



Flanders
State of
the Art

PUB. N°

4

**CE CENTER
CIRCULAR
ECONOMY**

POLICY RESEARCH
CENTRE

Towards a circular economy monitor for Flanders: a conceptual basis

Conclusions of stakeholder workshop
June 27, 2018

WE MAKE
TOMORROW
BEAUTIFUL
OVAM

DEPARTMENT OF
ECONOMY
SCIENCE &
INNOVATION

ce-center.be



CE CENTER CIRCULAR ECONOMY

POLICY RESEARCH
CENTRE

PUB. N°

4

Towards a circular economy monitor for Flanders: a conceptual basis

Conclusions of
stakeholder workshop
June 27, 2018

January 2019

CE Center publication N° 4

Contact information:

Luc Alaerts

manager Policy Research Centre

✉ luc@vlaanderen-circulair.be

☎ +32 16 324 969

Karel Van Acker

promoter Policy Research Centre

✉ karel.vanacker@kuleuven.be

☎ +32 16 321 271

Luc Alaerts

Sustainable Assessment of Materials, KU Leuven
Kasteelpark Arenberg 44, 3001 Leuven, Belgium

Karel Van Acker

Sustainable Assessment of Materials, KU Leuven
Kasteelpark Arenberg 44, 3001 Leuven, Belgium
Center for Economics and Corporate Sustainability (CEDON), KU Leuven
Warmoesberg 26, 1000 Brussel

Sandra Rousseau

Simon De Jaeger

Center for Economics and Corporate Sustainability (CEDON), KU Leuven
Warmoesberg 26, 1000 Brussel

Gustavo Moraga

Jo Dewulf

Department of Green Chemistry and Technology, Ghent University Coupure
Links 653, 9000 Gent, Belgium

Steven De Meester

Department of Industrial Biological Sciences, Ghent University
Graaf Karel de Goedelaan 5, 8500 Kortrijk, Belgium

Steven Van Passel

Departement Engineering Management, UAntwerpen
Prinsstraat 13, S.B.124, 2000 Antwerpen, Belgium

Tine Compennolle

Departement of Economics, UAntwerpen
Prinsstraat 13, S.B.124, 2000 Antwerpen, Belgium

Kris Bachus

Research Group Sustainable Development, HIVA, KU Leuven
Parkstraat 47 bus 5300, 3000 Leuven, Belgium

Karl Vrancken

Unit Sustainable Materials, VITO
Boeretang 200, 2400 Mol, Belgium
Department of Bio-Engineering Sciences, UAntwerpen
Groenenborgerlaan 171, G.V.621b, 2020 Antwerpen, Belgium

Johan Eyckmans

Center for Economics and Corporate Sustainability (CEDON), KU Leuven
Warmoesberg 26, 1000 Brussel

Towards a circular economy monitor for Flanders: a conceptual basis

Luc Alaerts^a, Karel Van Acker^{a,b}, Sandra Rousseau^b, Simon De Jaeger^b, Gustavo Moraga^c, Jo Dewulf^c, Steven De Meester^d, Steven Van Passel^e, Tine Compennolle^f, Kris Bachus^g, Karl Vrancken^{h,i}, Johan Eyckmans^b

^a Sustainable Assessment of Materials, KU Leuven, Kasteelpark Arenberg 44, 3001 Leuven, Belgium

^b Center for Economics and Corporate Sustainability (CEDON), KU Leuven, Warmoesberg 26, 1000 Brussel

^c Department of Green Chemistry and Technology, Ghent University, Coupure Links 653, 9000 Gent, Belgium

^d Department of Industrial Biological Sciences, Ghent University, Graaf Karel de Goedelaan 5, 8500 Kortrijk, Belgium

^e Departement Engineering Management, UAntwerpen, Prinsstraat 13, S.B.124, 2000 Antwerpen, Belgium

^f Departement of Economics, UAntwerpen, Prinsstraat 13, S.B.124, 2000 Antwerpen, Belgium

^g Research Group Sustainable Development, HIVA, KU Leuven, Parkstraat 47 bus 5300, 3000 Leuven, Belgium

^h Unit Sustainable Materials, VITO, Boeretang 200, 2400 Mol, Belgium

ⁱ Department of Bio-Engineering Sciences, UAntwerpen, Groenenborgerlaan 171, G.V.621b, 2020 Antwerpen, Belgium

Summary

In this document the concept for the circular economy monitor to be developed in the Policy Research Centre Circular Economy is explained in detail. This concept is the result of combining academic expertise, literature insights, feedback from policy officers and developments at the international scene. It has been discussed with and accepted by an audience of policy, sector and societal stakeholders at a workshop held at June 27, 2018.

The circular economy monitor is essentially composed of three levels:

- A macro level composed of indicators focusing on society-wide material flows and associated environmental, economic and social impacts connected to the Flemish region, including the effects outside the Flemish borders.
- A meso level composed of indicators focusing on the achievement of circular economy in particular systems to fulfill needs.
- A micro level featuring a set of specific products and services, meant to establish a representative and broad sample of our daily consumption and that is also relevant considering the circular economy transition.

The central appearance of systems to fulfill needs in the context of circular economy monitoring is relatively new. They do not at all appear in current monitoring frameworks, and are only suggested a few times in literature, especially in the broader context of sustainable consumption. The concrete measurement of such systems has still to be developed. In this sense it is an ambitious choice, but justified by the consulted sources and the opinions of stakeholders. There are a number of clear advantages of this perspective:

- As the fulfillment of needs is empowered by products and services, a bridge between the micro and the macro level is provided. This allows policy makers to trace the effects of innovation and policy that start at the micro level already in an early stage, and to see how the economy at a broader level will be affected over time.
- Models of production and consumption play a major role in the way products and services are used to fulfill needs. By a focus in the monitor on systems that fulfill needs, a clear position is created for circular business models, an aspect that up to now has received little or no attention in monitoring.
- Also, the consumer perspective is put at the forefront, an aspect that up to now has neither received much attention in the context of circular economy monitoring. Moreover, it is expected to reflect well the cross-sectoral nature of the circular economy transition. On the other hand, the production perspective is also present in the products and services that are to be considered more closely.
- The feedback obtained via the monitor is more direct compared to scores of existing macro indicators in which circular economy would only become visible from the

moment it has grown substantially large, and which are updated infrequently and late. The suggestions for indicators in the exemplary elaboration of monitoring of mobility as a system are largely based on data that are available in the administration on yearly basis, and sooner after the closing of a year. Also, the link with the specific products and services in the monitor allows to detect evolutions at the micro level.

Overall, the idea of circular economy is to keep products and materials in use at the highest application level as long as possible while decreasing environmental impacts. The result of the different manifestations of this will be visible in the monitor, and will be set against developments in the fulfillments of societal needs themselves. In this way the role that circular economy will and can play in staying in the safe zone with respect to planetary and societal boundaries will be monitored.

