwide. A recent study from Avdiushchenko and Zajac (2019), emphasizes the lack of indicator systems for the circular economy on multiple levels, including the regional level. According to Wise (2016) investigating the effectiveness of CE strategies on multiple levels including the regional level is important. However, numerous attempts have been made over the last years to identify indicators, but in an inconsistent way with differing scopes, applications and aims. Overall, there is an academic lack of knowledge on indicators which results in a barrier towards further implementation of the circular economy concept (Akerman, 2016).

2.4.2 EVALUATION OF POLICY INSTRUMENTS

As stated in Section 2.3.1, all policy cycles have the evaluation step in common. This step entails an assessment of the successfulness of the policy. These assessments can be qualitatively or quantitatively performed. Mees et al. (2014) uses six different criteria to evaluate policy instruments. The first two are economic criteria. They entail the effectiveness, which is explained as the extent to which targets are being met by means of the deployment of policy instruments and the available resources. The second criterium is efficiency, which is described as the optimum allocation of means to make sure an intervention is realised with the lowest cost. The third and fourth, are legitimacy and accountability and from legal studies, legal certainty (fifth) and fairness (sixth) have been derived. Although all evaluation criteria are relevant. This study will focus on the effectiveness of policy interventions.

Figure 9 shows a policy evaluation framework from PBL that is found in multiple reports on the circular economy. In this framework a distinction is made between means, activities, achievements and effects. Means are the input needed to create circular activities and entails funding and effort. The policies that are created are referred to as throughput and entail the number and characteristics of

implemented circular policies. Finally, a distinction is made between the achievements (output) and the effects (outcome) of policies. The output is the direct result of the CE action whereas the outcome is the effect on the surroundings such as resource use and socio-economic development (Prins & Rood, 2020). Since in this study the definition of the European Commission is adopted, which links to the material aspect of the CE, only the effects on resource use are considered. It is expected that, since the CE is in the beginning phase, not all policy instruments will already have a direct effect in terms of reducing material flows. Thus, the direct effectiveness of the policy on the material flows can be hard to measure. This shows that a combination of outcome and output indicators are needed in order to evaluate policies for the CE.



Source: Netherlands Court of Audit 2005; adaptation by PBL

FIGURE 9 Policy Assessment Framework for measuring the progress of the transition towards a circular economy (Potting et al., 2018)

2.4.3 TRANSITION INDICATORS

In order to find indicators for the evaluation of regional circular policies, it needs to be considered that the circular economy is a societal transition. In general, there are roughly four phases within each societal transition (see Figure 10). The first phase is the (pre-) development phase. This phase is characterised by doing research and pioneers. The next phase is the start-up phase. In this phase experimenting and pilots lead to new applications. The following phase is the acceleration phase in which the existing system and its stakeholders will experience pressure from, pioneers following working within a new system. The final phase is the stabilisation phase in which stakeholders are

adjusted to the new system (IenW, 2016). Similarly, within the scope of sustainability and even circular economy, more examples of transitional phases can be found in literature.

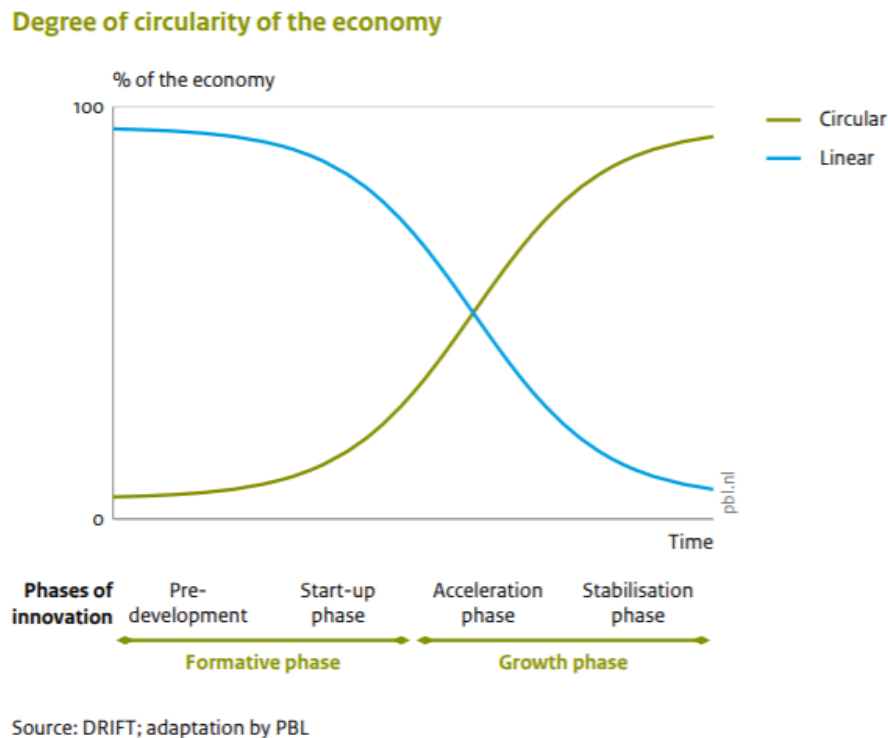


FIGURE 10 DEGREE OF CIRCULARITY OF THE ECONOMY (POTTING ET AL., 2018)

In Figure 10 the degree of circularity of the economy is shown considering the four phases mentioned above. In this case the four phases are aggregated into two phases: the formative phase in which the condition is being created for the circular economy and the growth phase in which there is an actual increase in market share of circular products and services. The tipping point between both phases is set at 2.5% of the potential market share of circular products and services. This relates to Figure 9 (Section 2.4.2) in which the different steps of policy evaluation are shown. The formative phase emphasizes on the input, activities and achievements steps, while the monitoring of effects is part of the growth phase within the transition.

Since the CE is in the formative phase, (some) intended effects are not measurable yet. Thus, there is an additional focus on the monitoring of the transition process before the effects are being shown (Potting et al., 2018). Examples of transition indicators used to measure circularity of the Netherlands are for example, CE businesses, means spend on CE, knowledge sharing (networks), knowledge development, change of laws & regulation, attitude of citizens and market formation (PBL, 2020b). Additionally, what regional governments do to enhance the transition, is also seen as important information for monitoring the transition. Considering the achievements out of policy actions, PBL, provides a Table (Table 3) with suggested indicators for transition dynamics. The focus is

not on the macro level but merely on the level of specific product groups. However, the indicators are generic and apply to all transition agenda and might just be applicable to the regional level as well.

TABLE 3 SUGGESTED INDICATORS FOR POLICYMAKING (POTTING ET AL., 2018)

Suggested indicators for transition dynamics monitoring for circularity initiatives in all priority themes (generic indicators)

	Capacity (able to)	Permission (allowed to)	Motivation (want to)
	All the indicators below are measured in three sub-classes (see Figure 2.2 for an explanation of the R numbers): R0–R2: Smarter product use and manufacture R3–R7: Extend lifespan of product and its parts R8–R9: Useful application of materials		
Means (input)	For increasing circular knowledge and expertise, e.g.: - Number of circular economy researchers (in FTE) - Investment in research (in euros) - Circular courses	For developing circular regulations and change 'linear' regulations, e.g.: - Number of circular policy advisers (in FTE) - Number of circular advisers in branch organisations (in FTE)	For developing circular visions and transition agendas, e.g.: - Number of people actively working on this (in FTE)
Activities (throughput)	Related to knowledge and expertise, e.g.: - Number of circular innovation projects - Share of circular projects in total number of innovation projects - Number of network meetings for circular projects	Related to developing circular and changing 'linear' regulations, e.g.: - Policy process for new circular laws and regulations - Negotiations for circular standards	Related to increasing motivation for the circular economy, e.g.: - Number of vision-forming meetings - Number of awareness campaigns - Description of awareness campaigns - Development of new laws and regulations that discourage linear practices (e.g. resource tax, public circular procurement, resource passport)
Achievements (output)	Knowledge- and expertise-related activities, e.g.: - Number of publications - Number of patents (technology, product design) - Number of new revenue models - Number of new circular products - Share of circular products in total number of products - Number of circular start-ups	New and changed regulations that permit circular initiatives, e.g.: - Number of legal and regulatory barriers to the circular economy removed - Description of new standards and regulations	Results of activities that increase motivation for circular economy, e.g.: - Number and description of vision documents - Number of circular economy media reports - Consumer perception of circular economy - Market volume of public circular procurement - Number and description of new laws and regulations that discourage linear practices (e.g. resource tax, public circular procurement, resource passport)
Core achievements (core output)	Circularity strategies (see Fig. 2.2; realisation of first and third strategic objectives) & Substitution (first and third strategic objectives)		

Additionally, Metabolic carried out a measurement framework to track the circular progress of the Metropole Region Amsterdam. In their monitoring framework they included a first selection of possible transition indicators that could be used to help evaluate their CE approach. Indicators included the number of new rules that discourage linear practices, disinvestments in the circular economy, etc. (Metabolic, 2018). However, transition indicators are not researched in much detail yet (Potting et al., 2018).

Regarding transition indicators, PBL recommends determining in which of three main categories within the circularity ladder (Figure 1) the indicators for the transition process (the means, activities and achievements) focus (Potting et al., 2018). As explained in Section 2.1.1, the three main categories are smarter product use and manufacture (R0-R2), extended lifespan of product and its parts (R3-R4) and useful application of materials (R5-R6). Additionally, they suggest going one step further and assign indicators to individual R-strategies, although this might be one step too far. Linking the indicators to

the main categories or R-strategies provides insight in whether activities are focused on lower ranked strategies such as recycling (R5) or higher strategies such as re-use (R3).

2.4.4 EFFECT INDICATORS

Although transition indicators can provide insights in the creation of necessary conditions and achievement from policy action by regional governments, eventually the intended goal is to measure the effects of the effort of (regional) governments on the material flows in the region. Avdiushchenko & Zajac (2019) explore possible indicators for the monitoring of the CE on a regional level based on specific dimensions of the CE transition. One example is municipal waste generated by an inhabitant of the region as an indicator to monitor the zero-waste economy. Additionally, potting et al. (2018) provides an overview of monitoring frameworks of the circular economy, including the monitoring system of the European Commission. These frameworks cover the transition progress and its effects and are seen as relevant for policy (see Table 4).

TABLE 4 Overview of policy-relevant indicator sets for measuring progress in the transition to a circular economy (Potting et al., 2018)

Source	Description	Types of indicators addressed					
		Transition process		Effects			
		R8 and R9 recycling and recovery	Ro-R7	Transition dynamics	Resources	Environmental pressure	Socio-economic development
Circular economy							
EC (2017 ³)	Proposed EU monitoring system with 10 core indicators	X	X	X	X		X
Magnier et al. (2017)	French monitoring system with 10 core indicators		X	X	X		X
EEA (2016 ⁵)	Explorative study on required indicators for circular economy monitoring in the EU		X	X	X		
EASAC (2016)	Explorative study on available indicators for circular economy monitoring	X			X		
Potting et al. (2016)	Explorative study on required indicators for circular economy monitoring in the Netherlands	X	X	X	X	X	X
CBS (2016)	Quantification of several indicators for which data is available	X	X		X		
EMF (2015)	Description of a material circularity indicator				X		
Circular economy toolkit (2013)	Online tool for identifying product improvement options	X	X		X	X	

Two important aspects to consider are data availability and applicability to the regional level. Avdiushchenko et al. (2019) emphasizes that not every monitoring framework on the national level is applicable to the regional level. Therefore, they qualitatively test each set of indicators on their relevance for the regional level, making a distinction between not relevant, partly relevant and highly relevant. Virtanen, Manskinen, Uusitalo, Syväne, and Cura (2019) also acknowledge the lack of indicators on a regional level. Because of this, their study focuses on the development of a tool to evaluate circularity based on waste material flows at a regional level. Reliable data on waste flows of the investigated however, proved to be a difficulty. This relates to Paiho et al. (2020) statement mentioned in Section 1.2, explaining that the relevance of indicators from the national to the regional

level depends on the focussed scale of the indicator as well as the consideration of data availability issues on the regional level. Thus, in order to improve the quality of CE- evaluation, the appropriate indicators need to be identified at the regional level and enough data needs to be available. Because of the CE definition adopted in this study, this means indicators that are related to the material flows are considered, while indicator based on other pillars, such as energy or biodiversity are not included. Within this Chapter multiple monitoring systems that could potentially be applicable for the evaluation of policy instruments on the regional level have been mentioned and are considered.

2.5 CONCEPTUAL MODEL

Figure 11 provides an overview of the relationship between regional governments, CE strategy, policy instruments, indicators and the circular economy concept. The Figure shows how regional governments can have a CE approach that leads to a set of tools (policy instrument) to intervene in the current linear economic system. These policy instruments can either be part of separate projects within departments of a governmental organisation or part of a robust CE strategy covering the whole organisation. This thesis focusses on the evaluation of policies, thus the link between the deployed policies and the effect it intends to accomplish to help the transition to a circular economy. In order to do this, knowledge on how these policies are currently evaluated as well as finding indicators that are suitable for circular policy evaluation are needed to be able to show the effect of circular policies.

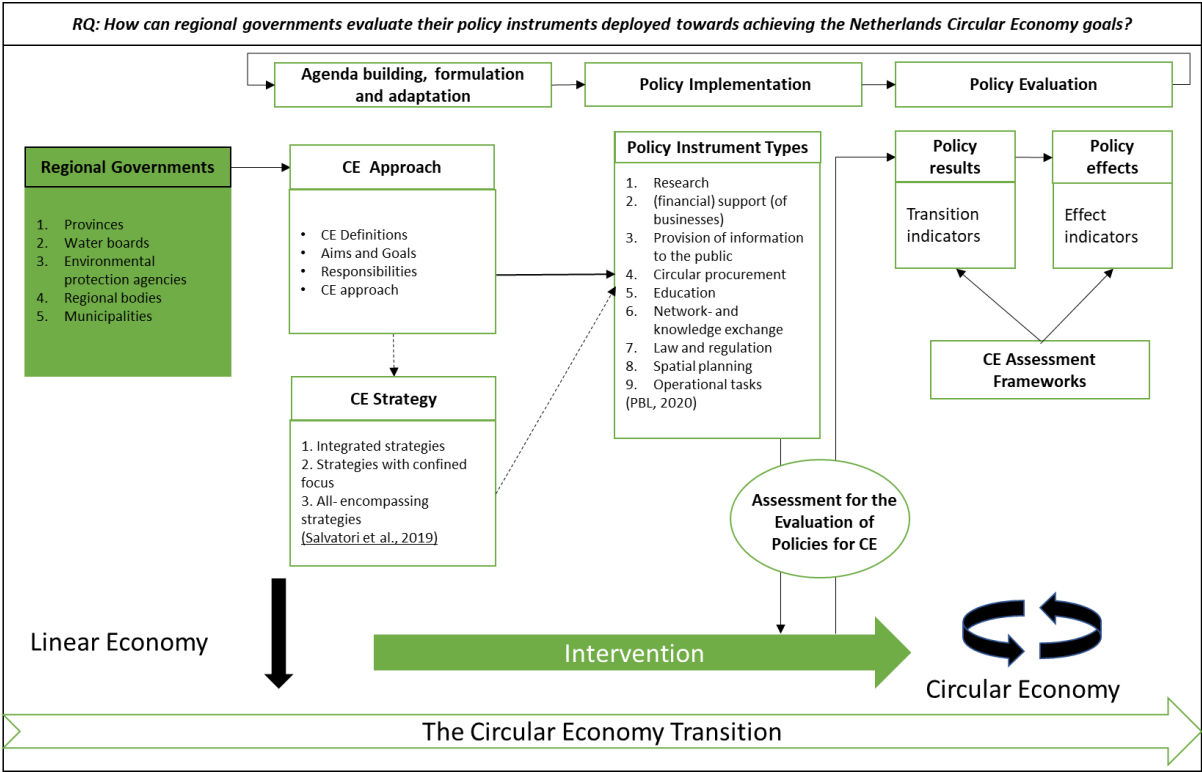


FIGURE 11 Conceptual Framework (Own Authorship)

3. METHOD

In this Chapter the methods used in this study are discussed. Section 3.1 provides an overview of the research design. Section 3.2 elaborates on the data collection and analysis of the first phase of this study and 3.3 elaborates the data collection and data analysis of the second phase.

3.1 RESEARCH DESIGN

This aim of this study was to explore the evaluation of circular policies deployed by regional governments in the Netherlands. The decision was made to divide this study into two phases since different methods were needed to provide an answer to both sub-questions (Section 1.3). Figure 12 gives an overview of the different phases of the research linked to the different methods used in this thesis. Phase one entailed semi-structured interviews of nine policy makers on the regional level that are involved in circular policymaking. This was done to gather insights in the current evaluation process of regional CE policies needed for answering the first sub-question. Additionally, it emphasized the link between the scientific approach of the CE concept and the more practical approach of the CE in governmental organizations. Phase two entailed an indicator assessment in which indicators from different existing frameworks as well as additional indicators and assessment frameworks proposed by the interviewees, were assessed. The goal of this phase was to find indicators that could be used to evaluate circular policies at the Dutch regional level.

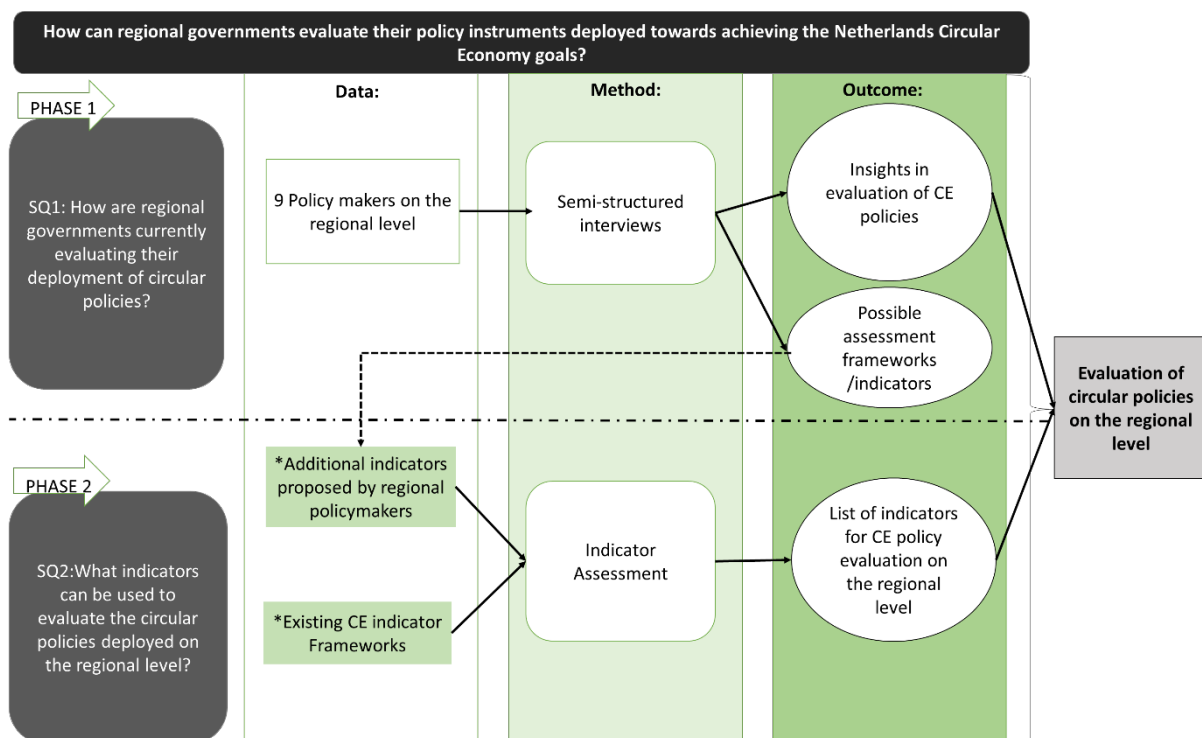


FIGURE 12 RESEARCH FRAMEWORK INCLUDING THE DIFFERENT PHASES OF THE RESEARCH, DATA NEEDED, METHODS USED AND EXPECTED OUTCOMES OF EACH SUB-QUESTION AND OVERALL OUTCOME OF THIS RESEARCH

3.2 PHASE 1: SEMI-STRUCTURED INTERVIEWS

The semi-structured interviews were executed to gain insights on the evaluation of the deployment of CE policy instruments. Semi-structured interviews were chosen since they are especially suited for the exploration of opinions and perception of respondents regarding complex topics (such as the circular economy) (Barriball & While, 1994). They allow the interviewer to improvise additional questions based on the response of the interviewee (Kallio, Pietilä, Johnson, & Kangasniemi, 2016). Furthermore, they leave space for the interviewee to formulate an answer while the interview can still be guided towards the intended topic when necessary.