Samenvatting

In deze tekst wordt het concept voor de circulaire economie monitor, in ontwikkeling binnen het Steunpunt Circulaire Economie, in detail uiteengezet. Dit concept is het resultaat van de combinatie van academische expertise, inzichten vanuit de literatuur, feedback van beleidsmedewerkers en ontwikkelingen op het internationale toneel. Het is bediscussieerd met en aanvaard door een publiek van vertegenwoordigers van diverse beleidsdomeinen, sectoren en maatschappelijke organisaties op een workshop die plaatsvond op 27 juni 2018.

In essentie bestaat de circulaire economie monitor uit drie niveaus:

- Een macroniveau bestaande uit indicatoren die focussen op maatschappijbrede materiaalstromen en de bijbehorende milieu-, economische en sociale impacten verbonden aan Vlaanderen als regio, met inbegrip van de effecten buiten de Vlaamse grenzen.
- Een mesoniveau samengesteld uit indicatoren die focusen op het tot stand komen van circulaire economie in specifieke systemen die behoeften invullen.
- Een microniveau met een set van specifieke producten en diensten, met als bedoeling een representatieve en brede staalname van onze dagelijkse consumptie voor te stellen die tegelijk relevant is met betrekking tot de circulaire economie transitie.

Het centraal stellen van systemen die behoeften invullen in de context van circulaire economie is relatief nieuw. Dit komt niet aan bod in de huidige monitoring frameworks, en slechts enkele keren is er sprake van in de literatuur, vooral in de bredere context van duurzame consumptie. De concrete monitoring van dergelijke systemen moet nog ontwikkeld worden. Daardoor is het een ambitieuze keuze, maar ze is gerechtvaardigd door de geraadpleegde bronnen en de opinies van stakeholders. Het monitoren van circulaire economie door middel van systemen die behoeften invullen biedt de volgende voordelen:

- Aangezien het invullen van behoeften gebeurt via producten en diensten, wordt er op die manier een verbinding gemaakt tussen het micro- en het macroniveau. Dit laat toe aan beleidsmakers om de effecten van innovatie en beleid die starten op het microniveau al in een vroeg stadium waar te nemen, en om te zien hoe de economie op een breder niveau beïnvloed wordt doorheen de tijd.
- Modellen van productie en consumptie spelen een belangrijke rol in de manier waarop producten en diensten gebruikt worden om behoeften in te vullen. Door in de monitor te focussen op systemen die behoeften invullen is er een duidelijke plaats gecreëerd voor circulaire businessmodellen, een aspect dat tot nog toe nauwelijks of niet aan bod gekomen is in monitoring.
- Daarnaast wordt het consumptieperspectief vooraan gezet, een aspect dat tot nu toe eveneens weinig aandacht gekregen heeft in circulaire economie monitoring. Daarenboven wordt op deze manier de sectoroverschrijdende aard van de circulaire

economie transitie goed weergegeven. Het productieperspectief is dan weer aanwezig in de producten en diensten die nader beschouwd worden.

- De feedback verkregen via de monitor is meer rechtstreeks in vergelijking met scores van bestaande macro indicatoren waarin de circulaire economie pas zichtbaar zou worden van zodra die voldoende groot geworden is, en die maar heel af en toe en na een lange tijd geupdated worden. De suggesties voor indicatoren in de exemplarische uitwerking van de monitoring van mobiliteit als systeem zijn grotendeels gebaseerd op gegevens die in de administratie beschikbaar zijn op jaarlijkse basis, en sneller na afloop van een jaar. Ook de link met de concrete producten en diensten in de monitor laat toe om evoluties op het microniveau te detecteren.

De uiteindelijk idee achter circulaire economie is om producten en materialen in gebruik te houden op het hoogste toepassingsniveau en dit zo lang als mogelijk, terwijl de milieu-impact verminderd wordt. Het resultaat van de verschillende manieren waarop dit kan gebeuren zal zichtbaar zijn in de monitor, en zal naast ontwikkelingen in de invulling van de maatschappelijke behoeftes zelf geplaatst worden. Op deze manier wordt de rol die circulaire economie zal en kan spelen in het navigeren binnen de veilige zone voor wat betreft de planetaire en maatschappelijke grenzen gemonitord.

Table of contents

1. Introduction	8
2. Circular economy: what and why?	8
3. Measuring circular economy	10
4. Existing monitoring frameworks	12
5. Gaps in monitoring	14
6. Research at the policy research centre	15
7. Monitoring circular economy in Flanders: considerations	17
7.1 A monitor, not an index	17
7.2 A monitor for Flanders, with an eye on Europe	17
7.3 'Circularity' and effects	18
7.4 Monitoring at different levels	19
8. Systems to fulfill needs	22
8.1 Products and services fulfill functions	22
8.2 The bridge between macro and micro	24
8.3 The meso level in the circular economy monitor	27
8.4 A preview on the circular economy monitor	27
9. Conclusions and next steps	29
References	31

Towards a circular economy monitor for Flanders: a conceptual basis

1. Introduction

In the research program of the Policy Research Centre Circular Economy (Steunpunt Circulaire Economie), which has taken off in 2017, one of the key deliverables is a circular economy monitor for Flanders by 2021. The first stage of the corresponding research line was dedicated to understanding the challenge by taking in insights from literature and from existing data and the perspectives of diverse stakeholders. The idea behind this approach was to create a shared understanding of and agreement on a number of considerations and decisions that need to be made in order to smoothly evolve towards the delivery of a circular economy monitor that will be built with specific indicators and data in the next stages of the research. This first stage is now concluded, and the resulting concept for a circular economy monitor is presented in detail in this document.

In the first sections of the paper, a general introduction is provided starting with a perspective on circular economy and the corresponding monitoring challenge. Next, three existing monitoring frameworks for circular economy are described in order to provide a state-of-the-art view of the field and as an input to the gap analysis in the next chapter. Then, a subsequent chapter is dedicated to the research in the Policy Research Centre Circular Economy focused on the monitoring of circular economy and contains a detailed description of all activities in the first research stage in order to give more insight into the backgrounds and basis behind the concept for a circular economy monitor.

Then, a section explains the main considerations and decisions in the development of the concept. This helps to understand how the circular economy monitor will eventually be tailored to fit the initial question, the desires of the primary users and the (international) context of circular economy and policy developments therein.

Finally, the concept of the circular economy monitor is elaborated. During the following research stages, the concept will be materialized according to the concrete indicators and data that will be further selected. An outlook on these future activities is provided.

2. Circular economy: what and why?

To provide clarity on the scope of our monitoring activities, the first question is how we define the term circular economy. There are in fact many different definitions of circular economy. Only a minority make explicit links to sustainability or to a systemic shift (Kirchherr et al., 2017). In Flanders circular economy is clearly framed as a transition, being one of the seven transition priorities set by the Flemish government in its long-term strategy towards 2050

(Flemish government, 2016). Hence in our plans to measure circular economy, we want to align with this broader vision and we aim to measure beyond the narrow reduce-reuse-recycle themes and to make a link to what can be the broader outcomes of circular economy.

The central element of circular economy is to maintain products and materials at their highest application level as long as possible – while minimizing the environmental impact. This is in contrast to current linear economy, where products and materials are consumed at a high rate and end up as waste, and as such require mining of large amounts of virgin raw materials. This has brought us up to today clear benefits at the expense of the environment. Our resource consumption has brought us in the danger zone with respect to a number of planetary boundaries, including biodiversity loss, climate change and the global nutrients balance. Moreover, the benefits are not equally distributed in society. Hence current linear economy displays a double shortcoming (Figure 1) (Raworth, 2017).

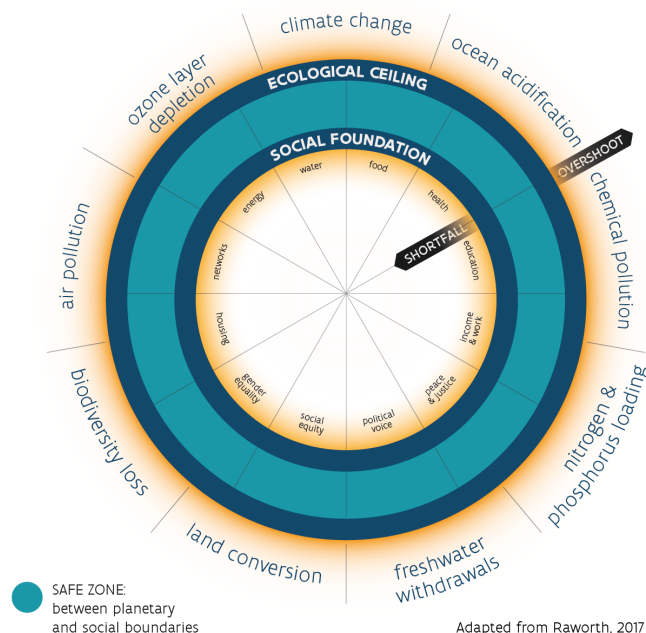


Figure 1: Representation of the safe and just zone for the economy to develop within, in between planetary and social boundaries (adapted from Raworth, 2017).

The link between these planetary and social boundaries and the potential of circular economy can be illustrated with the following examples:

- Our resource consumption does not only have adverse environmental effects in the mining and the waste phase, but also during the production and consumption phase. Recent research from the OECD has demonstrated that more than half of our carbon emissions are directly linked to the way we produce, store, transport and discard our products and materials (OECD, 2012).
- The critical situation with respect of particular rare metals may become a major obstacle for delivering the technologies required for making the transition to a low-

carbon society (Du and Graedel, 2013; Nassar et al., 2015). By extension, the high level of technological development that currently determines our high standards of living, e.g. with respect to health and communication, requires a very high input of virgin materials.

- Shortages in essential raw materials for human existence like water are in particular regions hampering human development and carry the risk of social unrest and violence.

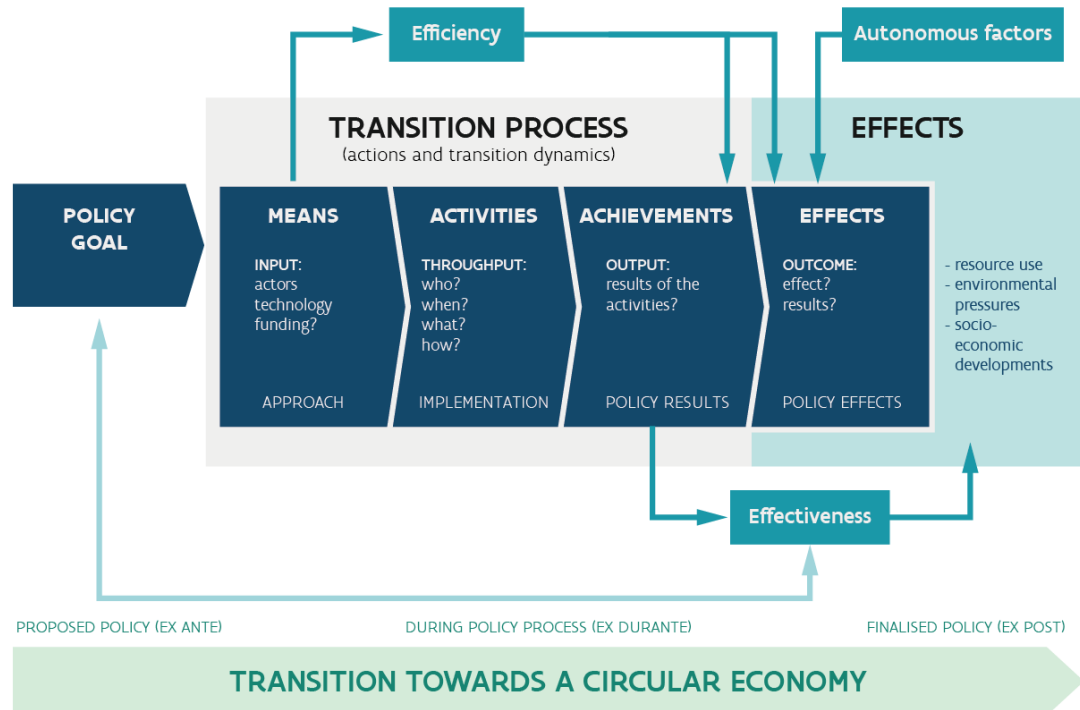
There are many more of this kind of examples that clearly demonstrate the link between maintaining products and materials at their highest application level as long as possible on the one hand and both ecological boundaries and wellbeing on the other hand. They all lead to the conclusion that we need circular economy, in order to deal with our raw materials and products in smarter and more efficient ways on the way towards a sustainable alternative to the current model (de Wit et al., 2018; Material Economics, 2018).

3. Measuring circular economy

In order to get to circular economy, our society needs to undergo a systemic shift. Management of such a transition is complex. Already many governments have shown an interest in making this transition, and for policy makers it will become more and more important to have tools available that allow to assess the directions in which society is evolving. As such, Flemish policy makers are considered as the primary target audience for the circular economy monitor that will be developed, as they should eventually use the circular economy monitor and feed it with data to know whether Flanders is on the right track towards circular economy. The circular economy monitor should also be able to provide input for continuous change via policy interventions directed towards production and consumption patterns. By presenting consistent data on the transition towards circular economy, feedback on policy will be available, and areas for further action may become visible. Moreover, monitoring circular economy will also provide information to diverse actors, in order for them to recognize the potential roles they can play and the needs they may have for contributing to the circular economy transition. Besides, on a broader societal level, the monitor will further allow policy makers to assess to which extent circular economy is affecting environment, economy and society (Reichel et al., 2016).

Hence there are many aspects that could be envisaged in order to monitor the transition to circular economy. In the context of a societal transition, the following scopes would be desirable (Vercalsteren, 2018):

- Indicators able to monitor all phases of the transition: the *inputs and activities* to make the transition happening, the manifestations of maintaining products and materials at their highest application level (e.g. via the circulation of materials, the closing of cycles, life time extension, efficiency of cycles) as a direct result (the *output*) and also the eventual economic, environmental and social *outcomes* (see Figure 2) (Smol et al., 2017; Potting et al., 2018).