3.2.1 SAMPLING INTERVIEWS

The non-probability sampling technique; generic purposive sampling (expert sampling) was used to gather different policymakers of five main types of regional governments in the Netherlands, involved in circular policymaking. The aim of this sample method was to strategically pick policymakers with expertise on regional CE policies (Bryman, 2012). The sample criteria can be found in Box 1. Since the intended purpose of the interviews was to gain knowledge on how regional government evaluate their CE policies and provide input for possible indicators, regional government with experience in enhancing the circular economy were picked. The internal database of regional CE activities from PBL and RHDHV, created for their study mentioned in Section 2.3.3 and Figure 8 in particular. Since it contained outliers, the median was used ($n=18$ activities). Thus, regional governments with at least 18 circular activities were preferred.

Box1: Sample criteria Interviewees:

- Should have a policy function within a regional government
- Regional government should have at least 18+ circular activities from 2015 onwards
- Should have experience in CE related policies
- If possible, should be a program manager or senior policymaker within the circular economy program
- Should be available during the time period of this thesis.

In order to determine the sample distribution, a comparison was made with PBL's study on CE activities of regional governments (PBL, 2020a). PBL's distribution was mirrored. More interviews often improve the quality of the research (Rudestam & Newton, 2012). However, after nine interviews a point of data saturation was reached and data collection was stopped leading to 1 regional body, 1 EPA, 2 water authorities, 3 provinces and 3 municipalities. The list of interviewees can be found in Appendix 1. The interviewees were approached by email and the interviews were done using either skype or Microsoft teams (due to COVID-19 restriction), taking approximately one hour. An interview guide was used to ensure the quality of the interview, which can be found in Appendix 2. This interview guide was validated by expert judgement of one employee of RHDHV and one employee of VNG (Association of Dutch Municipalities) with experience in regional governmental policies and CE.

Furthermore, a trial interview with a policymaker on the regional level was conducted. This step was taken since it is important to conform the relevance of the questions and to see whether possible questions need to be reformulated (Kallio, Pietilä, Johnson & Kangasniemi, 2016,). Informed consent forms had to be signed to ensure the interviewees consent and can be found in Appendix 3.

3.2.2 ANALYSIS OF SEMI-STRUCTURED INTERVIEWS

After the interviews were conducted, they were transcribed and thematically analysed. In order to guarantee anonymity, the transcripts are not included in this thesis but can be accessed upon request. For the coding of the interviews the software NVivo was used. Open coding was used to classify the concepts mentioned by the respondents and to identify new indicators for evaluation policies that had not been found in literature. Axial coding was used to see if concepts could be grouped together. When this was indeed the case, they were grouped together. Finally, selective coding was used to determine the main concepts. The coding process was not always chronological but depended on the data retrieved.

3.3 PHASE 2: INDICATOR ASSESSMENT

The main aim of this phase was to find indicators that could be used to evaluate circular policies at the Dutch regional level. This was done by the collection of existing CE assessment frameworks. Figure 13 reveals the intended, scope, type, characteristics, and sources for the indicators. The scope was determined by the research question, focussing on the evaluation of policies at the regional level. Each of the characteristics are explained in more detail in Sections 3.3.1 and 3.3.2.

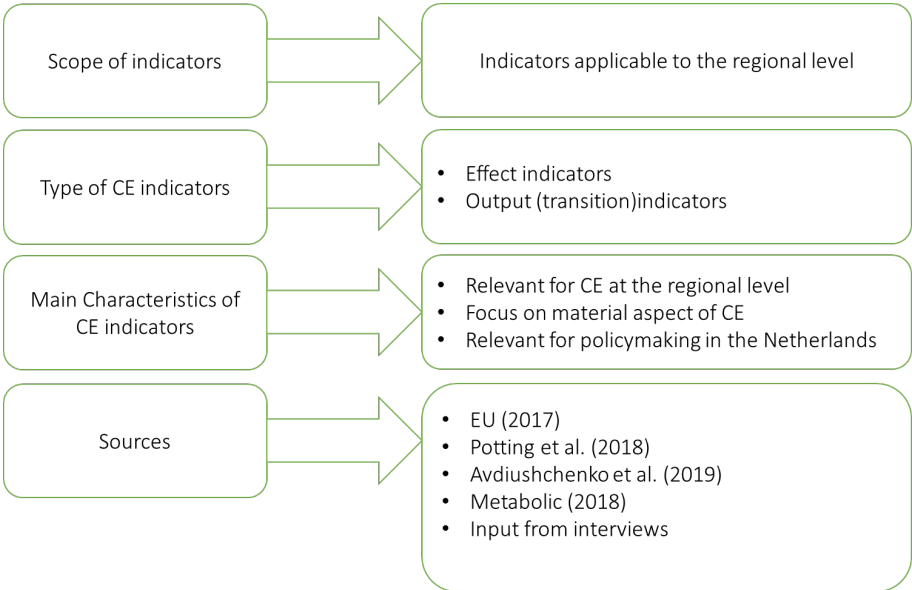


FIGURE 13 ALTERED CONCEPT OF CE INDICATORS DESIGN BY (AVDIUSHCHENKO & ZAJĄC, 2019.) (OWN AUTHORSHIP)

3.3.1 DATA COLLECTION OF ASSESSMENT FRAMEWORKS

Several generic and specific sets of circular economy assessment frameworks currently exist or are being developed (see Chapter 2). Because of this, this study focused on existing frameworks instead of developing new ones. Although all existing assessment frameworks address some aspects of the CE, not all aspects are relevant for this thesis. Thus, the criteria in Box 2 were used as a guideline for the sampling of the documents containing assessment frameworks. This decision to only include frameworks from 2017 onwards, was made since most of the 2017 frameworks already included indicators from frameworks that were developed prior to 2017, leading to an extensive overlap of indicators. The macrolevel criterium was needed to exclude frameworks with indicators that were not applicable to the regional level of this study (see Section 2.1.2). The European scope was mentioned as a criterion because of the varying scope of the CE concept within other geographical areas/ political systems, such as China (see Section 2.1.1). The theoretical foundation (Chapter 2) was used as the starting point for the collection of frameworks, since it already mentioned existing assessment frameworks within the scope. Most of the existing frameworks referred to other frameworks as input. These referred frameworks were considered as well, but this snowballing method did eventually not let to new frameworks added because they did not meet the sample criteria.

Box 2: Sample criteria assessment frameworks:

- Assessment frameworks from 2017 onwards
- Macrolevel/regional level
- European scope

3.3.2 ANALYSIS OF CE INDICATORS

After the selection process, each indicator within the assessment framework was analysed separately and either included or rejected based on the following criteria shown in Table 5. These criteria followed from the theoretical foundation (Chapter 2).

TABLE 5 CRITERIA TO BE MET

Criterion	Explanation
Relevant to the regional level	Fitting to the boundaries of the regional level.
Linked to the Material aspect of the CE	Not including energy related indicators and socio-economic indicators
Focus on effect indicators and output activity indicators	Not including input indicators such as amount of FTE's or money used in stimulating the circular economy.
Relevant for policy making in the Netherlands	Linked to one of the eight types of policy instruments used by regional governments or operational tasks (See Figure 7)

The origin of the first criterion, relevance to the regional level, comes from Chapter 1 in which the irrelevance of certain indicators due to the scope of the indicator is mentioned. An example is the

EU self-sufficiency for raw materials indicator which is defined as 1-(net) Import reliance and measures the independence of the EU for raw materials. Although being one of the key circular economy indicators for the EU, it is less relevant for the regional level since it is not necessary/expected for a region within the Netherlands to be self-sufficient in terms of raw materials. The second criterion, focussing on the material aspect of the CE follows from the narrow definition, focused on materials flows, that is applied in this thesis in Section 2.1.1.

The third criterion, focus on effect and output indicators, is derived from PBL's taxonomy of transition and effect indicators (Table 3 Section 2.4.3). Table 6 provides an overview of the different types of indicators by PBL. Since this study focusses on the evaluation of the effects of policies, effect indicators are considered. Because of the definition of CE applied in this study, exclusively effect indicators related to materials and resources are included. Because of the beginning phase of the circular economy, output indicators (and when specifically mentioned by the interviewees, throughput indicators) are also considered.

TABLE 6 OVERVIEW OF TYPES OF INDICATORS INCLUDED IN ASSESSMENT (LAY-OUT FROM TABLE 3)

Type of indicator	Sub-type	Indicators	Unit
Transition indicators:	Means (Input)	Effort	FTE
		Investments	€
	Activities (throughput)	E.g. number of circular innovation projects, share of circular projects in total projects.	Nr. %. Nr.
	Achievements (output)	Results of policy	To be determined
Effect Indicators	Resources	Effects of policy	To be determined
	Environmental Pressure	Effects of policy	x
	Socio-economic development	Effects of policy	x

After passing the criteria, the picked indicators were matched with the wide range of policy instruments proposed by PBL consisting of: Research, (financial) support of businesses, circular procurement, provision of information, education, network & information exchange, laws and regulation, spatial planning and operational tasks (Figure 7, Appendix 1). This was the fourth criterion, but not a hard criterion, since indicators that could not be matched to one policy instrument but were

still relevant for determining the progress of a CE-strategy were separately included as circular flow indicators. Some types of instruments, for example provision of information, do not directly impact the material aspect of the Circular economy. However, the line of reasoning here is that all deployment of instruments in which the material aspect of the circular economy is placed at the centre, is necessary to eventually help enhance the transition and should be included in the evaluation. Thus, network meetings revolving around e.g. the topic of CE in general or circular building, are to be evaluated whereas network meetings around the topic of the energy transition are not within the scope.

Afterwards, indicators were matched with the R-Ladder of circularity by Strategies Rood & Kishna (2019) which can be found in Figure 1, Section 2.1.1. This was done to see if indicators could be linked to a specific strategy aimed at material reduction: Smarter product use and manufacture (R0-R2), extended lifespan of product and its parts (R3-R4) and useful application of materials (R5-R6). In the case two or multiple closely related indicators were found, they were as much as possible adjusted to become one indicator. This was done to prevent too much overlap between the indicators, leading to confusion and unnecessary complexity. The final list of indicators was discussed with three of the interviewees. Figure 15 gives an overview of what phase two of the research looks like. Note that data availability was mentioned in the theoretical foundation (Section 2.4.4) as an important aspect for regional indicators. However, the decision was made to not take data availability into account beforehand since it might potentially exclude too many indicators. Data availability will be discussed while interpreting the results in Chapter 4.

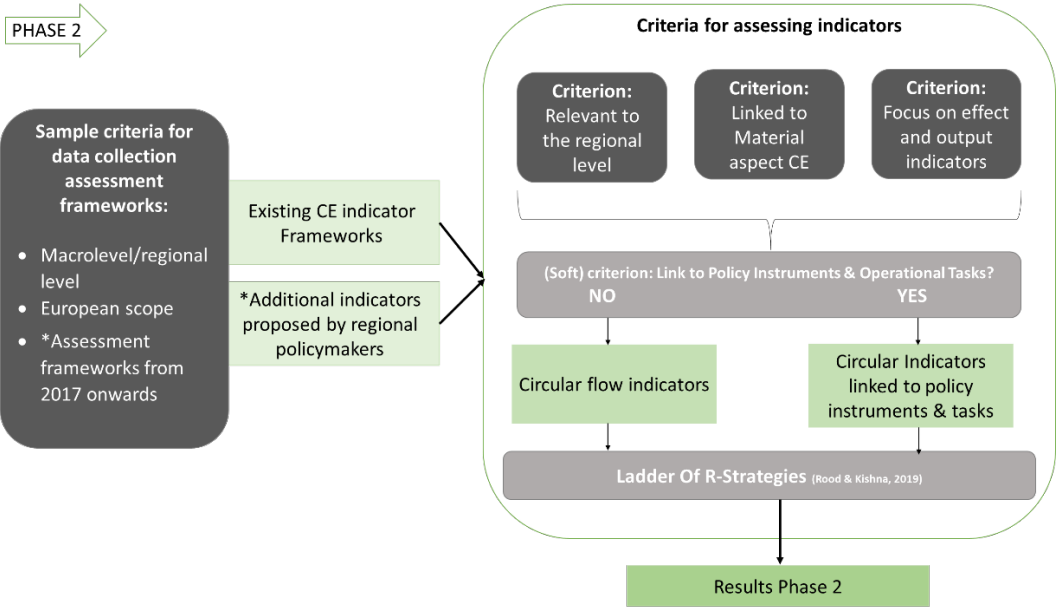


FIGURE 14 DETAILED DESCRIPTION OF INDICATOR ASSESSMENT (OWN AUTHORSHIP) *THE CRITERION: FRAMEWORKS FROM 2017 ONWARDS WERE SOLELY APPLIED TO THE EXISTING CE INDICATOR FRAMEWORKS AND WERE NOT AN CRITERION FOR THE ASSESSMENT FRAMEWORKS PROPOSED BY INTERVIEWEES. THIS WAS DONE TO AVOID TO MANY RESTRICTIONS FOR THE INTERVIEWEES

4. Results and Discussion

This Chapter presents the outcome of the study. Since the results obtained need interpretation the decision was made to have the results and discussion in one Chapter. As explained in Chapter 3, two different methods were used. Section 4.1 describes the outcomes of the interviews and simultaneously interprets the results. At the end of the Section a final reflection including the methodological limitations is presented. In Section 4.3, the same is done for the indicator assessment, which is the second phase of the research. Finally, in Section 4.4 the study as a whole is reflected on and recommendations that follow from this reflection are elaborated on.

4.1 RESULTS AND DISCUSSION PHASE ONE: INTERVIEWS

4.1.1 SELECTED INTERVIEWS

The aim of the expert interviews was to gain insight in how regional policymakers evaluate the deployment of policy instruments used to enhance the circular economy. An additional aim was to examine ideas about assessment tools to incorporate in phase two of the research. For the interviewing part of the research, nine interviews were carried out (see Table 7). All but one included the term circular economy in their function description. The function descriptions differed slightly between circular economy program manager, circular economy developer etc. The years of experience in the field of circular economy policy among the sample varied from 1 till a maximum of 5 years. This shows that the policy field is quite new and begins around 2016 when the transition agendas were published (see Section 1.1). The place of the CE program within the governmental organisation varied and was often part of either the waste management program, sustainability program, economy program or a program in itself. During the conduction of the interviews an unexpected finding occurred. Most of the interviewees commented on the CE policy making process instead of the evaluation of these policies. This was because the interviews showed that the regional governments, despite being frontrunners when it comes to the circular economy transition, do not seem to focus much on policy evaluation yet. This will be explained in more detail in Section 4.1.5 Therefore, more was to be said about the policymaking and implementation of circular policies and perceived barriers within the policy process.

TABLE 7 LIST OF INTERVIEWS EXCLUDING THE TRIAL INTERVIEWS

Interview Nr.	Date	Function	Regional Government
2.	03-08-2020	Program manager Circular economy	Water Authority
3.	03-08-2020	Circular economy Developer	Municipality
4.	11-08-2020	Innovation and circular economy coordinator	Province
5.	12-08-2020	Policy officer environment and waste management	Municipality
6.	13-08-2020	Policy officer (frontrunner: circular economy)	Water Authority
7.	14-08-2020	Program Manager Circular economy	Regional Body
8.	14-08-2020	Program leader circular economy	Province
9.	26-08-2020	Policy officer, strategic advisor sustainability	Municipality
10.	27-08-2020	Advisor circular economy and sustainability	Environmental Protection Agency

4.1.2 POLICYMAKING: DEFINITIONS AND TARGETS ON THE REGIONAL LEVEL

First, all nine interviewees were questioned on how their respective regional government defines the circular economy. Varying definitions were mentioned. All definitions mentioned included a material component (see Table 7). For example, when asked about the definition of their regional government: interviewee three mentioned, *“It [the circular economy] is about preventing waste, creating value throughout the chain, using fewer primary materials and scarce materials”* (Interview 3, 3rd of August, 2020). This definition includes minimization of material input, the keeping of materials in the chain and the prevention of waste. Considering the material component, the keeping of materials in the loop, was most mentioned (see Table 8). Furthermore, two definitions included less primary material input and four waste management of materials.

TABLE 8 MATERIAL COMPONENT OF CIRCULAR ECONOMY DEFINITIONS USED BY REGIONAL GOVERNMENTS

Interview nr.	Less primary material input	Keeping materials in the loop (value keeping & creation)	Waste management of materials
Interview 2		x	x
Interview 3	x	x	x
Interview 4		x	
Interview 5			x
Interview 6		x	
Interview 7	x	x	
Interview 8		x	
Interview 9		x	
Interview 10			x

However, not all definitions were limited to the material aspect of the circular economy. Five policymakers mentioned broader definitions, such as: *“An economic system that takes the reusability of products and raw materials and the conservation of natural resources as the baseline. And strives to create value for people, nature and the economy in every link of the system. The ideally infinite*

circulation of raw material flows makes an economy circular". (Interview 9, personal communication, 26th of August 2020). These are definitions with a focus on the material aspect, but also closely related to the broader sustainability concept, including a social or/and an environmental component. The social component includes the creation of value for human life and the economy whereas the environmental component entails the effect of the economic system on the environment, thus keeping the economic system within the natural boundaries and a focus on value creation within nature. Table 9 shows that half of the regional governments include either a social or environmental component in their CE definitions, while the other half adopted definitions with a focus on solely material the material aspect.

TABLE 9 INCLUSION OF SOCIAL OR ENVIRONMENTAL COMPONENTS IN CE DEFINITIONS REGIONAL GOVERNMENTS

Interview nr.	Social component	Environmental component
Interview 2	x	
Interview 3		
Interview 4	x	
Interview 5		
Interview 6		x
Interview 7		x
Interview 8		
Interview 9	x	x
Interview 10		

Thus, some definitions are broader than others. Two respondents stated that their regional government had a (too) narrow scope in which circular economy is mainly interpreted as related to waste management: *"The [name of regional government] defines it {the circular economy} as a waste problem. So, how can we re-use our waste? I am now trying to get the [name of regional government] to realize that it is actually a raw materials problem or a raw materials challenge,"* (Interview 10, personal communication, 27th of August 2020). Another respondent stated: *"You can note that waste is a very leading theme. And I believe that that is alright considering the phase we are in. However, I think that when considering monitoring, one must look further and realise that at a given moment this phase has been reached and processing [municipal] waste in a sustainable way is common practice"* (Interview 5, personal communication 12th of August 2020). This relates to Vanhamaki et al. (2019), who stated that waste management is a key factor in several CE strategies.

Apart from defining what the circular economy entails, targets are important to determine whether progress is being made. Considering the existing national targets, all the interviewees stated that they were familiar with the 2030 and 2050 targets and all but one stated that the targets were

directly translated into the policy documents of their regional government (See Table 10). *“We simply focus on the national propositions and ambitions and we say that we want to contribute to that national ambition with this regional program. And that actually means for us on a regional scale that we want to achieve the same percentages.”* (Interview 7, personal communication, 14th of August 2020).