Source: Netherlands Environmental Assessment Agency 2018, Netherlands Court of Audit 2005, adaptation by Circular Flanders

Figure 2: Assessment framework for measuring the progress of the transition towards a circular economy (adapted from Potting et al., 2018).

- As the aim is to monitor a transition, going for *macro* indicators that describe what happens at society-wide level (the country or region that is encompassed) is evident. But also indicators at meso and micro level are needed. The *meso* level could for instance concern the level of smaller regions, economic (sub)sectors, product groups, industrial symbioses etc. and the *micro* level goes down to circularity of particular products and services. At these levels evolutions towards circular economy will be noticeable in a much more direct way, and policy measures and innovation in the context of circular economy will materialize much sooner than at the macro level (Potting et al., 2017). This makes monitoring at these levels indispensable to complement the macro level of monitoring.
- The circular economy transition is evidently rooted in *technology*: due to the complexity of our materials and products, technology is at the core of the transition, for instance when it comes to design and recycling. Then the measurement of stocks and flows of materials at the macro level and of product properties at the micro level can be considered. But the transition also clearly includes *socio-institutional* changes in which technology is not key but rather plays a secondary or supporting role (Potting et al., 2017). An example is the emergence of the sharing economy: for this to happen the availability of mobile networks has been crucial, but mobile networks have not been developed for the prime purpose of facilitating sharing, they rather have had a supporting role. Hence it is also important to have reflections of aspects beyond technology and material flows in the monitor, for instance the innovations in models of product and consumption, in product design, and socio-institutional evolutions.

Given these scopes of the space to be measured, the question is what can be measured already today, and based on which data this can be done. This is reflected in the currently available monitoring frameworks for circular economy, discussed in the next paragraph.

4. Existing monitoring frameworks

From the moment that the idea of circular economy was progressing to become the subject of societal transition, the question how to monitor its progress has arisen, in some cases even on direct request of governments (Potting et al., 2017). Initial analyses have been presented on the measurement question, and guidance principles for development and selection of indicators have been suggested (Potting et al., 2017; Reichel et al., 2016). While in these documents the focus was on phrasing adequate diagnostic questions, also some elements of conceptual visions on how to measure circular economy were already discernible throughout these proposed lists of questions. For instance, in the report of the European Environmental Agency, the subsequent steps in the lifetime of a product, from material input to waste and recycling, were central (Reichel et al., 2016). In the Dutch approach, in addition to these steps also the inputs needed for and the effects of the transition were included (Potting et al., 2017).

Very quickly the search for indicators and for monitoring systems intensified. On the one hand the need for indicators was extended towards more and more diverse aspects, like cities, regions and projects – see for instance initiatives like the Urban Agenda or the Horizon2020 project SCREEN.¹ Furthermore, more and more monitoring tools, frameworks, scorings etc. are being published (Vercauteren, 2018). On the other hand the first monitoring frameworks for countries became available. As the region of Flanders can be considered in a similar way as a country in terms of monitoring, we discuss below more in detail the frameworks available for European countries:

- In 2017 the French government published a monitoring framework consisting of ten indicators in three main areas: waste management, supply from economic stakeholders and the consumer side (Magnier et al., 2017). The results are presented as a dashboard with colors indicating progress. Comparisons at the European level are made according to data availability. Five of the indicators are about materials and waste. With the exception of food waste, the underlying data availability is very good. The other indicators try to assess more concrete manifestations of circular activities, but this appeared to be less straightforward with respect to data collection and/or the link with circular economy. For instance, with respect to counting ecolabels or ecological projects, next to the challenge of the counting itself (how to be complete, what to include, how to avoid double-counting, is merely counting the appropriate way to reflect the size), also the link with circular economy is more difficult to make.
- In 2018 the Netherlands Environmental Assessment Agency published a monitoring framework with an in-depth analysis on the monitoring challenge (Potting et al., 2018). The report provides a thorough description of what would ideally be measured in order to cover all aspects of circular economy in all the stages of the transition, and in a

¹ Urban Agenda: see <https://ec.europa.eu/futurium/en/circular-economy/better-knowledge-draft-action-11-develop-city-indicators-circular-economy> (accessed on October 2, 2018); for the SCREEN project, see <http://www.screen-lab.eu/> (accessed on October 2, 2018).

subsequent step the proposed framework is nourished with data available today as far as possible. The conclusion of this exercise is that currently at the macro level a number of aspects with respect to the flows of materials in a circular way and the wider effects of this can already be measured. This combination allows to assess a few aspects of the recent course of the Dutch economy in light of circular economy. Moreover, a further elaboration at the level of five priority sectors in the Dutch economy with respect to circular economy was made, in alignment with agreements between those sectors and the government on transition agendas (the so-called *Grondstoffenakkoord*²). Further, the authors indicate two clear avenues for future work: indicator development beyond output and outcome, e.g. on money, people, initiatives and actions dedicated for the transition, and the incorporation of monitoring at the micro level. The argument for both avenues was to be able to obtain a clear and more direct response of the monitoring framework on circular economy progress. The initial stages of the circular economy transition are difficult to monitor with the currently available macro indicators focusing on output and outcome, as results and effects have not been materialized yet and the changes in economic activities are very small compared to the economy as a whole.

- Also in 2018, the European Commission published a monitoring framework, based on ten main indicators grouped in the themes production and consumption, waste management, secondary raw materials and competitiveness and innovation (European Commission, 2018). Two clear choices were made from the start of the development: to keep the effects in other domains (like the environment), and to make the best use of existing data in order to not increase administrative burdens for companies and governments. The result of the former choice is that the framework reflects mostly the output-side of circular economy, while neither the input nor the outcome sides are dealt with. The latter choice is reflected in the fact that the majority of the indicators has been borrowed from other existing frameworks at the European level, e.g. the Waste Framework Directive, the Raw Material Scoreboard and the Resource Efficiency Scoreboard (Moraga, 2018). As it will take some time before the results of the actions on circular economy will become visible in the statistics, the first idea of the monitoring framework was also the establishment of baselines. Two indicators (food waste and green public procurement) are not available yet due to data unavailability and will be developed in the near future. To the extent that data availability allows it, the indicator scores are also available at country level via the Eurostat website³.

The overall resemblance in these three monitoring frameworks is the appearance of a number of macro indicators on materials, waste and recycling, like direct material input, amount of municipal waste per capita, recycling rates etc. These indicators are supported by readily developed data, as a consequence of a long-standing previous policy focus in the context of waste and materials. Also, in none of the frameworks any attempt was undertaken to summarize the monitoring into a single score; in the Dutch and the European frameworks this was explained as a deliberate choice.

² See <https://www.circulair economienederland.nl/grondstoffenakkoord/default.aspx> (accessed on October 2, 2018)

³ See <https://ec.europa.eu/eurostat/web/circular-economy> (accessed on October 2, 2018)

The differences between the existing frameworks are in the way the aspects of circular economy currently not covered by data are treated, more specifically in the conceptual design of the monitoring systems. The French system was developed as a menu and tried to address the data limitations by reserving a large part of the monitoring system by proxy indicators. The Dutch report has elaborated circular economy monitoring in a more in-depth way, by defining the different dimensions to monitor the transition from input to outcome and by highlighting the added value of micro monitoring. The Dutch focus is on shaping future developments in monitoring, as the authors chose to provide suggestions for further work rather than selecting preliminary indicators not fully matching the monitoring objectives. As for the monitoring framework of the European Commission, the scope was narrowed in advance and the majority of the chosen indicators were borrowed from existing frameworks. Two of the indicators will need further elaboration in order to deliver scores, despite the intention not to increase administrative burdens.

In conclusion, data availability is a clear bottleneck for monitoring circular economy (EASAC, 2016; Reichel et al., 2016). Moreover, the conceptual basis and scope of a monitoring system are crucial because they determine the feasibility to deal with information in those areas where data are not available for circular economy.

5. Gaps in monitoring

The previous paragraph revealed that the currently available monitoring systems have significant imperfections, due to either data availability or a narrow scope of aspects incorporated. Consequently, at the moment it is not possible to measure in a satisfactory way the progress and the impacts of circular economy. If future circular economy policies were supported by only this kind of data, a number of risks would arise. Most probably the profitability of e.g. material efficiency and use of waste would improve considerably, but with a serious risk of not directing the course of economy within planetary and social boundaries (Raworth, 2017). Think for instance of a material footprint completely exported to regions outside Europe, or increased carbon dioxide emissions connected with industrial and logistic activities of a recycling sector that has grown very large. Besides, the time lag for seeing clear results of circular economy would be unacceptably large: monitoring would only start to reflect on circular economy from the moment it has grown already considerably large. Also, the time lag for updates of the datasets underlying macro indicators is considerable. This means that meaningful feedback information for making policy decisions would arrive late.

The above examples refer to elements that are either missing from the aforementioned frameworks, or elements that are only considered in a limited way. It is good to first determine what is really missing, and next to try to build a monitoring framework amenable for incorporation of these aspects in the best possible way. The following aspects would be valuable for elaboration in order to better reflect the progress of circular economy:

- A way to provide a link between micro and macro indicators. While there is a lot of literature on the development of micro indicators, it is currently not clear how they could be related to the macro level (Vercalsteren et al., 2018). The added value of the micro level is that both policy interventions and innovative practices are materialising there first, offering the opportunity to obtain more direct feedback.

- A way to assess the development and the potential of circular business models. Monitoring these elements would allow policy makers to see whether progress is made away from the current linear way of doing business where the transfer of a product is central. Taking circular business models into account in monitoring is essential (Reichel, 2016), but is currently not often considered (Kirchherr, 2017).
- A way to make the link with the possible impacts of circular economy on people, planet and society, including impacts outside the own territory. Some examples of the added value of making this link are demonstrated in the Dutch monitoring framework at the macro level, as it allows to draw conclusions on the extent to which the material consumption was shifted to other countries (Potting, 2018), thus creating international externalities or spillovers (Bachus et al., 2018).
- A way to give a more prominent place to circular economy strategies beyond recycling. There are only a few indicators in the above frameworks referring to this, for instance the indicator on reuse of WEEE in the EU monitoring framework (European Commission, 2018) and two indicators in the French framework on household spending on maintenance and repair, and on car-sharing (Magnier et al., 2017). The potential for material and energy savings of such circular economy aspects is much larger compared to recycling (Potting, 2017).

6. Research at the policy research centre

In the research project dedicated to develop the circular economy monitor, a number of key activities were highlighted at the onset of the project, e.g. the selection of a set of products to serve for monitoring at the micro level, data gathering, indicator development and stakeholder involvement. These elements were converted into a phased approach for developing the monitor. The first phase was reserved for broad idea generation and stakeholder interaction focusing on the challenge to develop the circular economy monitor, to be followed by subsequent phases in which we will explore step by step how to fill up the monitor with data and indicators. For the initial phase, sufficient time was reserved, in order to allow to explore expectations and needs at the level of stakeholders, to pick up ongoing developments in the field, and to assess different conceptual options. This approach was considered essential in order to guarantee smooth progression throughout the remainder of the project: with a well-founded and agreed concept, the need of rediscussing the considerations and decisions at the basis of the work at later moments would be minimized. These considerations and decisions are explained in section 7. In order to clarify the approach, the main research activities of the first phase are listed below (Figure 3):

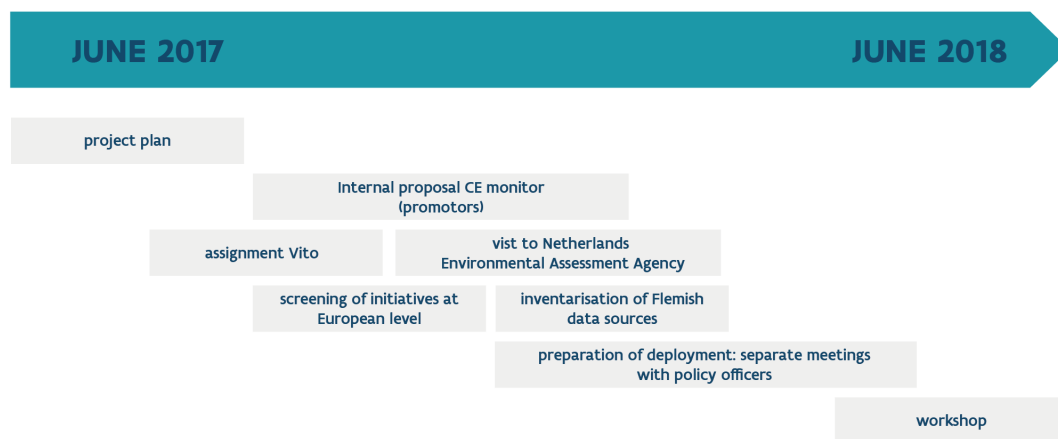


Figure 3: Overview of the research activities in the first phase of the development of the circular economy monitor.

- The promotors and researchers involved in the policy research centre, who have ample expertise in the domains economy, engineering and systems thinking, and with experience in many projects with topics in the context of material management, contributed in the preparation of an internal draft proposal of how the monitor could be shaped. For this activity, three meetings were organized, and the proposal was consecutively improved by each time restarting the discussion with the open points of the previous meeting.
- VITO, as partner institution connected to the policy research centre, was requested to make a review on existing indicators on circular economy, with a focus on what is available in generally accepted monitoring frameworks and in upcoming developments. Based on this overview, the authors made a gap analysis and identified some remaining challenges with respect to monitoring (Vercalsteren et al., 2018).
- Developments at the international level were closely followed up. The most important events were the launches of the three monitoring frameworks discussed in more detail in section 4. These were studied and discussed in detail with the researchers focusing on indicators (Moraga, 2018). A visit to the Netherlands Environmental Assessment Agency was organized shortly after the release of their monitoring framework. This was an occasion for an in-depth discussion and an exchange of views on circular economy monitoring.
- An inventory of data sources available at the level of the Flemish and the Belgian federal administration was compiled from a meeting with the relevant policy experts. This allowed to see the monitoring challenge from the user side: instead of considering possible indicators and determining the data need, available data could perhaps inspire further indicator development.
- After all of the above actions, the internal draft proposal was further modified and elaborated. This new version was next discussed in separate meetings with policy officers closely involved with the policy research centre and/or with a particular focus

on environmental and economic indicators. These policy experts were from the following departments: Minaraad (Flemish advice council on environment), Departement EWI (Flemish policy department on economy, science and innovation), Departement Omgeving (Flemish policy department on environment) and OVAM (the waste and materials agency of Flanders – more in particular the divisions on data and monitoring, policy innovation and the transition team of Circular Flanders).