TABLE 10 TRANSLATION OF NATIONAL TARGETS IN REGIONAL CE POLICY

Interview nr.	Aware of national targets	Direct translation of targets in own policy	Stricter targets than national level targets	No direct translation
Interview 2	x	x		
Interview 3	x	x	x	
Interview 4	x			x
Interview 5	x	x		
Interview 6	x	x		
Interview 7	x	x		
Interview 8	x	x		
Interview 9	x	x		
Interview 10	x	x		

One interviewee stated that their government has more ambitious aims compared to the national targets. *“In some respects, our targets go a little further, but in general they are in line with national targets.”* (Interview 2, personal communication, 3rd of August 2020). On the other hand, five policymakers were sceptical of achieving the national targets. *“But when I see where we are now, I think we will not make it.”* (Interview 4, personal communication 11th of August 2020). One government had calculated whether they could achieve 50% reduction of raw materials in 2030 and stated: *“If we really start implementing all measures in full swing with all parties, we would be able to achieve about a quarter of that 50%”* (Interview 8, personal communication 14th of August, 2020). Adopting different definitions as well as interpreting the targets in different ways, can have implications on which indicators are used for the monitoring and evaluation as well.

Although most regional governments adopt the national targets in their policy, currently the targets are formulated in general terms. In December 2019, the PBL published a policy letter about the 2030 CE target (Kishna et al., 2019). It advises the national government to use tonnes as a measuring unit, provide a base year for the 50% reduction, choose whether or not the target includes fossil fuels, apply a chain approach and to apply both the production as well as the consumption perspective considering the use of raw materials. This particularization of the targets is currently missing but is needed to measure the achieved progress and enable required adjustments to steer the transition (Kishna et al., 2019). Furthermore, as stated in Section 2.2.1, despite the mentioning of the importance

of regional governments in the transition to a circular economy (IenW, 2016), it is unclear how the national targets should relate to the regional level. The lack of concreteness on the national level is mentioned by three as a barrier when it comes to defining the circular economy and providing targets that can be applied on the regional level. *“You see that the national policy is ‘too-loose’. You can see it with the deposit discussion as well. In the context of the circular economy, it should not be a discussion but simply introduced”* (Interview 5, personal communication, 12th of August 2020). This is closely related to the lack of sense of urgency that is mentioned as a barrier by three interviewees. *“With the circular economy it also [just like climate change] needs to sink in more, there needs to be more sense of urgency.”* (Interview 5, personal communication, 12th of August 2020). *“If we look at when we have to be circular. Well in 2050, it must be arranged. Then you do not have an obligation to act now.”* (Interview 9, personal communication, 26th of August 2020).

The formulation of the Dutch targets could be linked to the lack of a concrete definition for the circular economy that is uniformly adopted. This relates to the literature in that the CE concept is known to have a varying range of definitions. According to Kirchherr et al. (2017) a wide range of circular economy definitions are currently in use. *“It [the circular economy] means many different things to different people”* (Kirchherr et al., p.221, 2017). This was clarified in Section 2.1.1 which states that the CE concept has developed differently within political systems and explains that the Chinese depiction of the Circular economy is broad compared to the Europe’s interpretation that focusses on waste management and business opportunities. (Avdiushchenko & Zajac, 2019). The interviews show that the same can be said when comparing different regional governments within the Netherlands. One possible explanation of why the CE concepts develops differently within regional governments is that a leading definition on the Dutch national level is missing (Section 2.1.1). The lack of one uniform definition for regional governments that fits to the tasks and roles of (regional) governments and is applicable to different types of governments leaves room for a variety of different definitions to be adopted by regional governments. The main risk of this development is that a variety of different definitions could result in an impasse of the concept or eventually in the collapsing of the concept (Kirchherr et al., 2017).

4.1.3 POLICYMAKING: THE ROLE OF REGIONAL GOVERNMENTS

As described in Section 4.1.2, policymakers on the regional level are adopting the national targets in their policies. This raises the question what the role of regional governments entails and where the role of a regional government begins and ends regarding their contribution to these Dutch Circular economy targets. Up until now, in this study, the role of regional governments has been considered as stimulating or enhancing the circular economy (e.g. Section 1.4). However, policymakers involved in

circular policies on the regional level gave varying descriptions of the role of regional governments in the transition to a circular economy. One interviewee mentioned that its regional government is not sure yet of their role in the circular economy transition. *“We are actually still orientating a bit there. As you know, we have started work on a starting note [for the circular economy], which has yet to be determined.”* (Interview 5, personal communication, 12th of August 2020). However, the most common role is indeed the role of ‘boosting’, enhancing or stimulating, which is mentioned by six different interviewees. *“The role that you have as a government, including the strategies that I explained earlier [in the interview], they are all aimed at boosting the circular economy, to create the preconditions necessary to facilitate [the circular economy transition]”* (Interview 7, personal communication, 14th of August, 2020). Part of boosting of the circular economy is related to the creation of awareness, which is mentioned by four different interviewees. The creation of awareness can be aimed at society in general, at businesses and entrepreneurs or within the respective governmental organisation itself.

But there is more to be said considering the role of regional governments. Other regional governments go further than just boosting the circular economy. Interviewee 8 states that while the last couple of years its regional government focussed on creating awareness and informing business, a new phase begins in which businesses should not only be made aware of chances and opportunities but the regional government should also actively examine where breakthroughs are possible (Interview 8, personal communication, 14th of August 2020). *“We are going to co-invest, co-finance project, make selections and have conversations with businesses.” “Getting a hold on companies and see what we [the regional government] can do in those chains to create change.”* (Interview 8, personal communication, 14th of August 2020). Another interviewee also differentiated between facilitating the circular economy and taking a more active role when possible. *“Our role is more to enable the circular economy. To take an active role in the flows in which we can have an impact and in other cases it is more a facilitating role.”* (Interview 2, personal communication, 3rd of August 2020).

However, seven of the interviewees think that their role as a regional government does not go further than creating awareness within society and showing businesses the need to move towards more circular practices. *“As a government, you are not the one who creates jobs, or who credits economic activities. That belongs to businesses and entrepreneurs and you [the regional governments] are boosting.”* (Interview 7, personal communication, 14th of August 2020). Not every interviewee is comfortable by taking a more dominant role as a regional government, especially since there are no strict laws and regulations in place that would require this action, yet. *“We cannot force others to build in a circular way, compel businesses to, when procuring machines, do that in a circular way”* (Interview 4, personal communication, 11th of August 2020). This is a barrier mentioned by other interviewees as well. *“One of the obstacles is that you cannot impose anything, so the lack of possibilities for regulation”*

(Interview 9, personal communication, 26th of August 2020). Interviewee 4 provides a similar statement: *“Up until now you can only do it [enhancing the circular economy] on a voluntarily basis. This is less the case with your own procurement. If you are going to buy a circular carpet than you will exclude a lot of supplies in advance. ...”* However, we cannot oblige others to build circular viaduct.” (Interview 4, personal communication, 11th of August 2020). But even in the case of procuring your own goods in a circular manner as a regional government, you are bound to the laws and regulation at the national level, which have, in the case of the circular economy, a “low” standard. *“Often you are not allowed to ask companies, especially within circular construction. Then you would like to make a requirement of 20% use of biobased material, but that is not allowed at all. So, in that sense we are left empty-handed. Then you can only do it [helping the transition] by seducing.”* (Interview 9, personal communication, 26th of August 2020). Furthermore, secondary raw materials are often still treated as waste instead of raw materials *“You will notice that, [...], laws and regulation are not always facilitating but merely obstructing. This is the case for the “Einde Afval status” [...]”* (Interview 6, personal communication, 13th of August 2020).

Thus, laws and regulation are an important barrier. This aligns with literature. As mentioned in Section 2.2.2, the OECD performed a survey of 34 cities and regions on the status of the circular economy. The survey showed 13 barriers mentioned of including regulatory framework (2nd biggest obstacle) and incoherent regulation (6th biggest obstacle). The biggest obstacle mentioned was cultural barriers. This was also mentioned by Kirchherr et al. (2018). Cultural barriers entail the lack of consumer interest and awareness and a hesitant company culture. This is complementary to the lack of sense of urgency and participation based on voluntariness, stated as perceived barriers by the interviewees in Section 4.1.2.

Overall, most policymakers seem to take on the role of stimulating and creating awareness which relates to the removal of cultural barriers within society, the own governmental organisation and businesses. Furthermore, they take on the role of enabler to create the necessary preconditions of which the removal of regulatory barriers is an example. Since, this study did not initially focus on the policymaking itself, the literature foundation of this study lacks insights on the role of regional governments regarding the circular economy. However, other literature does provide insights in the different roles of governmental organisations. According to NSOB (*Nederlandse School voor Openbaar Bestuur*) and *Provincie Zuid-Holland*, governmental organisations (in the Netherlands) are shifting from previously placing the main operational task of the organization in the centre towards a challenge-oriented approach in which they steer and organise from a societal organisation’s perspective. Because of this, more focus is needed on what roles governmental organisations can adopt regarding specific challenges and tasks. According to NSOB four different governmental roles are to be distinguished in

a quadrant model: A performing, a rightful, a collaborative and a responsive government. It is not about picking one role, but about combining the roles in a clever way. A cultural shift is necessary in which the government consciously adopt roles to overcome a challenge but can also adjust the roles based on reflection (Provincie Zuid-Holland & NSOB, 2019). However, the roles mentioned by the interviewees are more in line with the ladder of government participation developed by Mees, Uittenroek, Hegger, and Driessen (2019). In their paper they investigate the role of regional governments regarding community initiatives for climate change adaptation in the Netherlands. The ladder distinguishes five different roles each indicating a degree of intervention: 1. Letting go, 2. Facilitating/enabling, 3. Stimulating, 4. Network steering, 5. Regulating. It seems that most regional governments included in this study focus on the middle degrees of intervention such as enabling and stimulating. However, their role might change depending on the progress of the circular economy transition.

4.1.4 POLICYMAKING: FROM APPROACH TO CE- STRATEGY

Although all regional governments included in this study, are involved in contributing to a circular economy, five governments do not have a CE strategy that is approved administratively. This is not to say that they do not have policy documents explaining their CE approach, but some governments are still working on forming a strategy whereas others are currently waiting for the CE strategy to be administratively accepted. The regional governments that already have a CE strategy, state that having an administratively accepted CE strategy helps them “getting things done” within the administrative government. Having targets and ambitions on the regional level that are acknowledged, stops the circular economy from being voluntary. *“Negatively put, having a strategy, takes away the noncommittal aspect”* (Interview 4, personal communication, 11th of August 2020). Moreover, it makes it easier to acquire financial support for projects.

In Section 2.2.2, three different types of CE strategies amongst regional governments were described. The strategies could either focus on steering the public opinion, focus on creating impact with the stakeholders within prioritized themes, or have an all-encompassing approach (a combination of the first two strategies) (Salvatori, Holstein, & Böhme, 2019). When asked during the interviews, most interviewees described their governments CE approach or CE strategy as either all-encompassing or having a focus on prioritized themes. Table 11 also shows how none of the interviewees mention strategy 1 as a description of their respective governments approach or strategy. Especially the steering of the public opinion is not much of a focus. This observation got confirmed multiple times during the interviews. When asked about why an interviewee picked strategy 3, which is a combination of 1 and 2 they stated: *“[It is] not so much aimed at the public opinion, but a program that fits with all*

the tasks that the province has in all policy fields". (Interview 8, personal communication, 14th of August 2020).

TABLE 11 CE-STRATEGY OF REGIONAL GOVERNMENTS

Interview	Strategy 1: Integrated strategy with a focus on steering the public opinion	Strategy 2: Strategy with a confined focus	Strategy 3: All-encompassing strategy with clear priorities (mix of strategy 1 and strategy 2)
Interview 2			
Interview 3			x
Interview 4			
Interview 5			x
Interview 6		x	
Interview 7			x
Interview 8		x	x
Interview 9			x
Interview 10		x	x

A focus on the inhabitants was only mentioned by 2 of the 10 interviewees. One interviewee mentioned the residents of the region in a general way: *"I think it [the CE approach] is all encompassing, it is not focused as a particular group of stakeholders, but we actually want to include both residents as well as business"* (Interview 5, personal communication, 12th of August, 2020). The other interviewee stated a focus on steering the public opinion related to the waste management task of their regional government. *"Yes, with raw materials policy, that is very publicly focussed. A lot of [saying] 'people don't throw away your textile and collect your waste'"* (Interview 9, personal communication, 26th of August 2020). But most regional governments aim their approach towards specific priorities helping businesses and companies (mentioned by 7 interviewees).

There are other ways to describe the approach, or attitude of regional governments. Three regional governments explain their approach as a 'practical' or 'learning by doing approach'. This is also supported by PBL's study of what regional governments do to enhance the circular economy (see 2.3.3). Over 1000 of circular activities have been detected in more than 60 regional governments, of which the majority do not have a circular CE strategy (PBL, 2020a). *"We are just going to start; we are not going to wait around until it is al crystalized. So, we are going to carry out four pilot projects, in which we will discover what the circular economy entails for our work."* (Interview 2, personal communication, 30rd of August 2020). This attitude of acting now, learning later could be stimulated by the nearing targets of 2030 and 2050. Although the 2030 target is up until now only explained in general terms, it is a challenging target to reduce 50% of the national raw material input within 10

years. However, this might negatively impact the effectiveness of their approach since, as mentioned in Section 2.3.3, the design and implementation of policies as part of a robust strategy is a contributing factor to the success of the CE transition (Walendowski, Roman, & Miedzinski, 2014).

On the other hand, some of the governments do mention an attitude that is not just pragmatically oriented. One interviewee explained their four-step approach: 1. Measuring possible impact, 2. Act on impactful themes, 3. Learn from the action and secure the acquired insights, 4. Learn and develop (Interview 2, personal communication, 3rd of August 2020). The first step of this approach contained a raw material analysis to see which sectors/themes and governmental practices would be most promising. Three of the regional governments have carried out such a raw material analysis. The ones that did, feel that it helps in explaining the necessity of proposed projects within the organisation and to determine focus. *“Yes, I just noticed from the fact that we have the atlas [raw material analysis] and that we have those four tiles [prioritized themes], that the focus that we have determined [with the raw material analysis], whatever you think of it, it helps to get things sharp”*. (Interview 8, personal communication, 14th of August 2020). *“At a certain point you have to make choices, for which raw materials do you go?”* (Interview 2, personal communication, 3rd of August 2020). Thus overall, two different approaches are to be distinguished: ‘learning by doing’ and ‘measuring what you want to know’ attitude. They are not mutually exclusive as CE approaches that have carried out a raw material analysis, might still fill additional knowledge gaps by doing pilot projects. Table 12 provides an overview of both attitudes.

TABLE 12 OVERVIEW OF CHARACTERISTICS OF THE ‘LEARNING BY DOING’ AND ‘MEASURING WHAT YOU WANT TO KNOW’ ATTITUDE (OWN AUTHORSHIP)

Attitude:	Learning By doing	Measuring What you want to Know
Main characteristic	Instead of waiting for strategies to be accepted on an administrative level, most knowledge is being gathered through executing (pilot) projects.	Raw material analysis is being placed at the centre of the CE approach or strategy. Focus on the areas in which more impact can be generated according to the RMA.
Strengths	Time efficient, possible to see effects early in the process.	The approach can effectively target the areas in which most impact can be created. Sometimes easier to acquire support for projects since the approach is validated by underlying research.
Weaknesses	Not all effort might be effective, more steering could be necessary throughout the process.	Time consuming, having research carried out cost’s money.

Finally, the making and implementation of circular economy approaches, and strategies requires financial funding, which is seen as an important barrier, mainly on the municipal level,

according to five interviewees. *“What you see is there are too few signals at the national level, that they embrace the [CE] policy in such a way that on the municipal level politicians will say; this is important and we are going to fully focus on this because we are being supported by the national. But now it is all plans, and the national government emphasizes its importance, but does not give us [municipalities] money.”* (Interview 5, personal communication, 12th of August 2020). This, lack of financial force aligns with OECDs survey in which financial resources were mentioned as the second most important barrier beside cultural barriers (Romano, 2018).

4.1.5 EVALUATION OF CIRCULAR POLICIES

As explained in Chapter 2, the evaluation of policies is closely related to monitoring the circular economy in general. In fact, monitoring can be used as a tool to evaluate CE strategies. Multiple scientific papers explain the importance of monitoring for steering policies, not just on the national level but also on lower regional levels to steer policies. Regions have an important role to play in the transition to a circular economy (RLi, 2015; ACR+, 2014). However, up until now PBL is still working on a monitoring system of the circular economy on a national level. This means that regional governments cannot align with indicators regarding the circular economy on a national level but must come up with their own way of evaluating circular policies. When the interviewees were asked whether the circular policies of their respective government were evaluated, seven of the interviewees stated that circular policies were not, or only limited evaluated. *“We do not do that [evaluating circular policies], to date”* (Interview 4, personal communication, 11th of August 2020). *“I think that [evaluating circular policies] rarely happens.”* (Interview 5, personal communication, 12th of August 2020).

Part of the reason that not much emphasize is being placed on the evaluation of circular policies, is because the circular economy is still in an early stage. This was already mentioned in Section 2.4.3 (Figure 9) which shows the two stages of societal transitions and explains how the circular economy is currently in the formative phase. This formative phase has also been emphasized by three interviewees. *“We are really still in the initial phase, in that pioneering phase of the transition, circular.”* (Utrecht, personal communication, 2020). *“A completely different economic system is really different from what we are talking about now. We are really at the beginning.”* (Interview 2, personal communication, 3rd of August 2020). For regional governments this means that the circular economy is a new policy field starting approximately from 2016 onwards. This also explains why five out of the nine regional governments do not have a confined CE strategy that is administratively accepted let alone having a monitoring or evaluation system in place.

Furthermore, an additional aspect linked to the beginning phase is the lack of unifying and concrete definitions and targets mentioned in Section 4.1.2. It is challenging to measure things that

are not clearly defined. *“In any case, because the circular economy is difficult to define and therefore difficult to measure. You have to start from the same set of indicators that are defined in the same way, whereby you also agree jointly on which sources you use and how you know, because it is complicated enough.”* (Interview 7, personal communication, 14th of August 2020). *“I think that if you have a national objective, then you should all work towards it and look at how can we achieve it, what is the objective and how can you make it operational, how can you measure it? And if you have that clear, we will [can] all contribute to getting it done.”* (Interview 8, personal communication, 14th of August 2020) Thus, it is useful to decide on one definition, not only for the making and deployment of CE strategies, but also for the evaluation aspect of policies.

Another reason has less to do with evaluation of CE policies specifically, but more with the evaluation of policies in general. Three interviewees state that within governmental organisations there is a lack of focus on reflection and evaluation. *“The focus is always on the beginning of the project, in order to set up the project and get it financed. It seems as if no one is interested in the eventual outcome, completion and effects.”* (Interview 8, personal communication, 14th of August 2020). *“I am critical of the self-learning capacity of civil service organizations because scaling up plans and making new plans is actually more attractive than saying, what have we actually achieved with the plan?”* (Interview 3, personal communication, 3rd of August 2020). This is also due to political reasons. *“Often with big policy, because it is always political, there are assumptions made. And sometimes those assumptions just aren't right and even when it is known at the front, one does not want to be confronted at the back with the fact that they have consciously made the wrong choice to push something through”* (Interview 5, personal communication, 12th of August 2020).