- The final step of this first project phase was a stakeholder workshop held at June 27, 2018. The aim of the workshop was to expose the concept to an audience of primary stakeholders and to brainstorm how it could be nourished with indicators and data, as an input for the next phase in the project. For this workshop a diverse range of 34 policy officers and sector and societal representatives were involved. In this meeting the concept of the circular economy monitor was presented, followed by an extended discussion allowing to include direct feedback and concerns, and a series of scenario building exercises in subgroups resulting in proposals what could be possible indicators. The current paper has also been sent to the participants to the workshop in order to allow an extra occasion for feedback before definitive issuing.

The remainder of this paper contains a detailed description of the conceptual proposal, elaborated with the insights and feedbacks collected during and after the workshop. First a number of relevant considerations and choices will be clarified, and next the concept of the circular economy monitor will be explained.

7. Monitoring circular economy in Flanders: considerations

7.1 A monitor, not an index

Circular economy contains many dimensions, as already explained above. As we have the ambition of clearly reflecting all these dimensions, we made the clear choice to go for a circular economy monitor, not an index⁴. This monitor will be a scoreboard with indicators, and the activity of monitoring comes down to tracking the evolution of indicator scores throughout time, which could be for instance annually. In fact the monitoring frameworks for circular economy that have already been published seem to have incorporated a similar consideration (see section 4).

7.2 A monitor for Flanders, with an eye on Europe

As policy makers and actors in Flanders will be the primary end-users of the monitor, a focus on this region is evident in the monitor. However, making a monitor strictly and only applicable for Flanders may not be fully desirable. There are a number of benefits connected both to taking advantage of Flemish data and initiatives and to connect with the interregional and international scene. As both are valuable, we try to keep a balance in the development of the monitor while not forgetting to reflect to a sufficient extent the situation in Flanders.

⁴ Going for an index would mean that the progress of circular economy is to be eventually summarized in a single number, to be set against a reference (see the inflation index as a common example).

Within Flanders datasets are being collected already, and insights in data collection and interpretation are continuously growing at the side of policy.⁵ Hence optimal use can be made from these sources. Also other developments are taking place at the Flemish level in the context of monitoring, see for instance initiatives in the context of the Sustainable Development Goals and the Monitor Green Economy (Vizier 2030; Beyst and Daneels, 2016). For those running initiatives it may be interesting to align the activities planned in the policy research centre.

On the other hand the economy of Flanders is open: there is a large proportion of import and export in the material flows. This is due to the relatively large size of the Flemish industrial sectors, the large amount of companies operating internationally and the relatively small size of the territory. This reality needs to be reflected in the monitor as well, in order to make sure that the efforts of companies operating in international circular economy can be recognized as well.

Also the amenability of the monitor for use for other regions or countries could bring advantages. In fact a monitoring framework also bears a vision on how the circular economy transition is to be conceived – as such it contains a reflection of the policy vision on circular economy. If the concept and the constituents of the circular economy monitor developed for Flanders can be smoothly translated to other regions and countries, especially within Europe, the Flemish vision on the circular economy transition could be promoted better at the European policy level and serve as an input to policy developments at this level.

As a remark, within the current policy research project explicit benchmarking with other regions or countries is not planned – but ideally the key elements of the monitoring framework should be amenable for such activities, if and when benchmarking would become desirable in another context.

7.3 ‘Circularity’ and effects

In the monitor we will focus on the output and the outcome of the circular economy transition. The former is about manifestations of products and materials being maintained at their highest application level (e.g. via circulation of materials, closing of cycles, life time extension, efficiency of cycles) and the latter about the associated impacts. Considering both elements is crucial in order to make sure that the circular economy monitor is also able to tell whether we are heading towards desired impacts. Only focusing on the output leaves the question unanswered what will be the impacts, and only focusing on impacts would not allow to conclude what is the share of circular economy in the results (and hence the success and the usefulness of the respective policy efforts). Of course these desired impacts need to be described more exactly. In terms of sustainability, it is important to include outcome indicators that shed a light on economy, environment and society, in order to have a balanced view. So the circular economy monitor will in part also contain elements of a broader sustainability monitor.

⁵ As an example, see the publications on sustainable management of copper and aluminium in Flanders, available online via <https://www.ovam.be/afval-materialen/materiaalbewust-ontwerpen-produceren-en-aankopen/modellen-voor-integrale-milieu-impactanalyse/voorraadbeheer-van-metalen> (accessed on October 2, 2018)

An important aspect here is how the link between output (circularity) and outcome (sustainability) can be demonstrated in the monitor. There is no clear solution for this issue. In the context of circular economy, this has been extensively discussed by the Netherlands Environmental Assessment Agency (Potting et al., 2018). As a provisional solution they provided to adopt two 'autonomous factors' in their monitoring framework: the size of the economy and employment. The idea is that the inclusion of these numbers would allow to attribute outcome scores to circular economy or rather to other societal evolutions (e.g. think of a growth in 'circular' jobs due to a general growth of the economy). In fact we are experiencing here the known challenge for everyone working with data: converting a correlation into a causality is always difficult and risky.

Another aspect is to which extent the monitor will be able to assess policy efficiency. A direct way to do this could be via including the *inputs and activities* to make the transition happening: the resources and the money invested and the running initiatives. An example is the role of education: this is an important input element in a transition to provide e.g. knowledge building, alternative ways of thinking and preparation for new kinds of jobs. Besides, with monitoring of inputs and activities, the transition will be visible already from the initial stages. The feasibility of input monitoring has been thoroughly investigated by the Dutch Environmental Assessment Agency. Their conclusion is that indicator development at the input side is only in a premature stage compared to the availability and development of output and outcome indicators, and it is very difficult to make causal links between efforts and results in terms of material use and associated impacts in general. The same holds for underlying conditions or evolutions for circular economy. Therefore we decide not to include inputs and activities in the monitor in a direct way for these practical reasons, although clearly recognize the importance of this kind of efforts. In a later stage, and/or when better ways of monitoring are available, input monitoring can be smoothly added to the monitor if desirable. In the next paragraph we explain an alternative way of incorporating early visibility of the transition and policy efficiency assessment.

7.4 Monitoring at different levels

Including the macro level in a monitoring system at regional level is rather evident. Following the available examples in the Resource Efficiency Scoreboard and the monitoring framework proposed by the Dutch Environmental Assessment Agency (EU Resource Efficiency Scoreboard, 2015; Potting et al., 2018), we want to go for a layered structure in our circular economy monitor, allowing to combine different levels of monitoring in one structure, and to offer deeper insights either by focusing on key areas or by showing more detailed data.