Despite not every regional government actively focussing on the evaluation of circular policies, when asked if the interviewees thought evaluation is important in the CE transition, most interviewees agreed. *“Yes of course. Because then you can always adjust your policy and [see] what works and what doesn't work.”* (Interview 9, personal communication, 2020). In fact, it is even required to evaluate projects: *“It is actually a requirement from the {...} council to evaluate policy and if something costs money, it should be legitimate.”* (Interview 9, personal communication, 26th of August 2020). But despite this, focus is lacking. *“You know there is always a bit of this half-evaluation, in the sense that it is said that we did not make it, but it is explainable because of this and this [arguments]”* (Interview 5, personal communication, 12th of August 2020).

In case the interviewees of the regional governments did pay attention at evaluation, it was often intertwined with the monitoring of the circular economy of the region in general. Three regional governments mention the raw material analysis of their regional government when talking about

monitoring. Having a reoccurring raw material analysis could provide insights in how the circular economy develops in the region. However, interviewees for the most part also look towards PBL and the development on their monitoring system that is still in progress. Five interviewees opt for a universal framework that can be applied to different regions. *“I am very much in favour of a national system. That every region simply adheres to {...}. I am against regional manufacturing.”* (Interview 8, personal communication, 14th of August 2020). However, they also mentioned how some parts of the monitoring system should be customized to the characteristics of the region. This connects to Section 2.2.2 which states that for the creation of a strong circular strategy it is important for regional governments to gain insights into the specific qualities of the region (RLi, 2014). Hence, it would be expected that the same applies for the evaluation strategy of the regional government.

Since there is no national monitoring system in place at the moment, regional governments that want to be active in evaluation and monitoring, have to find their own indicators. *“So, we are actually looking for which indicators you should use that you can monitor annually or of which you can certainly see in a few years from now that [name regional government] is heading in the right direction?”* (Interview 4, personal communication, 11th of August 2020). Most policymakers provided possible indicators and referred to public and internal documents that contain possible indicators/frameworks to help evaluate the deployment of policies. The raw material analysis, implied material flows as the basis for indicators for the CE transition and indicators related to material flows were mentioned by multiple interviewees as potential indicators. Other indicators that were not directly related to materials included innovation, employment rates, CO₂- emissions, the economy, amount of jobs. Two of the regional governments included in this study are already working towards their own monitor and or evaluation system. One other regional government is working on an evaluation system for circular procurement. The indicators from their systems as well as mentioned documents are considered in the second phase of this research. The documents that were eventually included can be found in Table 14 in Section 4.2.1.

Finally, some interviewees are critical about the amount and meaning of the indicators to be included in a monitoring/evaluation system, stating that it adds complexity. *“That’s what I learned after four years that circular is damn complicated {...} All kinds of indicators often make it even more complicated. Because people are not used to work with that, so they don’t know how to use those tools.”* (Interview 3, personal communication, 3rd of August 2020). One interviewee was in favour of not having too many indicators. *“So maybe not want to take the whole spectrum but choose four or five indicators and just start with that”* (Interview 8, personal communication, 14th of August 2020). Another interviewee put critical remarks on transition indicators, stating that one has to be careful of

putting too much focus on realising a number of projects instead of investigating the quality of the projects. *“I prefer to have some kind of analysis that shows in what ways we are actually excelling then if we are able to ask all 200 projects in a circular manner? Because in all 200 projects I can do something with circularity, but does that mean I am doing the right thing?”* (Interview 6, personal communication, 13th of August 2020).

4.1.6 FINAL REFLECTION PHASE ONE

Overall, the interviews were executed with the aim of answering the first sub-question: How do regional policymakers evaluate their deployment of policies to help contribute to the Dutch CE goals? Overall, there is not much focus on the evaluation of circular policies by regional governments. There seems to be a gap between theory and practice. It is quite evident that evaluation is an important part of policymaking, as stated in literature. However, in practice it is viewed as complex and is not much focussed on. Furthermore, the results emphasize how evaluation is not an independent step of policy but is highly intertwined with how the circular economy is defined and how targets are being interpreted.

As with every research, there are methodological limitation that need to be discussed. Semi-structured interviews are a qualitative research method. This means that the carrying out of the interviews are prone to a bias. Therefore, objectivity is one of the main constraints in carrying out semi-structured interviews. The questioner must be prudent to not (sub)consciously lead the answers of the respondent to a preferred direction of the questioner (Diefenbach, 2009). This limitation was minimized by testing the research question by doing a trial-interview and by limiting the speaking time of the questioner as much as possible to the asking of the question as formed in the interview guide.

Another main limitation is the representativeness of the sample. Although purposive sampling was applied, researches have been critical towards purposive sampling, stating that its subjects are usually not picked based on possible representativeness of the subject, but merely because of convenience (Diefenbach, 2009). This was somewhat the case. Due to COVID-19 restrictions and the vacation period it was difficult to find the preferred regional governments leading to the inclusion of one regional government with 17 counted activities instead of the preferred 18 and a regional government that was not included in PBL's study on the deployment of CE action by regional governments. However, Diefenbach (2009) states that a difference ought to be made between quantitative representativeness and qualitative representativeness. Quantitative representativeness is necessary in the case of generalising by statistical means, but within this study the outcome is to be generalised qualitatively, with an 'inductive' approach. Since, the sample size and distribution are still

close to the intended ‘representative’ size and distribution, the issue of representativeness is still considered but not seen as a major limitation. But eventually, research solely based on interviews might not be a sufficient research. As Diefenbach (p. 882, 2009) states: “*What people say or don’t say is only part of the picture. There is a definite need for further checking and additional information*”. Hence, this research is not solely based on interviews but includes the indicator assessment as well. Additionally, a connection has been made between both the outcome of the interviews and the indicator assessment with the insights gathered from the theoretical foundation (Chapter 2).

4.2 RESULTS AND DISCUSSION PHASE TWO: INDICATOR ASSESSMENT

4.2.1 SELECTED FRAMEWORKS AND INDICATORS

The aim of the indicator assessment was to investigate existing frameworks and to add additional elements mentioned by policymakers throughout the interviews, to compile indicators for the evaluation of circular policies by regional governments. The frameworks were derived from Chapter 2 and picked based on the characteristics mentioned in box 2 (Section 3.3.1). They entail macro level frameworks from 2017 with a European scope. Table 13 shows how the frameworks relate to the characteristics determined in Box 2.

TABLE 13 CHARACTERISTICS OF INCLUDED FRAMEWORKS

Author	Year	Characteristics				
		Macro level			Type of indicators	
		European Level	National level	Regional level	Effect indicators	Transition indicator
Potting et al. (2018) (PBL)	2018		x			x
European Commission (2017)	2017	x			x	x
Avdiiushchenko & Zajac (2019)	2019			x	x	x
Metabolic (2018)	2018			x	x	x

As can be noted from Table 13, two assessment frameworks were already specifically aimed at the regional level (Metabolic on the Metropole Region Amsterdam in the Netherlands (2018) and Avdiushchenko and Zajac on the Malopolska region in Poland (2019)). Furthermore, all frameworks included transition indicators and all except Potting et al. (2018) include effect indicators. Additionally, as mentioned in 4.1.6, the interviewees mentioned aspects they found relevant for the evaluation and monitoring and referred to documents containing possible indicators in the interviews. Not all documents were suited for this assessment since some documents did not include specific indicators or indicators that matched the pre-existing conditions. The eventual documents that included indicators that passed the criteria can be found in Table 14 below. All included documents are within the scope of regional governments. Duurzaam GWW (2018) is specifically focussed at circular

procurement of ground- road and water works. A short description of both the frameworks in Table 13 and the documents in Table 14 can be found in Appendix 4.

TABLE 14 DOCUMENT CONTAINING INDICATORS FROM THE INTERVIEWS

Author	Year	Title	Characteristics
Duurzaam GWW	2018	Teksten digitaal ambitieweb toelichting ambitieniveaus voor 12 thema's	Circular procurement indicators for (regional governments)
Waterboard X	2020	Uitwerking- Doelen - Inspanningen - Netwerk - Circulaire Economie	Regional indicators
Royal HaskoningDHV	2020	Routekaart CE [Name Municipality]	Regional KPI's
Circulaire Stad	2016	Indicatoren Set City Deal <i>Circulaire Stad</i>	Regional indicators
Municipality of Amstelveen	2019	<i>Plan voor de energietransitie, circulaire economie en klimaatadaptatie, Samenwerken aan een energieke stad voor onze kinderen</i>	Regional indicators

After passing the criteria mentioned above, the picked indicators were matched with the classification of eight different policy instrument types proposed by PBL which entail, research, (financial) support of businesses, circular procurement, provision of information, education, network & information exchange, laws and regulation, spatial planning and operational tasks. (see Section 2.3.2) Then, they were matched with the R-ladder of circular strategies determined by PBL and shown in Section 2.1.1. The R-ladder entails the six different R-strategies that contribute to the reduction of primary abiotic materials.

In total 37 indicators were found of which 24 were attributed to one of the eight types of policy instruments and seven to management tasks of regional governments. A list with the indicators and their characteristics can be found in Appendix 5. Six indicators were found that could not be traced back to policy instruments or management tasks but were addressing material flows in the region and could therefore be used for the evaluation of the CE approach or strategy as a whole. (Section 4.2.2). Of the 37 indicators, six indicators were linked to Smarter product use and manufacture strategy. Nine indicators were linked to Extended lifespan of products and its parts strategy and 22 indicators were linked to useful application of materials. An overview of the 37 indicators and their link to the main strategies can be found in Appendix 6.

For the indicators that could be linked to policy evaluation, it was found that certain indicators could not always be traced back to one type of policy instruments. This was because certain types of policy instruments are closely related towards each other such as provision of information and network

& information exchange which are both knowledge oriented, while others can be measured using the same indicators such as circular procurement and spatial domain. For example, a circular building as part of the area development and spatial domain or a circular building that is procured by a regional government do not need different indicators. Thus, some types of policy instruments have been merged. This will be explained for each of the concerned policy instruments in more detail in the Sections below.

4.2.2 CIRCULAR FLOW INDICATORS

As stated in Section 2.4.1, the evaluation of policies used to enhance the circular economy is part of the monitoring and evaluation of the transition to the circular economy. As mentioned by the interviewees as well as in literature (Section 2.2.2), several regional governments are working on, or have developed a CE strategy. The CE strategy is aimed to contribute to the national CE goals including achieving a circular economy in 2050. The indicators mentioned in Figure 15 cannot be used for the evaluation of specific types of instruments within a CE strategy but can indicate the effectiveness of the contribution of regional CE strategies and CE approaches as a whole, to help achieve a Dutch circular economy.

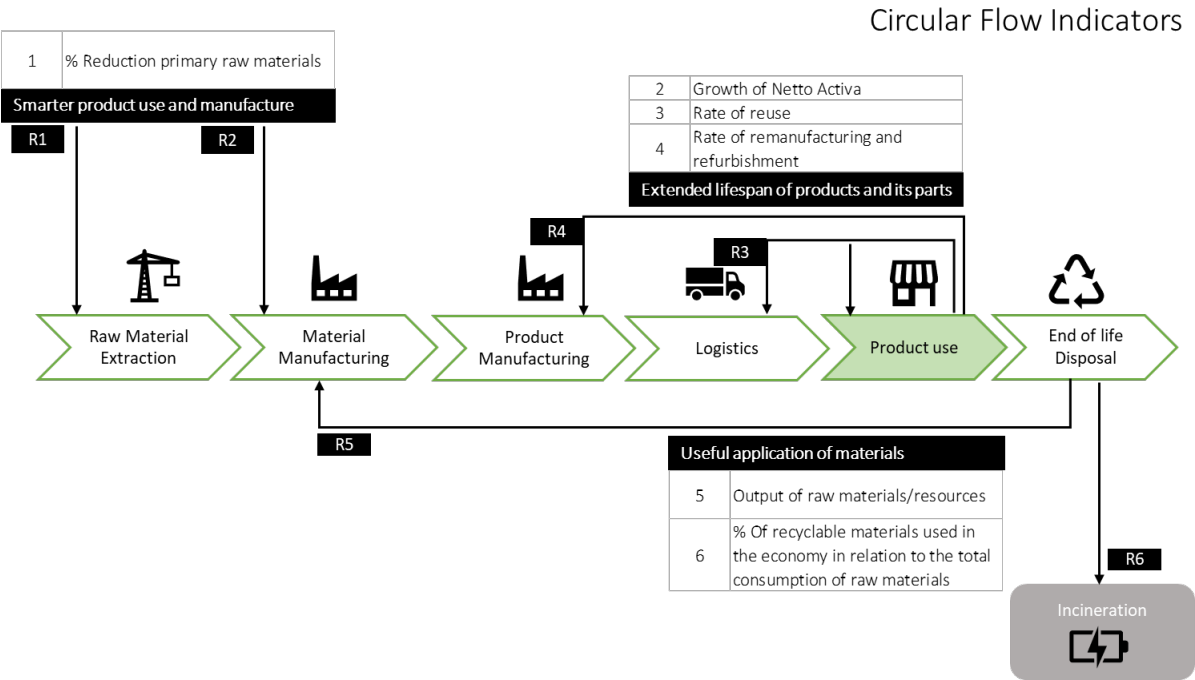


FIGURE 15 CIRCULAR FLOW INDICATORS

Figure 15 shows 6 indicators linked to the R-ladder of circular strategies and their relation to the main life cycles steps of products: Raw material extraction, material- and product manufacturing, logistics, product use and end of life disposal. The link of the indicators with the R-Ladder of circular strategies was made to see whether the indicators are more focussed towards e.g. recycling or the re-

use of products, because, as been stated in Section 2.1.1, the higher the strategy the more material reduction to be acquired. This suggests that the guiding indicator should be a percentage of raw material use with a target of 100% reduction or 0% virgin material use. Three assessment frameworks do mention the input of materials as an indicator to determine circularity. Thus, the first indicator is the percentage of primary raw material reduction which is in line with the national target in which 50% less raw material input is to be achieved by 2030.

However, the circular economy entails more than just the input of materials. It is the whole of materials, flowing into the economy, being used in the economy and flow out of the economy. Thus, PBL states that on the national level, more than one target is eventually needed which would logically relate to both inputs, use and output (Kishna et al., 2019). Regarding the use phase and the strategy of extending the life span of products and its parts, the growth of net assets indicates the amount of materials that are stored in products or buildings on a yearly basis. Additionally, the rate of reuse and rate of remanufacturing and refurbishment relate to R3 and R4 specifically and indicate the amount of materials that are being reused and or repaired. The indicators related to the output are the amount of materials that are disposed, and the percentage of recyclable materials used in the economy in relation to the total consumption of raw materials.

The main constrain of these indicators is the lack of data availability at the regional level. Although these indicators can be applied at the regional level this does not mean data is currently collected on the regional level as well. This got confirmed by multiple interviewees and literature. For example, studies on the input and output mainly focusses on the national level and regional data is missing. *“Those [circular] indicators are established partly through information from those [regional] companies that have to pass on data somewhere in the system. But how do you require that data? Through the companies themselves? But companies do not like when they have to provide data for PBL, for a municipality and for a province. They are not willing to do that.”* (Interview 4, personal communication, 11th of August 2020). Thus, data must be collected from a regional level, but companies are not always willing to comply. Still more regional level data is needed in order to show the circularity on the regional level.

Furthermore, seeing the seven indicators in Figure 16, raises the question how the indicators exactly relate to the circularity of the region? As stated in Section 2.1.1, this study adopted the circular economy definition of the European Commission:

“In a circular economy the value of products and materials is maintained for as long as possible; waste and resource use are minimised, and resources are kept within the economy when a product has

reached the end of its life, to be used again and again to create further value.” (European Commission, 2015).

This definition focuses on the material aspect of the circular economy and to what extent waste is minimised and resources are being kept within the economy, thus reducing the need for raw materials. The found indicators are all linked to this definition by targeting material flows. But in order to see whether regions are becoming more circular, baseline measurements are needed as well as an agreement on what the baseline year should be. Section 4.1.2 shows how the lack of concreteness in defining the circular economy and the setting of targets is a barrier for policymaking and evaluation. There are no indicators for the 100% circular economy in 2050 target in place and additionally a base year for the target of 50% reduction of raw materials by 2030 is still missing. Concrete target values for the indicators are needed as well as baseline years to determine whether progress has been made. However, although target values are essential for the relevance of these indicators, they should be tailor made within regional context, making the introduction of identical (sub-)targets for each regional government in the Netherlands undesirable. The economy of region A might be different than the economy of Region B. Furthermore, as stated in Section 2.2.2 moving towards a circular economy will have differing implications depending on the region. For regional governments, knowledge on how the economy of the region is structured and how this relates to the national economy might be needed to determine the right target values. Thus, these indicators can be applied to all regional governments, but the sub-targets to be set might differ depending on the characteristics of the region in which the regional government operates.

Furthermore, there are indicators that are not related to the flow of materials and are thus not included in Figure 16 but were still found to be relevant for the regional level because they provide information about the impacts or implications of adopting CE. These are the circular domestic product which entails the net added value of circular services and goods per capita and the productivity of resources which entails the GDP per unit of resources used by the regional economy. Finally, the employment rate was considered. It is not a circular indicator, and this not included in the framework, but it was mentioned in several documents as well as seen as important by multiple interviewees. *“We have said that one of the arguments why you should start with a circular economy is that it also contributes to the economy. So, is there more employment created through these actions?” (Interview 4, personal communication, 11th of August 2020).*

These were the indicators found that can help indicate the effectiveness of the regional CE approaches and CE strategies and its contribution to a help achieve a Dutch circular economy. The next

Sections (4.2.3 – 4.2.8) include indicators found that could help evaluate the effort of regional governments regarding specific policy instruments and operational tasks.

4.2.3 INDICATORS FOR CIRCULAR PROCUREMENT AND SPATIAL DOMAIN

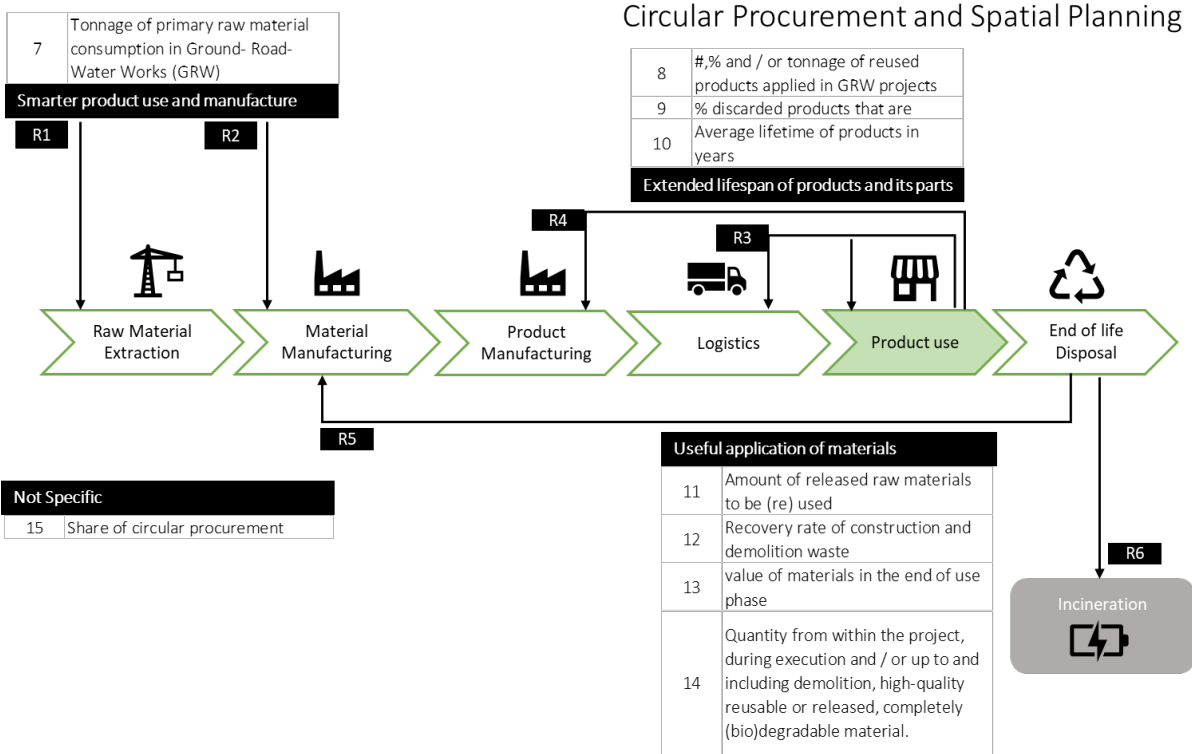


FIGURE 16 INDICATORS RELATED TO CIRCULAR PROCUREMENT OR SPATIAL DOMAIN

Figure 16 shows the indicators found that could be allocated to circular procurement in relation to the R-ladder of circular strategies. Circular procurement entails the purchase of ground, road and water constructions, buildings, energy, ICT equipment, facilities, other purchases and the supply of raw materials. However, during the interviews one policymaker critiqued the supply of raw materials as being part of circular procurement. The supply of raw materials to another party was interpreted as circular procurement for that party, but this is not circular procurement for the regional government itself. Thus, the decision was made to include indicators related to raw material extraction as part of management tasks instead of circular procurement (see Section 4.2.8).

Although circular procurement and spatial domain are two separate types of policy instruments, it was found that indicators related to circular procurement could often be applied to the spatial domain as well. This is because most indicators are about the amount of materials reduced or managed in a circular way, which is for example applicable to both governmental owned buildings (circular procurement) as well as the development of multiple buildings in neighbourhoods (spatial domain). As stated in Appendix 1, spatial domain is the organizing of public space and includes the

allocation of land, spatial planning/ area development, buildings, and the storage of raw materials. This got confirmed by multiple of the policymakers. However, despite the finding that circular procurement indicators can also be applied for spatial domain, additional indicators might be needed for example for the storage of materials, of which no indicator has been found.

In total nine indicators were found, of which eight could fit to one of the main three strategies: smarter product use and manufacture, extended lifespans of products and its parts and useful application of materials. Three indicators were focussed on recycling, two indicators were focused on the extended life span of products and its parts and one entailed the primary raw material input which can be linked to smarter product use and manufacture. It is striking that two of the indicators seem to be directed to GRW-works (Ground, Road and Water works) specifically, although these indicators can be generalized to circular procurement and spatial planning in general. No indicator was found that could be applied to the storage of raw materials as part of the spatial domain.

One indicator, the share of circular procurement projects was not specific enough to be allocated to a certain R-strategy. The share of circular procurement is actually described by PBL as a throughput indicator instead of output indicator (see Table 3, Section 2.4.3) which is out of the scope determined in Chapter 3, Section 3.3.2. However, it was found in five different documents and was also mentioned by multiple interviewees. This is because, as can be noted from Section 2.2.1 it is also a target included in the national raw material agreement. All governmental procurement must be circular in 2030. Some interviewees mentioned sub-targets of 10% share of circular procurement in 2022 (Interview 7, personal communication, 14th of August 2020 & Interview 2, personal communication 3rd of August 2020).

However, this raises the question what circular procurement entails. PIANOo is the Dutch Public Procurement Expertise centre who are professionals in procurement within governmental departments. They describe circular procurement as follows: *“Circular procurement enables the purchasing party to ensure that, at the end of its service life or useful life, products or materials will be re-used effectively in a new cycle. It is crucial that products and materials retain their value. It is important to avoid value destruction due to “downcycling” (e.g. processing A4 paper into toilet paper) wherever possible.”* (PIANOo, n-d). However, as stated in Section 2.1.1 and discussed in Section 4.1.2 the definition of the circular economy is interpreted differently by different parties and the same issue exist for circular procurement. This also applies to spatial planning. For example, in order to construct a new building, an environmental permit is needed that must be acquired through a regional governments (municipality). A mandatory aspect for the application of an environmental permit is the

MilieuPrestatie Gebouwen, or MPG (Environmental performance of Buildings). This calculates the environmental impact of the materials used in the building. The lower the MPG score, the less environmental impact and the more circular the building is. However, as has been stated by Interviewee 3, the MPG does not consider the disassembly of the materials in the building as part of the circularity. *Three quarters of the people in seminars talk about MPG, but that says very little, because if you put all products in a building and you glue them together, just like we have done so far {...} you are just creating future construction waste”* (Interview 3, personal communication, 3rd of August 2020). None of the indicators takes disassembly into account.

4.2.4 INDICATORS FOR THE PROVISION OF INFORMATION AND NETWORK & INFORMATION EXCHANGE

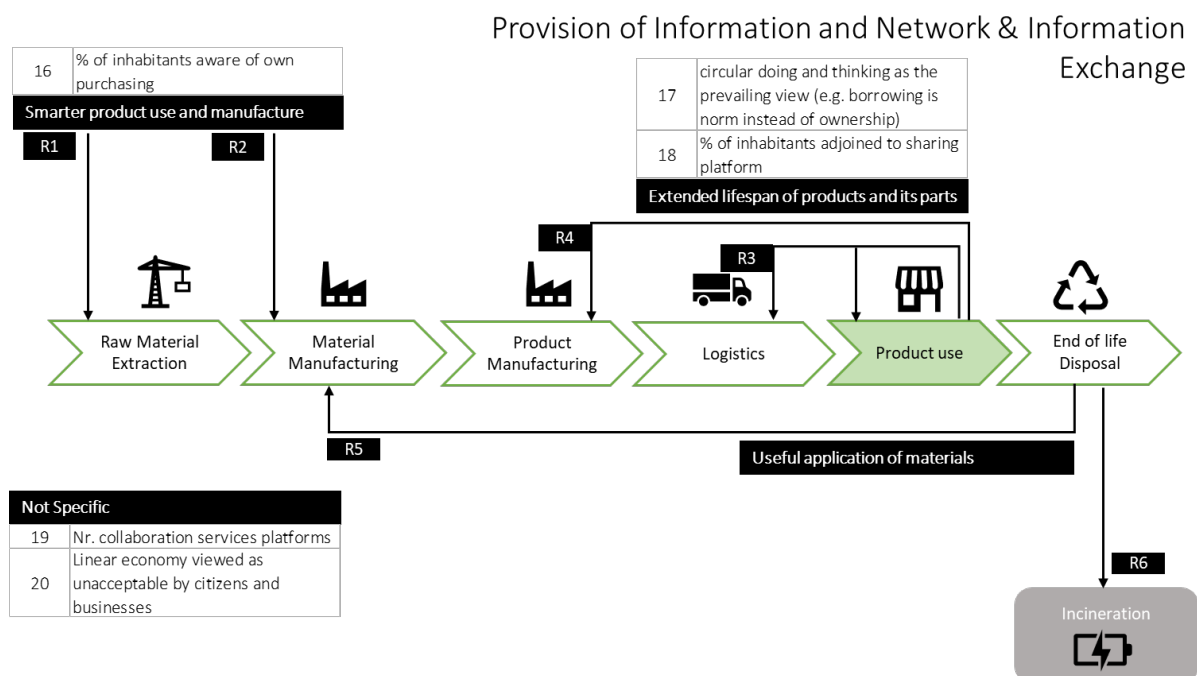


FIGURE 17 INDICATORS RELATED TO THE PROVISION OF INFORMATION AND NETWORK & INFORMATION EXCHANGE

Figure 17 shows the indicators found related to the provision of information and network & information exchange. Provision of information entails campaigns, expert centers, (news)letters or flyers, informative conversations and being a knowledge partner. In this case the focus is on providing information about the circular economy to the public and society in general. Network & information exchange is about the interaction of knowledge and the creation of circular networks often including businesses and entails (online) platforms, network meetings, seminars, congress, knowledge networks and lobbying. Although like procurement and spatial domain, these two are different types of policy instruments and the indicators found can be applied to both types of instruments.

None of the indicators directly link to the material aspect of the Circular economy. Two of the indicators were not specific enough to be linked to a certain strategy. For example, the number of

collaboration services platforms is interpreted as the exchange of knowledge through a platform. A possible improvement to this indicator would be to not just count the number of network meetings but also the number of participants, which could give more information on the participation of residents and businesses in exchanging knowledge and networking. Indicator 20, linear economy viewed as unacceptable by citizens and businesses, is aimed towards the circular economy in general instead of a specific strategy and thus also generally focussed. The indicators that could be linked to a certain strategy are indicator 16-18. For indicator 16, % of inhabitants aware of own purchasing, the assumption was made that more awareness about the own purchasing and the environmental impact linked to it, would result in inhabitants buying less products. Indicator 18 and 19 were linked to the extended lifespan of products and its parts because both link towards sharing platforms, which promote the reuse of products.

Overall, the indicators that were found are all transition indicators and do not include effects. One exception could be indicator 20, the amount of collaboration services platforms, which is interpreted as the exchange of knowledge through a platform but can also entail the exchange of used materials through a platform. In this case effect on material flows could be detected, but for knowledge platforms this is not the case. This was expected as the creation of networks (providing access to knowledge) is part of the formative phase, in which the conditions are created for the increase of circular products and services (Potting et al., 2018) (see Section 2.4.3). However, the exchange of knowledge as well as knowledge development are both seen as key processes for a successful innovation system (Prins & Rood, 2020) Thus, the sharing of knowledge is an important aspect of the transition to a circular economy, but it is challenging to allocate the exchange and provision of knowledge to specific effects such as a reduction in material flows. *“Since 2016, a lot of network meetings have also been organized to stimulate companies that worked with circular applications. {...} But I think the number of results, so companies that make products or buildings circular, is disappointing. So that's a side note, on those network meetings. There must be some sort of correlation. If you have nice network meetings, that it will also lead to upscaling in the transition.”* (Interview 2, personal communication, 3rd of August 2020). This also shows how network meetings, or the sharing of knowledge are not a goal in itself but serve other goals such as increasing the amount of companies that are involved in the circular economy, which is also part of the support of businesses (see Section 4.2.5).

4.2.5 INDICATORS FOR THE (FINANCIAL) SUPPORT OF BUSINESSES

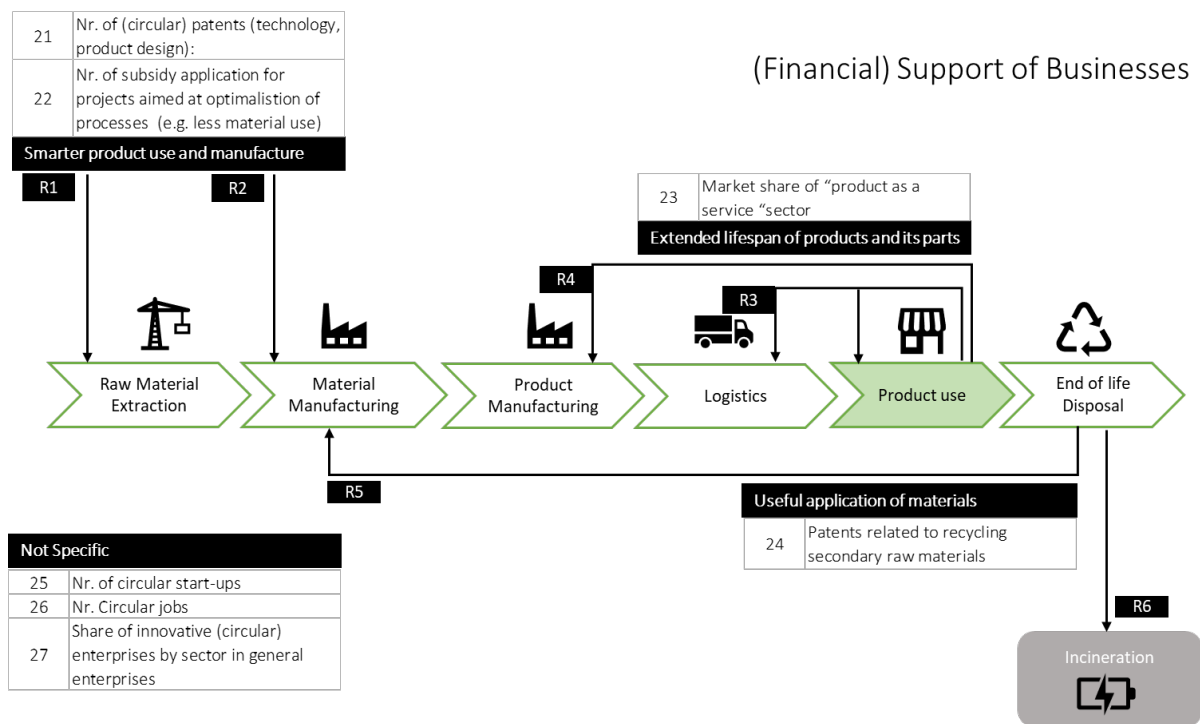


FIGURE 18 INDICATORS RELATED TO THE (FINANCIAL) SUPPORT OF BUSINESSES

Figure 18 provides the indicators that can be linked to the policy instrument type (financial) support of businesses. This entails several specific instruments (see Appendix 1) such as financial stimulation by giving subsidies, loans or a (revolving) fund, providing vouchers for research or just facilitating in a broad sense, for example by providing a working space for circular start-ups. As been discussed during the interviews, regional government do focus on enhancing circular business activities (Section 4.1.4).

In total, six different indicators were found of which two relate to the creation of smart technologies and more specifically the optimization of processes part which is part of the R2-reduce strategy. Indicator 21, just like indicator 24 measures the number of patents. The patents related to the design of products is part of the smarter product use and manufacture strategy, while indicator 25, related to patents in the recycling sector is placed in the useful application of materials strategy. One discussion regarding these patent related indicators, is that this is usually done on a national level. Thus, the indicators might not be interiorly suitable for the regional level. However, if information about regional background of the company is included in the application, it could be a proxy for regional innovation. Furthermore, patents were included all four selected frameworks from Table 13 including the one already suited to the regional level.

Indicator 23, the increase in market share of product as a service sector, was included in the extended lifespan of products and its parts strategy since it encompasses sharing platforms in which materials are re-used. The indicators that are not aimed at a specific strategy are all three focussed on

the growth of circular businesses in the region. The indicators cover the number of circular start-ups in the region, the amount of circular jobs and the share of circular businesses by sector. This last indicator relates to Section 2.4.3 in which 2.5% of the potential market share of circular products and services is determined as the tipping point between the formative and the growth phase of the circular economy transition.

Here, again the question remains how a ‘circular business’ or a circular start-up is defined. In 2019, PBL carried out a baseline study on the amount of circular jobs in the Netherlands (PBL, 2019). According to this study, *Circulaire Economie in Kaart*, the Netherlands has around 85.000 circular business activities, providing 420.000 jobs. The data was provided on a municipal level. A circular activity is defined as an activity that contributes to a more efficient handling of raw materials. However, the results show that most of the circular activities could be linked to repair and remanufacture (R4 and R5). Additionally, approximately 1500 innovative circular initiatives could be detected. Innovate circular business activities entailed initiatives with a new product design, technology or business model or new application for existing products designs, technologies or business models (PBL, 2019). Of these 1500 activities most were related to recycling R5, which is considered a ‘low’ circular strategy. Thus, it is important to not only measure the quantity of circular businesses activities but also to what circular strategy they belong and if more focus is being placed on higher strategies that result a bigger reduction of raw materials.

4.2.6 INDICATORS FOR LAWS AND REGULATION

Laws & Regulation

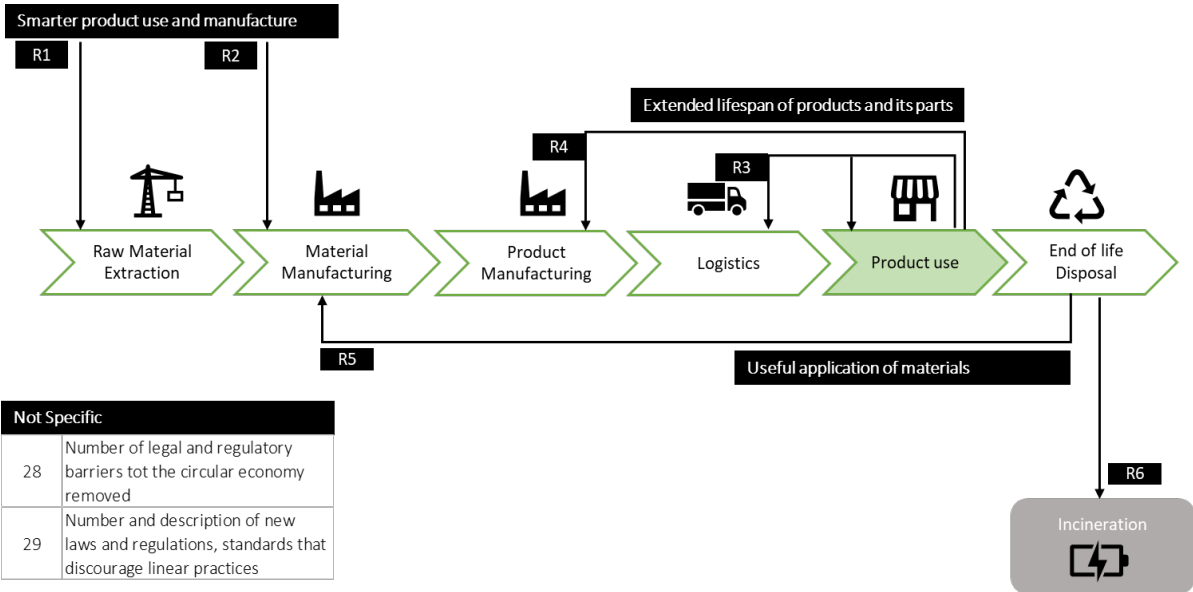


FIGURE 19 INDICATORS RELATED TO LAWS AND REGULATION

Figure 19 shows the two indicators that relate to laws and regulations. As shown in Appendix 1, laws and regulations include a wide range of policy instruments including the granting of permits, the enforcement and supervision of laws and regulations and zoning plans. The found indicators do not fit to specific instruments such as the granting of permits but cover more the making and changing of laws and regulation and its enforcement in general.

As mentioned in Section 4.1.3 as well as in Section 2.2.2, laws and regulations are viewed as an important barrier to overcome both by the interviewees as well as in academic literature. However, the question remains how much influence regional government have in removing this barrier. According to one interviewee: *“The legislation is national, but local municipalities and provinces can draw up rules.”* (Interview 10, personal communication, 27th of August 2020). Therefore, in removing barriers and creating new regulations, a connection to the national level has to be made. One of the interviewees mentioned that its regional government has a platform that collects encounters with laws and regulation. *“We have a joint platform, which contains environmental protection services and where these cases where obstructive laws and regulations are encountered are discussed”* (Interview 7, personal communication, 14th of August 2020). Another interviewee mentioned that regional governments collaborate and exchange knowledge on what is needed from the national level related to laws and regulations (Interview 6, personal communication, 13th of August 2020).

Thus, even though laws and regulations are viewed as an important barrier and some of the regional government have at least some influence on it, the indicators found are generally formulated and cannot be assigned to a main strategy or a policy instruments that is part of laws and regulation. It seems to be more linked to lobbying, which is, according to the current classification of instruments part of network & information exchange but could be moved to laws and regulations. This is also the case for research related to laws and regulation, but this is covered in the following Section (Section 4.2.7).

Furthermore, it is important that indicators related to the implementation of new laws and regulation include a description and are not solely quantified. The amount of changed or new laws and regulations gives limited information on the importance of these laws and regulations for the development of the circular economy transition (Prins & Rood, 2020). Indicator 30 is an example of such an indicator including both the number of laws and regulations as well as descriptions. Still, additional indicators might be needed that are more matching with the actual activities regional governments take place in, which is not the changing of laws and regulation, but more identify barriers and lobby towards the national government.