In our circular economy monitor we aim for giving a place to the micro level. At the micro level concrete products and services are being targeted, as these are the instances where innovation and policy measures are having the most direct impact, and where evolutions towards circular economy will be visible the soonest. Also, a connection between the macro and the products and services level is required to optimally reflect how innovation and dedicated policy measures will be eventually reflected at the macro level. For this, an additional third level is needed in the monitor.

The macro level: measuring at the level of Flanders

A number of macro indicators relevant in the context of circular economy have already been developed elsewhere and are in use, for instance on material input, consumption, waste etc. (Beyst and Daneels, 2016; Vercalsteren et al., 2017). To the extent that indicator scores would be smoothly derivable for Flanders, we will first borrow from what exists already. It is also important to understand that different perspectives are available (Vercalsteren et al., 2018):

- the consumption perspective, focusing on the footprint of our material demand and the associated impacts – hence including the parts of the chains outside the regional borders
- the territorial perspective, focusing on material use and impacts within our borders
- the production perspective, including what is being produced in Flanders for other parts of the world.

It is not possible to summarize these perspectives into one number, and neither is there one perspective clearly more relevant than others. Hence, we aim to display the diversity of perspectives, following the example of the Dutch monitoring system (Potting et al., 2018). This showed the added value of this approach by demonstrating how the Netherlands has increased its burden of material use and impacts outside its borders over the past years.

The micro level: products and services

Because circular economy is about keeping products and materials as long as possible at the highest application, for good monitoring a clear reflection of what happens at the level of products and materials is indispensable. Moreover, there are three additional reasons for adding this level in the monitoring framework:

- The progress to circular economy implies a transition, and this will require innovation in products and services. Hence at this level this indispensable innovation will materialize sooner than at the macro level.
- In order to make the transition happening, government interventions will be required, and will be reflected in policy measures. The effects of such measures will in the first place become visible at the products and services level.
- The challenge of monitoring transitions is that the onset phases are largely hidden due to the very small scale of the initial activities. At the moment they have grown sufficiently large, the transition is already in a next stage. With respect to the added value of monitoring, a crucial phase for transition management or for guidance via policy measures has already passed by then (Potting et al., 2018). Hence by including the products and services level in the monitor, the initial small scale will be picked up sooner.

In summary, the inclusion of the micro level offers the possibility for more direct feedback on policy and a better visibility of the initial phases of the transition.

As a remark, when discussing the micro level we have explicitly chosen for the term ‘products and services’ as an alternative for the term ‘economic goods’ which in fact has the same meaning, i.e. including both products and services. In the monitor we want services to be reflected as well. Also, products and services can mostly not be seen separated from each other: in most cases a service is associated with every product, and vice versa. In fact there is a gradual scale between product and services; for instance consider a privately owned car (the focus is on the product, and there are some associated services, e.g. a maintenance contract) or a shared car (the focus is on the service, but there is still a car involved) (Tukker, 2006).

The meso level: providing the link between macro and micro

Next, the link between the micro and the macro level needs to be provided. The challenge to do this in a straightforward way has been described before (Vercalsteren et al., 2018):

- Starting from the data of which the currently available macro indicators have been developed, disaggregation is only possible to a limited extent and is limited by the available level of detail in the data.
- Bottom-up, an approach could be to add data from products and services, but this is not realistic if to be done in an exhaustive way. Also, by mere adding, the question is how to address system dynamics, e.g. the occurrence of rebound effects.

Hence due to data and time constraints there is a bottleneck with respect to directly going from the macro to the micro level and vice versa. In some cases a *meso* level has been suggested in order to fill this gap. In fact the term *meso* is less sharply defined in economics and reflects a clear connection with either the macro level (e.g. via a disaggregation into economic sectors) or the micro level (e.g. via aggregated interactions between companies). In terms of circular economy, monitoring at the meso level has for instance been represented as follows:

- In the Dutch monitoring system, the set of indicators at the macro level has been disaggregated into five sectors, in order to align the monitor with the separate sectoral agreements made in the Netherlands for the circular economy transition (the so-called ‘Grondstoffenakkoord’, see section 4). To our opinion the disadvantage of applying a disaggregation on sector (or similarly, on material class) level bears the risk that the monitor may encourage each sector to largely turn back on itself for making the transition happen internally – while circular economy should especially also provide linkages between different actors.
- Alternatively, the meso level for monitoring has been described with eco-industrial systems and industrial symbiosis networks (Ghisellini, 2016). In fact the Chinese monitoring framework for circular economy relies heavily on this aspect (Geng, 2012). Factories becoming connected to a network with respect to raw materials and energy are a desirable evolution in terms of circular economy transition, and in the context of a nation with a rapidly growing industrial sector the monitoring of this aspect is very relevant. However, considering the aspects we want to monitor (see section 3), the extra information obtained from such a level would be limited as the obtained information is rather specific and only deals with the production perspective.

None of these examples is successful in making a link between the macro and the micro level. For a successful transition many different actors need to interact in certain ways in order to change the habits, customs etc. of the current linear economy. The actions of different actors are reflected in the kinds of products and services delivered by the economy, which corresponds to the micro level of our circular economy monitor. In order to provide a link with the macro level and hence to show how evolutions in products and services eventually affect the macro level, we have elaborated a meso level based on systems to fulfill societal needs. This will be explained in the next section.

8. Systems to fulfill needs

In this section we focus on making the connection between the macro and the micro level in the circular economy monitor. With such a connection, the more direct visibility of circular economy achievements at the micro level, due to innovation and policy, can become available for showing over time how the progress of circular economy will eventually affect society as a whole.