4.2.7 INDICATORS FOR RESEARCH AND EDUCATION

Research and Education

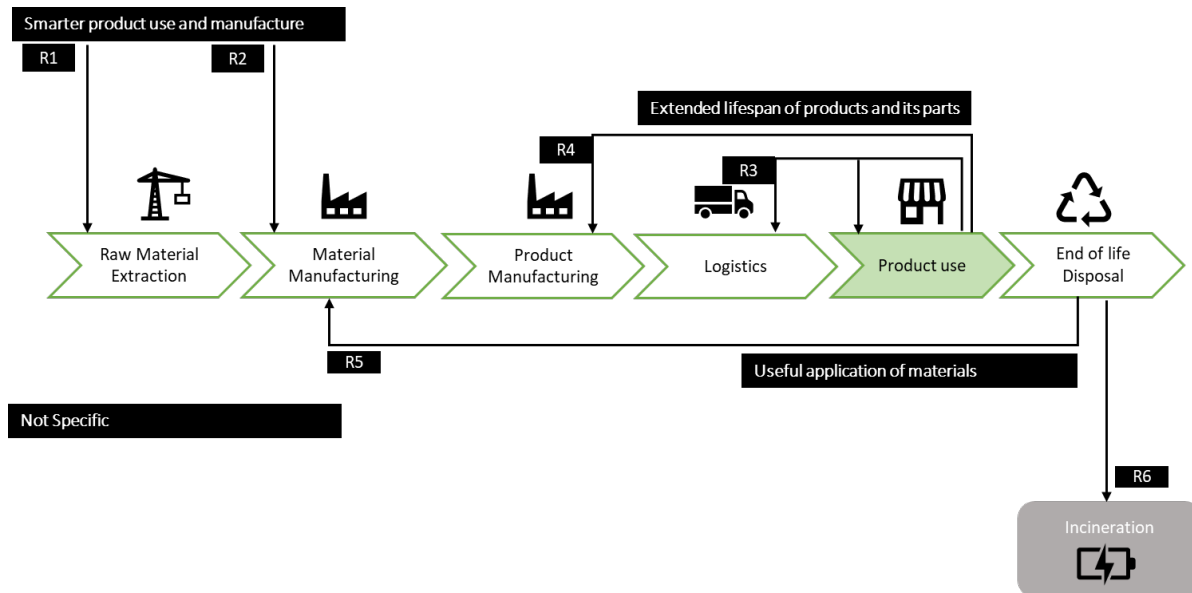


FIGURE 20 INDICATORS RELATED TO RESEARCH OR EDUCATION

As can be noted from Figure 20, no indicators have been found related to education and research. Education and research are different types of policy instruments. Their being placed in the same Figure is not to say they are similar or can be measured with the same types of indicators but merely to show that for both instruments no indicators have been found. Research entails raw material analysis, feasibility research, evaluations, market explorations, monitoring or other types of studies. According to PBL's study of what regional governments do to enhance the circular economy, it is the most deployed policy instrument (PBL, 2020a).

However, research has been considered a supportive instrument by multiple interviewees. Two interviewees mentioned that they expect research to become of less importance in the future. This is because research is now needed to discover where regional governments can have the most impacts, and when that knowledge gap is filled other instruments, such as circular procurement will increase. *"Well I think less research because you have to know where the playing field is and what to do. So, I expect that it can decrease [over time]."* (Interview 8, personal communication, 14th of August 2020). Thus, for example research about circular procurement is expected to decrease, while actual circular procurement increases.

In a way research is closely linked to network & information exchange and the provision of information since it entails the filling of knowledge gaps needed for CE action. Although important in the formative phase of the CE transition, it is hard to allocate effects to this type of instrument.

Research is also an overarching instrument since studies on regulatory barriers for example could also be allocated to laws and regulations. However, in both cases no indicators were found related to the outcome and effects of research done.

Educations entails internships, collaboration, development/innovation, (Reading) material for class, the facilitation of class, excursions and education programmes or classes. Regarding education, it was often found important for regional governments. *“We work together with knowledge institutions”* (Interview 9, personal communication, 26th of August 2020). *“People [Students] need to be trained, for the economy of tomorrow.”* (Interview 2, personal communication, 3rd of August 2020). However, regional governments are not responsible for the curriculum of knowledge institutions nor have a direct influence on it. Thus, indicators related to the curriculum of knowledge institutions might not be suited for the evaluation of regional CE policies.

Finally, Avdiushchenko and Zajac (2019) did mention two broad, sustainable development-oriented indicators related to research and education. First, the expenditure on environmental education which can be allocated to education. And the expenditure on (circular) research and development in relation to GDP or research. However, both indicators focus on the effort of regional governments in terms of funding and not on the outcome or effects of the effort. Thus, the indicators were classified as input indicators and not included in this study.

4.2.8 INDICATORS FOR OPERATIONAL TASKS

Operational Tasks 1/2 (Municipalities)

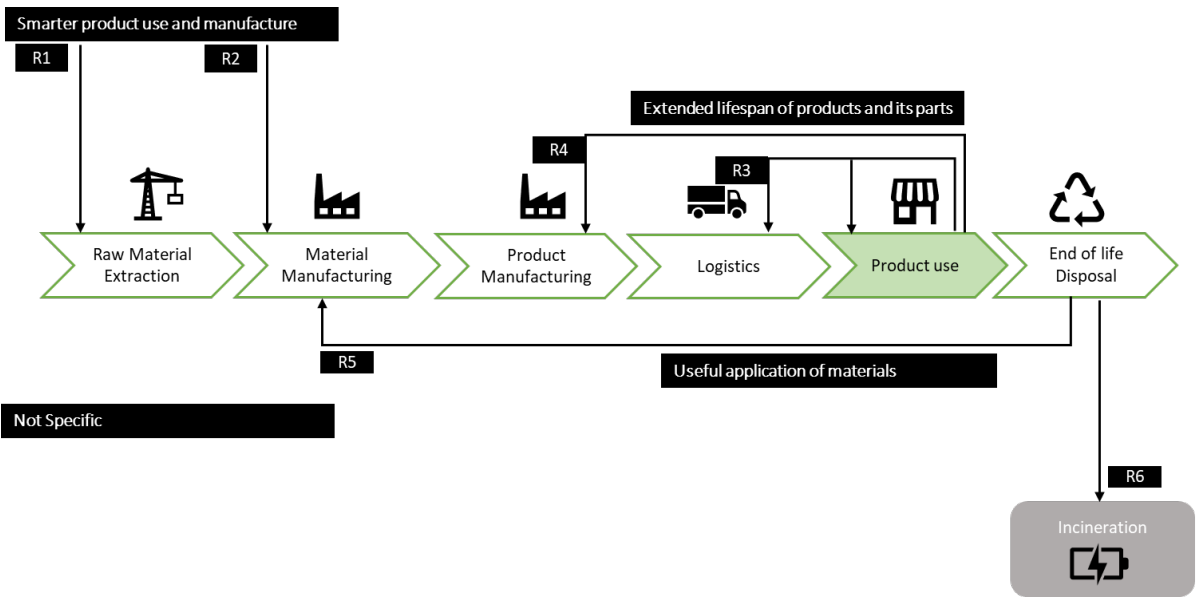


FIGURE 21 INDICATORS RELATED TO WASTE MANAGEMENT

Figure 21 shows indicators related to household waste management which is a legal task for municipalities. The indicators are all waste and recycling oriented. Indicators 30 entail the rate of recycling. According to Statistics Netherlands, the Netherlands ranks second among OECD countries with a recycling rate of 80 percent. But there are variations in the recycling rate depending on the specific waste streams such as recycling of municipal waste (Statistics Netherlands, 2018). Thus, sub-indicators were included. Recycling rates were mentioned in three of the four selected frameworks from Table 13 (Section 3.3.1).

Higher recycling rates implies lower waste generated which links to indicator 31. The (municipal) waste generated per inhabitant in the region was also mentioned in three different frameworks and finds its origin in the VANG Target. The program VANG has been developed to help municipalities become circular. The ambition is to have 75% waste separation which has been made concrete to 100 kg residual waste per inhabitant per year in 2020. This target is ambitious and has not been achieved by most of the municipalities yet but the closer to 100 kg a municipality gets the more 'circular'. The target has led some municipalities to implement waste management systems in which inhabitants pay for the amount of residual waste (Diftar systems) thus adopting the polluter-pays principle. However, a negative side effect is that it has led to an increase in the illegal dumping of waste and higher percentages of pollution in other waste flows in some municipalities (VANG, n-d). Indicator 32, the loss of material, which is measured by taking non-separated waste as a share of total household waste can be derived from the VANG-target.

Indicator 33 entails the raw material consumption of waste, this indicator also provides insights in the amount of residual waste as well, but is calculated considering the breakdown of the different types of materials as described by Statistics Netherlands and including the raw material equivalent (Raw Material Equivalent) as calculated by the Wuppertal Institute (Metabolic, 2018). This indicator takes into account the quality of the different raw materials that are to be recycled instead of just considering the total weight as done in the VANG target and which has been seen as a weak spot by PBL (Rood, 2014). On the other hand, since household waste management is an official task of municipalities a lot of data is available which already includes the data needed for the VANG-target.

Finally, the influence of municipalities regarding waste largely depend on the types of waste management systems that municipalities adopt. One interviewee even stated that municipalities only have an influence on 'the-end-of-the-pipe' when it comes to the generation of waste. *"Our waste policy is only focused on the fact that we rake things together and try to make different piles {...}. We have no influence on what goes in that pipe."* (Interview 5, personal communication, 12th of August 2020). However, some regional governments do focus on trying to influence the behaviour of

inhabitants when it comes to waste management (see quote Interview 9 Section 4.1.4) which links to the provision of information instrument.

Operational Tasks 2/2 (Water authorities)

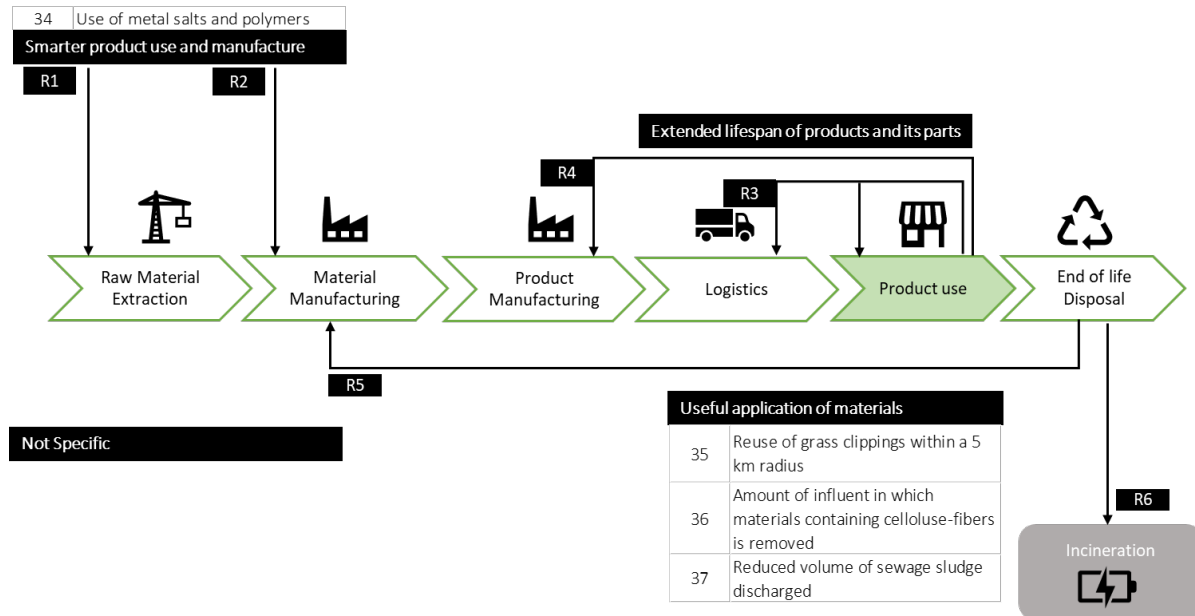


FIGURE 22 INDICATORS RELATED TO WATER MANAGEMENT

Figure 22 shows indicators related to the management tasks of water authorities. Three indicators were found, all coming from the internal document of one of the water authorities included in this research. Water authorities are a unique type of regional government because of the tasks they have regarding wastewater treatment and the extraction of raw materials.

The first indicator is the use of metal salts and polymers which are raw materials that are used for the treatment of sewage sludge, a by-product of industrial or municipal wastewater treatment. The second indicator is the reuse of grass clippings within a 5km radius which relates to the strategy; useful application of materials. Grass clippings can be reused to improve the soil of agricultural land. This indicator can also be adopted by provinces and municipalities, since they have to mow grass on within their region as well. Additionally, apart from grass clippings coming from dykes there are also materials extracted from the water itself. The main materials to be extracted from wastewater are phosphates and celluloses. Phosphates are already being harvested on a bigger scale but for celluloses this is not the case yet. Thus, one indicator mentioned the amount of wastewater in which materials containing celluloses-fibres is removed. The more cellulose is extracted the less sewage sludge is left which additionally leads to less transport needed of this sewage sludge and less CO₂ emissions. Sewage sludge in itself can also be seen as raw material, used for bio-fuel applications and a reduction in the amount of discharged sludge is an indicator as well. However, both sludge and grass clippings, are

biotic materials which are less applicable to the ladder of R-strategies, since this ladder focuses on abiotic materials. Further research entailing indicators with the Ladder of Mansink, which is the R-ladder for biotic materials, might be needed.

For future indicators regarding operational tasks, it might be worth to also look at other materials that are used as part of the operational tasks of water authorities (and other types of regional governments). Same is to be said about indicators for the useful application of materials, such as an indicator on phosphates which are already being extracted but for which no indicator was found. Finally, the definition adopted in this thesis focusses on the material aspect of the circular economy, the decision was made to not include indicators on wastewater and wastewater treatment itself but only focus on the materials extracted from this water. Nonetheless, the re-usability of water is a crucial part of the operational tasks of water authorities and indicators for water itself might help this aspect of the circular economy.

4.2.9 FINAL REFLECTION PHASE TWO

Overall, the indicator assessment was done to provide an answer to the second sub-question: What indicators can be used to evaluate the circular policies deployed on the regional level? The indicator assessment did find indicators fit for evaluation of types of policy instruments, operational tasks and CE strategies as a whole. However, for some types of instruments such as research no indicators were found, whereas multiple closely related indicators were found for other types of instruments or operational tasks. Thus, further research is needed and will be elaborated on in the next Section (Section 4.3).

With the indicator assessment, just like the semi-structured interviews, there are methodological limitations that need to be discussed. For the assessment, relevant frameworks from the theoretical foundation (Chapter 2) were used as the basis for finding indicators. Additionally, the selection of indicators for the framework was done using the criteria mentioned earlier in Chapter 3. This include the pre-existing criteria mentioned in Box 2 excluding micro and meso oriented frameworks, frameworks before 2017 and frameworks with a non-European scope. The criteria were derived from the regional scope of this study, the definitions adopted in his study, and a pragmatic choice to avoid too much of the same indicators. One of the main limitations is related to the criteria set in this assessment. It could be that assessment frameworks were not included because of these criteria, but still have fitting indicators. In order to diminish this limitation a light form of desk research was performed to scan assessment frameworks, webpages from research organisations and governmental organisations and scientific papers, to see whether important assessment frameworks that did not satisfy all the criteria, might still have useful indicators. Furthermore, circular economy advisors from

RHDHV were consulted about possible indicator systems. However, it was found that this did not lead to extra frameworks due to the proposed frameworks not meeting the criteria. Additionally, in order to validate the indicators, the results were discussed with three interviewees to see whether they agreed with the indicators and their views were considered throughout Section 4.2. Still, for further research it is important to see whether additional indicators or criteria might be overlooked.

4.3 FINAL REFLECTION AND RECOMMENDATIONS

This Section provides an overall reflection with recommendations for further research. First, this study adopted PBL's classification of policy instruments. Putting the range of instruments at the centre of the assessment does enforce a uniformity in indicators for the five types of regional governments. Despite differences between regional governments, this total range of instruments was perceived as a common denominator between all regional governments, a toolbox from which regional government can extract policy instruments to deploy. Finding indicators related to these instruments would eventually help all regional governments with their evaluation. However, the results show that the current classification is not always applicable to the indicators found. Some types of instruments had to be merged and for some types of instruments no indicators could be linked. It could be that a different type of classification could be better matched such as the classification of the City of Amsterdam: Regulatory & legislative, economic and soft instruments (Section 2.3.2). In case the current classification used in this study is maintained, more research is needed to find additional indicators or create indicators for the evaluation of these types of policy instruments.

Secondly, the question remains whether the 'sharing of the same toolbox' is enough to justify one uniform evaluation system. It could be that some regional governments differ from one another and five different indicator systems should be developed for the five respective regional governments. Or one step further, it might be that, as every region has different characteristics, evaluation frameworks should be created individually for each regional government. It could be necessary to have some part of the evaluation system customized to the characteristics of the region. Nonetheless, the interviews show that a uniform evaluation or monitoring system, built with a set of indicators that can be applied to all regions is favoured by policymakers. Ideally, one that can be translated from the national level. This allows for comparison between regional governments. This is in line with the view of the study, to find one system for all regional governments. However, if regional governments adopt different definitions of the circular economy and interpret the targets differently, as discovered during the interviews, this will be challenging to realise.

This also relates to the definition applied in this study. The definition of the circular economy concept, as provided by the European Commission, was adopted. This definition was chosen since it

was limited to the material aspect of the circular economy, which touches the core of the concept. Therefore, the found indicators derived from the indicator assessment, are also focused on either the effects of policies on the material flows or the creation of necessary conditions to impact those material flows. However, since regional governments adopt different definitions, the indicators might not be applicable for all circular policies of regional governments. Thus, more dialogue is needed among the different regional governments and with the national government to work with uniform definitions and the same interpretation of targets so the same set of indicators could be applied. The indicators found in this study, could form the basis for this, since they relate to the material aspect which is the core of the circular economy concept.

Finally, this study focussed on the effects of CE policies on material flows. However, as can be noted in Table 4, Potting et al. (2018) differentiates between three different types of effects; resources and environmental pressure and socio-economic development. Although, this thesis focusses on materials, it is important to note that the circular economy is not solely about the amount of materials. Kishna et al. (2019) shows that the circular economy will have effects on the environmental pressure (which can be measured by CO₂, Land, Water and Toxicity) and security of supply. Eventually, as stated in Section 1.1. the circular economy is seen as a contribution and solution to several SDGs. This implies that the circular economy is not a goal in itself but also a means to help achieve other goals such as reducing the environmental impact on the earth's system (Section 2.1.1 and the security of supply (Section 1.2). This has also been emphasized by PBL: *"After all, reducing the use of raw materials is not an end in itself, but a means by which the Cabinet wants to reduce the environmental pressure and the security of supply risks of raw materials use."* (Kishna et al., p.6, 2019). More research is necessary on the impacts of the material flows on the environment, security of supply and other social components.

Overall, the main recommendations are further research on finding and creating indicators for the evaluation of regional policies. However, it is important to keep the link with policymakers in mind while studying indicators. Eventually, they are the ones that have to understand and implement the indicators in their CE approaches and strategies. Furthermore, for the regional governments themselves it would be recommended that they make the evaluation of (circular) policies a priority. Ideally, the outcome of the evaluation could be compared with the amount of effort and financial force that has been necessary to also determine the effectiveness of policies. Finally, it is recommended to keep a dialogue with each other, the national government and PBL to collaborate and to discover to what extent a uniform evaluation system can be realised. Eventually the realisation of an evaluation system is a conjoined effort of regional governments, the national government and knowledge institutions such as PBL.

5. CONCLUSION

This study was set out to explore the evaluation of circular policies deployed by regional governments in the Netherlands. Besides gaining insights in what regional governments are currently doing to help create a circular economy, evaluation of these circular policies is needed to help steer policies and contribute to the CE goals more effectively. Therefore, the main research question to be answered was: How can regional governments evaluate their policy instruments deployed towards achieving the Dutch Circular economy goals? In order to answer the research question, this study was divided into two phases. Phase one to gain insights on how regional government are currently evaluating their circular policies through the conducting of semi-structured interviews with policymakers on the regional level. Phase two entailed an indicator assessment to find indicators suited for the evaluation of regional circular policy making.

The results of phase one show that the circular economy is a new field of policy. Regional governments are still working on developing and promoting approaches into circular strategies to help contribute to the Dutch circular economy goals. Therefore, not much attention is being paid by circular policymakers on how to evaluate their policies. The monitoring of the circular economy and the evaluation of circular policies are viewed as complex and if policymakers are interested in measuring the progress of their governmental action, no framework is currently available for them to use. Additionally, the complexity of the CE concept and the missing of a uniform definition on the national level, have led to a variety of different definitions adopted by regional governments. Simultaneously, the provided national targets are unspecific and additional targets are needed that relate to both the input use and output of materials in an economy, but these are not in place yet. This makes the creation of a uniform evaluation system, which is preferred by most regional governments, a challenge.

The results of the second phase provided 37 indicators that could help with the evaluation of circular policies. Six indicators can help with the evaluation of overall CE strategies or approaches, while 31 indicators related to the eight different types of policy instruments identified and the operational tasks of municipalities and water authorities. Most of the indicators found relate to the useful application of materials strategy. These indicators can serve as a basis for the evaluation of circular regional policies. However, the results show that there is a lack of indicators for policies such as education, research, laws & regulation and the provision and exchange of knowledge and therefore further research is needed.

The main research question that had to be answered was: How can regional governments evaluate their policy instruments deployed towards achieving the Dutch Circular economy goals? This study

provides indicators and insights from policymakers that can help with the evaluation of circular policies. However, it is of importance to not mistake the found indicators as a finished framework to be directly applied for the evaluation of regional policies but merely as a starting point for further analysis. More research is needed to find or develop indicators that can be applied for the evaluation of types of instruments such as research and laws & regulation. Part of this research should be a method to decide which indicators to eventually include since multiple closely related indicators have been found and too much (of the same) indicators could lead to confusion. It might not be necessary to find evaluation indicators for every type of policy instrument. For supportive instruments such as research, education, provision of information and network & information exchange it might be best to stick with input and throughput indicators, since they are supportive to other types of instruments and cannot be directly linked to material effects. In the end, it should not be the aim to find as many indicators as possible but merely just enough to cover the circular approach or strategy of the regional governments. Additionally, research is needed to test the practical application of these indicators in all five different types of regional governments, to see to what extent they can be applied and to avoid a discrepancy between the indicators found and the practical application in regional context. This practical application should include data availability as criterion, since this was not part of this study. Also, targets should be set for the indicators to be able to see if the circular policies of regional governments are indeed successful and effort should be made to gather data needed for the indicators. Additionally, in this study the active decision was made to not just research indicators but combine this assessment with the insights from policymakers through interviews. With further research on developing a system for the evaluation and monitoring on the regional level, it is of importance to keep a link with the policymakers and make sure their thoughts and experiences are considered, since they have to comprehend and apply it. So that the knowledge gathered is useful knowledge.

In the end, this study emphasized the regional perspective of transitioning to a circular economy and explored the evaluation of regional CE policies to enable this transition. It showed the complexity and necessity of evaluation and provided indicators, but more research is needed. The circular economy is a complex concept. Complex to define, complex to translate and complex to evaluate. Nevertheless, an ongoing effort should be made, to keep unravelling this complexity and work towards a circular Dutch economy in 2050.

6. REFERENCES

- ACR+. (2014). *Towards Circular economy Action Plans at Regional and Local Levels*. Retrieved from https://www.acrplus.org/images/Circular_Europe_Network/Background_documents/CEN_working_document.pdf
- Akerman, E. (2016). *Development of Circular economy Core Indicators for Natural Resources - Analysis of existing sustainability indicators as a baseline for developing circular economy indicators*. Master of Science Thesis, Stockholm.
- Avidiushchenko, A., & Zajac, P. (2019). *Circular economy indicators as a supporting tool for European regional development policies*. *Sustainability*, 11(11), 3025.
- Barriball, K. L., & While, A. (1994). *Collecting data using a semi-structured interview: a discussion paper*. *Journal of Advanced Nursing-Institutional Subscription*, 19(2), 328-335.
- Bryman, A. (2012). *Social Research Methods (Fourth)*. New York: Oxford University Press Inc.
- C40. (2018). *C40: Amsterdam's Circular economy Roadmap: Lessons Learned and Tools for Upscaling*. Retrieved 24 April 2020, from https://www.c40.org/case_studies/amsterdam-s-circular-economy-roadmap-lessons-learned-and-tools-for-upscaling
- Cairney, P. (2016). *Policy Concepts in 1000 Words: The Policy Cycle and its Stages*. Retrieved from <https://paulcairney.wordpress.com/2013/11/11/policy-concepts-in-1000-words-the-policy-cycle-and-its-stages/>
- Cairney, P. (2019). *Understanding public policy*. Red Globe Press.
- Circle Lab. (n.d.). *Policy Instruments*. Retrieved 28 May 2020, from <https://circle-lab.com/knowledge-hub/policy-instruments>
- City of Amsterdam. (2020). *Amsterdam Circular 2020-2025 Strategy*. Retrieved from https://assets.amsterdam.nl/publish/pages/867635/amsterdam-circular-2020-2025_strategy.pdf
- Council for the Environment and Infrastructure. (Rli). (2015). *Circular economy: From Which to Practice*. Retrieved from https://en.rli.nl/sites/default/files/advice_rli_circular_economy_interactive_def.pdf
- Diefenbach, T. (2009). *Are case studies more than sophisticated storytelling? Methodological problems of qualitative empirical research mainly based on semi-structured interviews*. *Quality & Quantity*, 43(6), 875.
- European Commission. (2015). *Circular economy package: Questions & answers: MEMO/15/6204*. Retrieved from http://europa.eu/rapid/press-release_MEMO-15-6204_en.htm
- European Commission. (2018). *Communication from the Commission to the European parliament, the Council, the European Economic and Social Committee and the Committee of the Regions; on a monitoring framework for the circular economy*. Retrieved from <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516265440535&uri=COM:2018:29:FIN>
- Geissdoerfer, M., Savaget, P., Bocken, N. M., & Hultink, E. J. (2017). *The Circular economy—A new sustainability paradigm?* *Journal of cleaner production*, 143, 757-768.
- Gerritsen, E. (2011). *De slimme gemeente nader beschouwd*.
- 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.
- Humbs-Steinbeck, D., (2017). *A Circular economy: A Case Study on the Role of the Local Government in Nijmegen*, Faculty of Economic Geography, Radboud University, Master Economic Geography
- Kallio, H., Pietilä, A. M., Johnson, M., & Kangasniemi, M. (2016). *Systematic methodological review: developing a framework for a qualitative semi-structured interview guide*. *Journal of advanced nursing*, 72(12), 2954-2965.
- Kalmykova, Y., Sadagopan, M., & Rosado, L. (2018). *Circular economy—From review of theories and practices to development of implementation tools*. *Resources, conservation and recycling*, 135, 190-201.

Kirchherr, J., Piscicelli, L., Bour, R., Kostense-Smit, E., Muller, J., Huijbrechtse-Truijens, A., & Hekkert, M. (2018). Barriers to the circular economy: evidence from the European Union (EU). *Ecological Economics*, 150, 264-272.

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127, 221-232. <https://doi.org/10.1016/j.resconrec.2017.09.005>

Kishna, M. et al. (2019), *Doelstelling circulaire economie 2030*, Den Haag: PBL.

Korhonen, J., Honkasalo, A., & Seppälä, J. (2018). Circular economy: the concept and its limitations. *Ecological economics*, 143, 37-46.

Mees, H. L. P., Dijk, J., van Soest, D., Driessen, P. P. J., van Rijswijk, M. H. F. M. W., & Runhaar, H. (2014). A method for the deliberate and deliberative selection of policy instrument mixes for climate change adaptation. *Ecology and Society*, 19(2). <https://doi.org/10.5751/es-06639-190258>

Mees, H. L., Uittenbroek, C. J., Hegger, D. L., & Driessen, P. P. (2019). From citizen participation to government participation: A n exploration of the roles of local governments in community initiatives for climate change adaptation in the N etherlands. *Environmental Policy and Governance*, 29(3), 198-208.

Metabolic. (2018). *Monitoring voor een Circulaire Metropool Regio*. Author. Retrieved from <https://www.metabolic.nl/publications/monitoring-voor-een-circulaire-metropoolregio/>

Ministerie van Algemene Zaken. (AZ) (n-d). *Circulaire economie*. Retrieved from <https://www.rijksoverheid.nl/onderwerpen/circulaire-economie>

Ministerie van Infrastructuur en Waterstaat (IenW). (2016). *Nederland Circulair in 2050*. Retrieved from <https://www.rijksoverheid.nl/onderwerpen/circulaire-economie/documenten/rapporten/2016/09/14/bijlage-1-nederland-circulair-in-2050>

Ministerie van Infrastructuur en Waterstaat (IenW). (2019). *From a linear to a circular economy*. Retrieved 21 April 2020, from <https://www.government.nl/topics/circular-economy/from-a-linear-to-a-circular-economy>

Paiho, S., Mäki, E., Wessberg, N., Paavola, M., Tuominen, P., Antikainen, M., ... & Jung, N. (2020). Towards circular cities— Conceptualizing core aspects. *Sustainable Cities and Society*, 102143.

PIANOo. (n.d.). *Circulair inkopen*. Retrieved from <https://www.pianoo.nl/nl/themas/maatschappelijk-verantwoord-inkopen-duurzaam-inkopen/mvi-themas/circulair-inkopen>

Planbureau voor de Leefomgeving (PBL). (2019). *Circulaire economie in kaart*, Den Haag: Planbureau voor de

Leefomgeving. Retrieved from https://www.pbl.nl/sites/default/files/downloads/pbl-2019-circulaire-economie-in-kaart-3401_0.pdf

Plan Bureau voor de Leefomgeving (PBL). (2020a). *Regionale overheden zetten met duizenden prikkels transitie naar*. Retrieved 22 April 2020, from <https://www.pbl.nl/blogs/regionale-overheden-zetten-met-duizenden-prikkels-transitie-naar-circulaire-economie-in-gang>

Plan Bureau voor de Leefomgeving. (2020b). *WERKPROGRAMMA MONITORING EN STURING CIRCULAIRE ECONOMIE 2020*. PBL. Retrieved from https://www.pbl.nl/sites/default/files/downloads/pbl_2020_werkprogramma_monitoring_en_sturing_circulaire_economie_2020_4182.pdf

Plan Bureau voor de Leefomgeving (PBL) & Royal HaskoningDHV (RHDHV). (2020). *Inspiratieboek circulaire activiteiten regionale overheden 22 illustratieve voorbeelden*. Royal HaskoningDHV. Retrieved from <https://www.uvw.nl/wp-content/uploads/2020/06/Inspiratieboek-circulaire-activiteiten-regionale-overheden.pdf>

Potting, J., Hanemaaijer, A., Delahaye, R., Ganzevles, J., Hoekstra, R., & Lijzen, J. (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*. PBL Netherlands Environmental Assessment Agency, The Hague.

Prins, A.G. & T. Rood (2020), *Op weg naar een robuuste monitoring van de circulaire economie. Resultaten-2019 van het Werkprogramma Monitoring en Sturing Circulaire Economie*, Den Haag: PBL

- Provincie Zuid-Holland & NSOB. (2019). *Overheidsrollen in de opgave*. Retrieved from <https://platformoverheid.nl/artikel/overheidsrollen-in-de-opgave/>
- Rijksoverheid. (2018). *Circulaire Bouwagenda*. Retrieved from <https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2018/01/15/bijlage-4-transitieagenda-bouw/bijlage-4-transitieagenda-bouw.pdf>
- Rijksoverheid., (2020). *Naar Een Economie Zonder Afval: Brede maatschappelijke heroverweging/* Retrieved from: <https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2020/04/20/bmh-11-naar-een-economie-zonder-afval/bmh-11-naar-een-economie-zonder-afval.pdf>
- Rijksoverheid. (n.d.). *Wat is de Rijksoverheid*. Retrieved from <https://www.werkvoornederland.nl/over-de-rijksoverheid/wat-is-de-rijksoverheid>
- Romano, O. (2018). *The Circular economy in Regions*. OECD Retrieved from <http://www.oecd.org/cfe/regional-policy/Circular-economy-brochure.pdf>
- Rood, T. (2014). *Reflectie op Van Afval Naar Grondstof (VANG) (1522)*. PBL. Retrieved from https://www.pbl.nl/sites/default/files/downloads/pbl-2014-reflectie-op-van-afval-naar-grondstof-vang_1522.pdf
- Rood, T., & Kishna, M. (2019). *Outline of the Circular economy*. PBL Netherlands Environmental Assessment Agency, The Hague
- Rudestam, K. E., & Newton, R. R. (2014). *The method Chapter: Describing your research plan. Surviving your dissertation: A comprehensive guide to content and process*, 87-117.
- Salvatori, G., Holstein, F., & Böhme, K. (2019). *Circular economy strategies and roadmaps in Europe*. The European Economic and Social Committee (EESC). <https://doi.org/10.2864/554946>
- Schroeder, P., Anggraeni, K., & Weber, U. (2019). *The relevance of circular economy practices to the sustainable development goals*. *Journal of Industrial Ecology*, 23(1), 77-95.
- Shen, L., He, B., Jiao, L., Song, X., & Zhang, X. (2016). *Research on the development of main policy instruments for improving building energy-efficiency*. *Journal of Cleaner Production*, 112, 1789-1803.
- Statistics Netherlands. (CBS). (2018). *Waste recycling*. Retrieved from <https://www.cbs.nl/en-gb/society/nature-and-environment/green-growth/resource-efficiency/indicatoren/waste-recycling#:~:text=With%20a%20recycling%20rate%20of,a%20much%20lower%20recycling%20rate.>
- Van Buren, N., Demmers, M., Van der Heijden, R., & Witlox, F. (2016). *Towards a circular economy: The role of Dutch logistics industries and governments*. *Sustainability*, 8(7), 647.
- Vanhamaki, S., Medkova, K., Malamakis, A., Kontogianni, S., Marisova, E., Dellago, D. H., & Moussiopoulos, N. (2019). *Bio-based circular economy in European national and regional strategies*. *International Journal of Sustainable Development and Planning*, 14(1), 31-43.
- VANG Huishoudelijk Afval. (n.d.). *Factsheet 'Difftar in 5 punten'*. Retrieved from <https://www.vang-hha.nl/nieuws-achtergronden/2015/artikelen/factsheet-'difftar-5/>
- Virtanen, M., Mankinen, K., Uusitalo, V., Syväne, J., & Cura, K. (2019). *Regional material flow tools to promote circular economy*. *Journal of Cleaner Production*, 235, 1020–1025. <https://doi.org/10.1016/j.jclepro.2019.06.326>
- Walendowski, J., Roman, L., & Miedzinski, M. (2014). *Regional Innovation Monitor Plus*. Retrieved from https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/sites/default/files/report/RIM%20Plus_Circular%20Economy_Thematic_Paper%204.pdf
- Winans, K., Kendall, A., & Deng, H. (2017). *The history and current applications of the circular economy concept*. *Renewable and Sustainable Energy Reviews*, 68, 825-833.

7. APPENDIX

APPENDIX 1: LIST OF POLICY INSTRUMENTS AND OPERATIONAL TASKS

Type of policy instrument	Policy Instrument	Explanation
Research	Raw material analysis	Research on promising raw materials. With a raw material analysis or material flow analysis, the incoming and outgoing raw material flows can be mapped. A Raw Material Flow Analysis is also referred to as a "mass flow analysis".
	Feasibility research	Research on the feasibility of an (intended) implementation
	Evaluation	Research on the success of a previously implementation
	Market exploration	Research on what the market has to offer
	Other	Many other forms of research are also possible. These have been included in this study under the heading "other"
	Monitoring	Periodically performed research to investigate trends and developments.
(Financial) support of businesses	Subsidy	Temporarily financial contribution to enhance activities that are not financially viable.
	Loan	Financial support that needs to be paid back with interest
	Participation	Becoming a shareholder
	Voucher for research	Contribution to a business that makes use of a knowledge institution to answer a research question. Often used to stimulate innovation
	(Revolving) Fund	Fund: Money brought together for a specific purpose Revolving fund: The money used for a specific purpose will eventually return so it becomes available for future funds/loans.
	Tax/levy	Tax / levy to make something (e.g. an activity or waste stream) less attractive by means of a tax
	Guarantee	Warrant. Often used in the construction of new buildings. When applied the construction is certain even if the contractor goes bankrupt.
	Competition	Competition in which companies, residents or knowledge institution can present their innovations. The winner will be (financially) supported.
	To facilitate	Government takes on an executing role. But leaves tasks to society. It makes sure society can execute the tasks.
Circular Procurement	ICT purchase	Purchasing of ICT equipment
	Ground- road and water construction	Here circular means that you reuse materials and that roads are built modularly, so that they can be adapted with little use of raw materials.
	Purchase of building	Purchase of building. This is the case when a government owns the property.
	Energy purchase	purchase of energy. This can be done by purchasing biogas e.g.

	Facility purchases	Purchase of products within the government's own business operations such as office equipment and cleaning services
	Transport	Procurement of transportation means such as buses, trains etc.
	Supply of raw materials	The extraction and supplying of raw materials to other parties so they can be used again.
	Other purchases	Purchases in other categories.
Provision of information	Campaign	Information campaigns are used to inform residents about policy or to steer behavior. In an information campaign, it is important that the target group, the content of the campaign and its implementation, are carefully considered.
	Center of expertise	Center where experts work in a specific area within the CE. Residents / companies / interested parties can obtain information from this center.
	Newsletter	(regular publication of an) informative letter related to the CE.
	Letter/ flyer	Letter or flyer with information related to the CE. Mainly focused on providing information to residents.
	Informative conversation	Information interviews can often take place on request with the aim of transferring specific information to further help companies and / or residents.
	Knowledge partner	A regional government can itself be an expert in an area within the CE and make their knowledge available within a knowledge network or through other means.
Education	Education/ class	Providing information on the circular economy by giving classes. This also includes training/ workshop
	Internship	Providing an internship or thesis project for students with a topic linked to the CE.
	Collaboration	Cooperation with knowledge institution to inform, innovate on aspects of the CE.
	Development/innovation	Encouraging innovation and development in knowledge institutions.
	(Reading) material for class	Providing (Reading) material for class on the topic of CE
	Facilitate class	Facilitate a class on the topic of CE.
	Excursion	Providing an excursion e.g. to a waste treatment facility
Network & information exchange	(Online) platform	(Private) (online) environment used for communication on a certain topic.
	Network meeting	Meeting in which multiple parties or companies can exchange information and resources in the transition to a CE.
	Seminar/congress	Seminar: Meeting to share information (not biased)
		Congress: Meeting two exchange information (often conversation between multiple parties)
	Knowledge network	Network with organizations and/or individuals with the primary goal to exchange information
	Lobbying	Lobbying to other governmental parties such as the Dutch government or the European Union to gain resources to enhance the CE.

Laws and regulation	Covenant	Contract with agreements on policy (objectives)
	Permit	Granting permissions to follow through with circular activities
	Enforcement/supervision	Enforcing law and supervision for enabling circular activities
	Prohibition	Prohibition of certain activities to enhance circular activities.
	Certification	Release certificates that measure the circularity of a project
	Exemption	Exempting companies for following certain rules or using certain products to enhance CE.
	Concession agreement	Permit provided by a government that excludes other parties.
	Ordinance	Regulation/ordinance (governmental decision)
	Zoning plan	Plan in which a municipality assigns certain intentions on parts of their territory
Spatial Domain	Land allocation	Allocation of land for projects
	Spatial planning	Development of a certain area in all its aspects
	Building	Renovation/ demolition or building of a building (includes buildings that are not property of the regional government)
	Storage of raw materials	Storage of raw materials (includes the use of building as storage)

* Appendix 1 is derived from RHDHV and PBL (2020) (Own Authorship)

Operational tasks	Explanation
Municipal Waste Management	Municipalities have a legal task in managing waste from residents in the region.
Green/Nature/ Recreation	Management of nature such as mowing gras.
GRW/ arrangement of public domain	Management of Ground- Road- and Water works
Water purification	Purifying wastewater
Water system/ flood defenses	Operational tasks of the water system and flood defenses

APPENDIX 2: INTERVIEW GUIDE

General Information:

Date:	
Name:	
Regional Government:	
What is your function?	
How long have you been in this function?	

The circular economy

1. How does *regional government X* define the Circular economy?
2. A) Are you aware of the CE targets the Dutch governments is aiming to achieve, becoming circular in 2050 and 50% less material input in 2030?
B) If yes, how are these CE- targets translated in the case of *regional government X*?

The role of the regional government

3. How does *regional government X* describe their role in the transition to a Circular economy?
4. What “approach” is used to enhance the circular economy?
5. Is this approach part of an existing CE-strategy?
6. How would you describe this approach?
 - I) Integrated strategy that focusses on steering the public opinion in regard to the circular economy?
 - II) Strategy with a confined focus. Only stakeholders from specific sectors are involved
 - III) All-encompassing strategy with clear priorities. A combination of the first two strategies.

The deployment of policy instruments

7. According to the database of CE activities of regional governments, it shows what regional government X/ regional governments in general is/are doing to enhance the CE. Do you think this is correct?

The evaluation of policies

8. Are you currently evaluation the policies aimed at enhancing the circular economy?
9. Does this differ from the evaluation of non-circular policies?

In case no evaluation is taking place:

10. How are you planning to evaluate CE policies?
11. A) What do you think would be suitable indicators to evaluate policies from regional governments regarding the circular economy?
B) Do you think a possible evaluation system should contain both effect and transition indicator?



APPENDIX 3: INFORMED CONSENT FORM

Onderzoek:

STUDIE: Master Scriptie Sustainable Development, track Energy & Materials

TITEL: Evaluation of Policy Instrument Aimed at Enhancing the Circular economy on A Regional Level

Evaluatie van beleidsinstrumenten gericht op het stimuleren van de circulaire economie op een regionaal niveau

Naam onderzoeker:

Eva Herrewijnen

Doel van het onderzoek:

Dit onderzoek heeft als doel het evalueren van beleidsinstrumenten die regionale overheden inzetten om de circulaire economie te stimuleren. Het doel van het interview is om meer inzicht te krijgen in het proces van CE-strategieën van regionale overheden en om te bezien hoe regionale overheden hun CE-beleid (kunnen) evalueren.

Uw medewerking:

De gegevens van dit onderzoek worden verzameld via een-op-een online interviews die ongeveer een uur duren. Het interview zal worden opgenomen om later uit te schrijven zodat analyse van de gegevens mogelijk is. De gegevens die hiermee worden verzameld zullen zorgvuldig en vertrouwelijk worden behandeld. Tijdens het interview bent u niet verplicht antwoord te geven op de vragen en u heeft ook altijd de mogelijkheid om te stoppen met het interview. De verzamelde gegevens zullen anoniem worden verwerkt, wat betekent dat men hierin op een voor derden onherkenbare wijze wordt beschreven.

Door dit document te ondertekenen, geeft u te kennen dat u akkoord gaat met uw deelname aan dit onderzoek. Ook na ondertekening kunt u altijd afzien van uw medewerking. Uw deelname wordt echter zeer op prijs gesteld.

Ik geef toestemming voor deelname aan dit onderzoek:

Naam:

Handtekening

Plaats:

Datum:

APPENDIX 4: INCLUDED EXISTING ASSESSMENT FRAMEWORKS

Author	Year	Title	Description
Potting et al. (PBL)	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	Overview of policy relevant indicator sets for measuring progress in the transition to a circular economy. Subdivided into input, throughput, output and effect indicators.
European Commission	2017	Circular economy Indicators	Proposed EU monitoring system with 10 core indicators. Subdivided into production and waste generation, waste, secondary raw materials, competitiveness and innovation
Avdushchenko et al.	2019	Circular economy Indicators as a Supporting Tool for European Regional Development Policies	Set of possible indicators for circular economy policies on the regional level. Divided into 13 specific types of circular economy.
Metabolic	2018	Monitoring voor een circulaire Metropole Regio	Set of head indicators, dashboard indicators and proposed transition indicator for monitoring the circularity of the MRA

Author	Year	Title	Description	Characteristics
Duurzaam GWW	2018	Teksten digitaal ambitieweb toelichting ambitieniveaus voor 12 thema's	Indicator for circular procurement	Circular procurement indicators for (regional governments)
Vallei en Veluwe	2020	Uitwerking- Doelen - Inspanningen - Netwerk - Circulaire Economie	Internal policy document of water authority with goals and aims and indicators to measure their progress	Regional indicators
Royal HaskoningDHV	2020	Routekaart CE Rheden	CE Roadmap of the Municipality of Rheden with KPI's	Regional KPI's
Circulaire Stad	2016	Indicatoren Set City Deal <i>Circulaire Stad</i>	Set of indicators inspired by "monitor brede welvaart" and PBL-document: "Wat we willen weten en wat we kunnen meten"	Regional indicators
Municipality of Amstelveen	2019	<i>Plan voor de energietransitie, circulaire economie en klimaatadaptatie, Samenwerken aan een energieke stad voor onze kinderen</i>	Policy document including indicators for the CE, energy transition and climate adaptation	Regional indicators

APPENDIX 5: LIST OF INDICATORS

Nr.	Indicators	Type of Policy Instrument	Description	Main strategy	R-strategy	Type	Unit	Indicator mentioned by
1	% Reduction primary raw materials	Circular flow indicators	Percentage reduction in materials entering the region	Smarter product use and manufacture	R1	Effect	%	Amstelveen, Metabolic, Citydeal, Internal document water authority
2	Growth of Net Assets	Circular flow indicators	Mass of raw materials	Extended lifespan of product and its parts	R3-R5	Effect	kg	Metabolic, citydeal
3	Rate of reuse	Circular flow indicators	Percentage of reuse	Extended lifespan of product and its parts	R3	Effect	%	Avdiushchenko & Zajac
4	Rate of remanufacturing and refurbishment	Circular flow indicators	Percentage of remanufacturing and refurbishment	Extended lifespan of product and its parts	R4	Effect	%	Avdiushchenko & Zajac
5	Output of raw materials/resources	Circular flow indicators	Materials exiting the region	Useful application of materials	R5	Effect	kg. or ton per capita	Citydeal
6	% Of recyclable materials used in the economy in relation to the total consumption of raw materials	Circular flow indicators	Percentage of recyclable materials used in the economy in relation to the total consumption of raw materials	Useful application of materials	R5	Effect	%	Avdiushchenko & Zajac
7	Tonnage of primary raw material consumption in Ground- Road- Water Works (GRW)	Circular procurement and spatial domain	Tonnage of primary raw material consumption in Ground- Road- Water Works (GRW)	Smarter product use and manufacture	R1	Effect	kg.	RHDHV
8	#, % and / or tonnage of reused products applied in GRW projects	Circular procurement and spatial domain	#, % And / or tonnage of reused products applied in GRW projects	Extended lifespan of product and its parts	R3	Effect	kg.	RHDHV
9	% discarded products that are reused	Circular procurement and spatial domain	Percentage of discarded products that are reused	Extended lifespan of product and its parts	R3	Output	%	RHDHV
10	Average lifetime of products in years	Circular procurement and spatial domain	Average lifetime of procured products in years	Extended lifespan of product and its parts	R3	Output	yr./ product	RHDHV

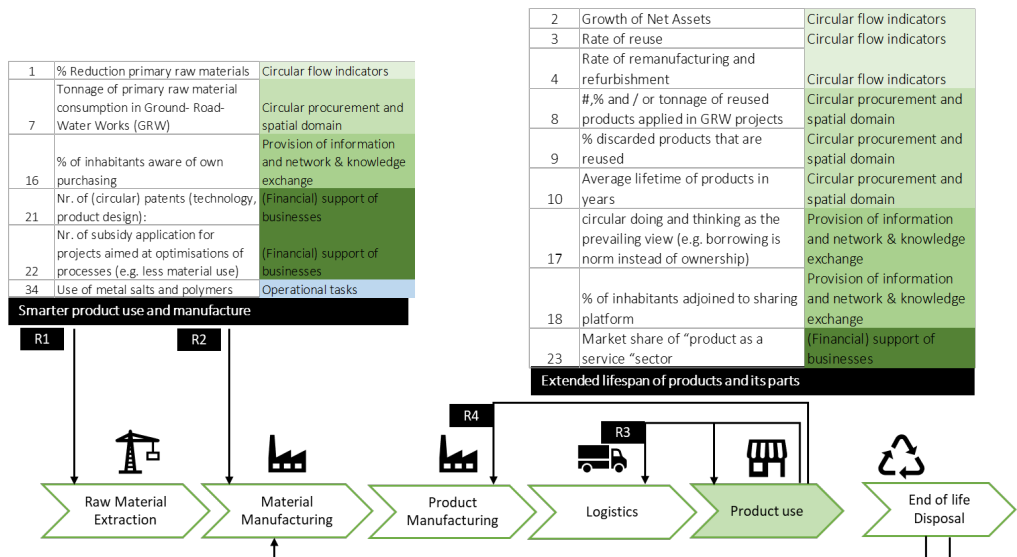
11	Amount of released raw materials to be (re) used	Circular procurement and spatial domain	Amount of released materials to be (re) used in or outside of procurement projects	Useful application of materials	R5	Effect	kg.	Duurzaam GWW
12	Recovery rate of construction and demolition waste	Circular procurement and spatial domain	Percentage of recovered materials from projects	Useful application of materials	R5	Effect	% recovered materials	European commission
13	value of materials in the end of use phase	Circular procurement and spatial domain	Value of materials in the end of use phase	Useful application of materials	R5	Output	€	Duurzaam GWW
14	Quantity from within the project, during execution and / or up to and including demolition, high-quality reusable or released, completely (bio)degradable material.	Circular procurement and spatial domain	Quantity of materials used in projects	Useful application of materials	R5	Effect	kg.	Duurzaam GWW
15	Share of circular procurement	Circular procurement and spatial domain	Share of circular procurement as part of total procurement	Not specific	Not specific	Output	% Circular procurement	Metabolic, Internal Document Water Board, RHDHV, Amstelveen, Potting et al.
16	% of inhabitants aware of own purchasing	Provision of information and network & information exchange	Percentage of inhabitants that are conscious about their own purchasing	Smarter product use and manufacture	R1	Output	%	Metabolic
17	circular doing and thinking as the prevailing view (e.g. borrowing is norm instead of ownership)	Provision of information and network & information exchange	Percentage of inhabitants that view borrowing as default	Extended lifespan of product and its parts	R3	Output	%	Metabolic
18	% of inhabitants adjoined to sharing platform	Provision of information and network & information exchange	Percentage of inhabitants adjoined to a program	Extended lifespan of product and its parts	R3	Output	%	RHDHV
19	Nr. collaboration services platforms	Provision of information and network & information exchange	Number of collaboration platforms	Not specific	R3	Output	Nr.	Potting et al.
20	Linear economy viewed as unacceptable by citizens and businesses	Provision of information and network & information exchange	Degree to which the linear economy is viewed as unacceptable by citizens and businesses	Not specific	Not specific	Output	% Inhabitants, businesses	Metabolic

21	Nr. of (circular) patents (technology, product design):	(Financial) support of businesses	Number of patents related to circularity	Smarter product use and manufacture	R2	Output	Nr.	Potting et al., Metabolic
22	Nr. of subsidy application for projects aimed at optimisations of processes (e.g. less material use)	(Financial) support of businesses	Nr. of subsidy applications for circular projects	Smarter product use and manufacture	R2	Output	Nr.	Metabolic
23	Market share of "product as a service" sector	(Financial) support of businesses	Share of "product as a service sector" as part of the market	Extended lifespan of product and its parts	R3	Output	%	Avdiushchenko & Zajac
24	Patents related to recycling secondary raw materials	(Financial) support of businesses	Patents related to the recycling sector	Useful application of materials	R5	Output	Nr.	Avdiushchenko & Zajac, European commission
25	Nr. of circular start-ups	(Financial) support of businesses	Number of circular start-ups in the region	Not specific	Not specific	Output	Nr.	Potting et al.
26	Nr. Circular jobs	(Financial) support of businesses	Number of circular jobs in the region	Not specific	Not specific	Output	Nr.	Metabolic
27	Share of innovative (circular) enterprises by sector in general enterprises	(Financial) support of businesses	Share of circular enterprises by sector as part of general enterprises	Not specific	Not specific	Output	%	Avdiushchenko & Zajac
28	Number of legal and regulatory barriers to the circular economy removed	Laws and regulation	Number of legal and regulatory barriers to the circular economy removed	Not specific	Not specific	Output	Nr.	Potting et al.
29	Number and description of new laws and regulations, standards that discourage linear practices	Laws and regulation	Number and description of new laws and regulations that discourage linear practices (e.g. resource tax, public circular procurement, resource passport)	Not specific	Not specific	Output	Nr.	Potting et al., Metabolic
30	Recycling rates	Operational tasks	Recycling rates	Useful application of materials	R5	Effect	%	Avdiushchenko & Zajac, European commission, Metabolic
30.1	*recycling rate of municipal waste	Operational tasks	Separated waste as a total share household waste	Useful application of materials	R5	Effect	%	Avdiushchenko & Zajac, European commission, Amstelveen

30.2	*recycling rate of biowaste in kg per capita	Operational tasks	Indirectly measured as the ratio of composted municipal waste (in mass unit) over the total population (in number).	Useful application of materials	R5	Effect	%	Avdiushchenko & Zajac, European commission, RHDHV
30.3	*recycling rate of all waste excepting major mineral waste in %	Operational tasks	Recycled waste (RCV_R) divided by total waste treated excluding major mineral wastes (TRT), multiplied by 100.	Useful application of materials	R5	Effect	%	Avdiushchenko & Zajac, European commission
30.4	*recycling rate of overall packaging waste	Operational tasks	Share of recycled packaging waste in all generated packaging waste.	Useful application of materials	R5	Effect	%	European Commission
30.5	*recycling rate of wooden packaging	Operational tasks	Share of recycled wood packaging waste in all generated wood packaging waste.	Useful application of materials	R5	Effect	%	European Commission
30.6	*recycling rate electrical waste (e-waste)	Operational tasks	Multiplying the 'collection rate' as set out in the WEEE Directive with the 'reuse and recycling rate' set out in the WEEE Directive	Useful application of materials	R5	Effect	%	European Commission
31	(Municipal) waste generated per inhabitant in the region	Operational tasks	Waste generated per inhabitant in the region	Useful application of materials	R5	Effect	kg per capita	Avdiushchenko & Zajac, European commission, RHDHV
32	Material loss (Loss of material values in euros)	Operational tasks	Non-separated waste as a share of total household waste in Euros	Useful application of materials	R5	Effect	kg, €	Metabolic, Citydeal

33	Raw material consumption waste	Operational tasks	The consumption of primary raw materials in the economy, measured throughout the value chain	Useful application of materials	R5	Effect	GVB = sum (mn * recycle percentage * RGE _n)	Metabolic
34	Use of metal salts and polymers	Operational tasks	Use of salts and polymers for the treatment of sewage sludge	Smarter product use and manufacture	R1-R2	Effect	kg/yr.	Internal document water authority
35	Reuse of grass clippings within a 5 km radius	Operational tasks	Reuse of grass for the improvement of soils on agricultural lands within a 5 km radius	Useful application of materials	R5	Effect	kg	Internal document water authority
36	Amount of influent in which materials containing celluloses fibres is removed	Operational tasks	Raw material extraction of celluloses	Useful application of materials	R5	Effect	m ³ /yr.	Internal document water authority
37	Reduced volume of sewage sludge discharged	Operational tasks	The amount of sewage sludge that is considered waste	Useful application of materials	RM	Effect	m ³ /yr.	Internal document water authority

APPENDIX 6: OVERVIEW OF INDICATORS



1	% Reduction primary raw materials	Circular flow indicators
7	Tonnage of primary raw material consumption in Ground- Road-Water Works (GRW)	Circular procurement and spatial domain
16	% of inhabitants aware of own purchasing	Provision of information and network & knowledge exchange
21	Nr. of (circular) patents (technology, product design):	(Financial) support of businesses
22	Nr. of subsidy application for projects aimed at optimisations of processes (e.g. less material use)	(Financial) support of businesses
34	Use of metal salts and polymers	Operational tasks

Smarter product use and manufacture

2	Growth of Net Assets	Circular flow indicators
3	Rate of reuse	Circular flow indicators
4	Rate of remanufacturing and refurbishment	Circular flow indicators
8	#, % and / or tonnage of reused products applied in GRW projects	Circular procurement and spatial domain
9	% discarded products that are reused	Circular procurement and spatial domain
10	Average lifetime of products in years	Circular procurement and spatial domain
17	circular doing and thinking as the prevailing view (e.g. borrowing is norm instead of ownership)	Provision of information and network & knowledge exchange
18	% of inhabitants adjoined to sharing platform	Provision of information and network & knowledge exchange
23	Market share of "product as a service" sector	(Financial) support of businesses

Extended lifespan of products and its parts

Not Specific		
15	Share of circular procurement	Circular procurement and spatial domain
19	Nr. collaboration services platforms	Provision of information and network & knowledge exchange
20	Linear economy viewed as unacceptable by citizens and businesses	Provision of information and network & knowledge exchange
25	Nr. of circular start-ups	(Financial) support of businesses
26	Nr. Circular jobs	(Financial) support of businesses
27	Share of innovative (circular) enterprises by sector in general enterprises	(Financial) support of businesses
28	Number of legal and regulatory barriers to the circular economy removed	Laws and regulation
29	Number and description of new laws and regulations, standards that discourage linear practices	Laws and regulation

Useful application of materials		
5	Output of raw materials/resources	Circular flow indicators
6	% Of recyclable materials used in the economy in relation to the total consumption of raw materials	Circular flow indicators
11	Amount of released raw materials to be (re) used	Circular procurement and spatial domain
12	Recovery rate of construction and demolition waste	Circular procurement and spatial domain
13	value of materials in the end of use phase	Circular procurement and spatial domain
14	Quantity from within the project, during execution and / or up to and including demolition, high-quality reusable or released, completely (bio)degradable material.	Circular procurement and spatial domain
24	Patents related to recycling secondary raw materials	(Financial) support of businesses
30	Recycling rates	Operational tasks
30.1	*recycling rate of municipal waste	Operational tasks
30.2	*recycling rate of biowaste in kg per capita	Operational tasks
30.3	*recycling rate of all waste excepting major mineral waste in %	Operational tasks
30.4	*recycling rate of overall packaging waste	Operational tasks
30.5	*recycling rate of wooden packaging	Operational tasks
30.6	*recycling rate electrical waste (e-waste)	Operational tasks
31	(Municipal) waste generated per inhabitant in the region	Operational tasks
32	Material loss (Loss of material values in euros)	Operational tasks
33	Raw material consumption waste	Operational tasks
35	Reuse of grass clippings within a 5 km radius	Operational tasks
36	Amount of influent in which materials containing celluloses fibres is removed	Operational tasks
37	Reduced volume of sewage sludge discharged	Operational tasks