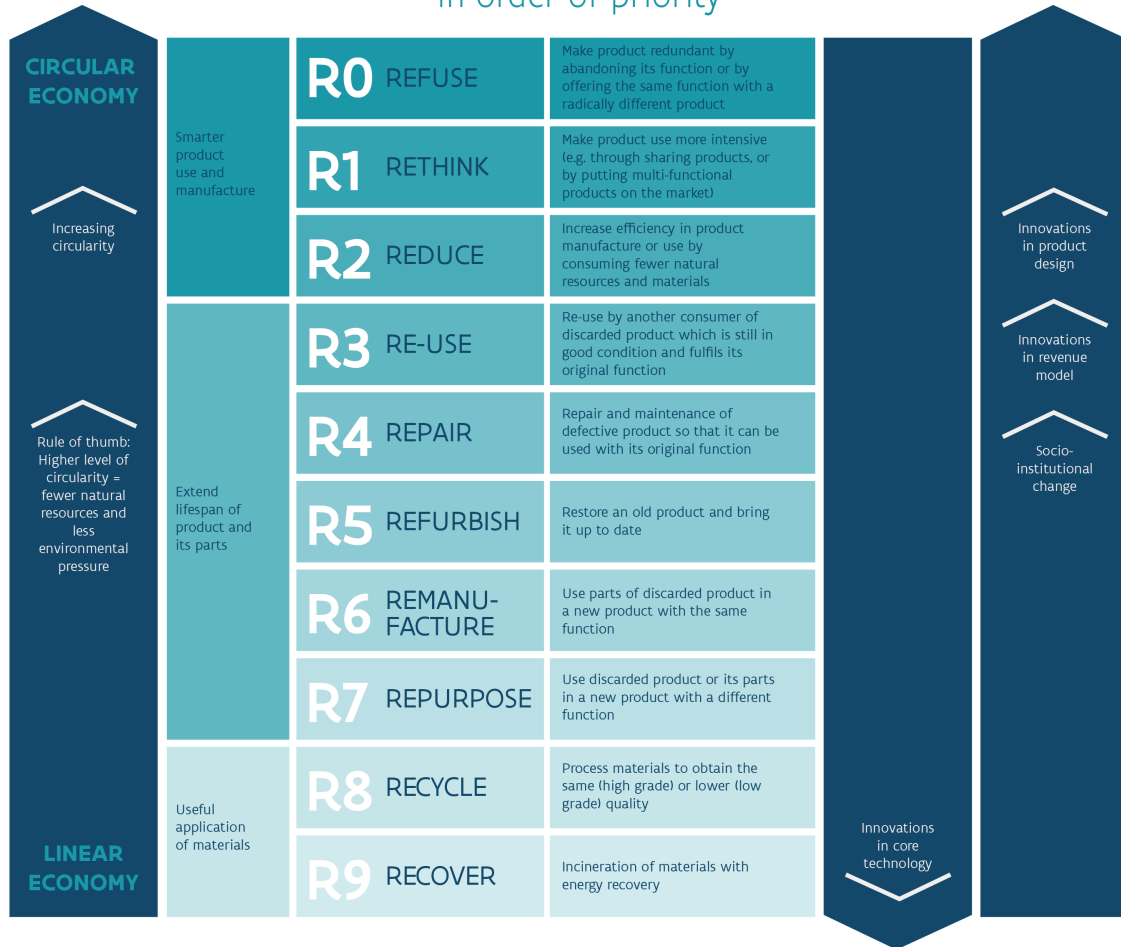
8.1 Products and services fulfill functions

A crucial element in monitoring at the level of products and services is the function that is being fulfilled by those products and services. The Netherlands Environmental Assessment Agency has demonstrated the notion of function as indispensable for bringing clarity in the possible strategies to come to circular economy, as it allows to consider also the more radical circular economy innovations in a relatively smooth way (Figure 4) (Potting et al., 2017).

An example could be as follows: if a car is considered in terms of circular economy, the initial focus could be on materials and impacts by considering for instance recycling, both in material inputs and in the end-of-life phase, or circulation of second-hand cars or car parts. But when the purpose (the function) that a car fulfills is addressed – the driver wants to get somewhere – also other circularity strategies will be considered, like car sharing: then the focus shifts to how a mobility need can be materialized with cars in an alternative way compared to private car ownership. Clearly addressing the functions behind products and services brings two advantages:

- By also considering more radical circularity strategies, the potential of realising a larger material and environmental benefit is larger, at least in absence of rebound effects (Potting et al., 2018).
- The way a function is delivered by a product is essentially determined by the underlying models of production and consumption. In this way a decent place is given to innovations in such models. For instance circular business models are currently not given a place in monitoring of circular economy (Kirchherr, 2017).

Circularity strategies within the production chain in order of priority



Source: RLI 2015; edited by PBL; adapted by Circular Flanders

Figure 4: List of R-strategies composed by the Netherlands Environmental Assessment Agency. The term 'function' has been more or less explicitly used in the majority of the texts explaining the strategies (adapted from Potting et al., 2017).

So with this approach of looking to circular economy at the micro level, the typical considerations on material use and impacts of products are extended with the way such products are delivering functions via the associated models of production and consumption (Figure 5).

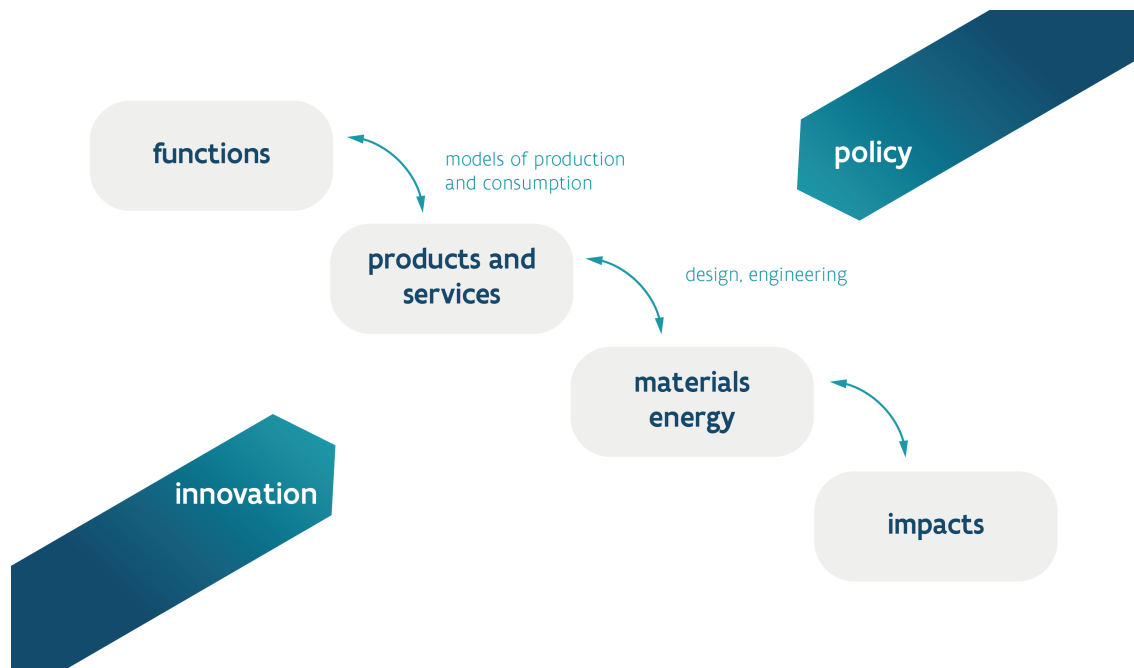


Figure 5: Functions are delivered with products and services and this takes place via models of production and consumption. Products and services imply the use of materials and energy in all stages of their life cycles, and this causes impacts. Policy measures and innovation can affect for instance the design and engineering of products and the boundary conditions for models of production and consumption (adapted from Alaerts et al., 2019).

An example of such an approach has recently been elaborated (Materials Economics, 2018): in this report the focus is on the potential role of circular economy in preventing runaway climate change, and the authors claim that the climate abatement potential of circular economy can only be fully assessed by including the role of circular business models in the measurement. Hence next to emissions caused by material use and product material efficiency, they have added a third element in their predictive analysis by considering the amount of service delivered by products.

8.2 The bridge between macro and micro

In the context of circular economy monitoring, the theory of transition management provides a number of stepping stones to build up such a monitor (Geels, 2002). In this theory the so-called transition space is divided into three distinctive layers (Figure 6):

- the *landscape*: the level of society, where changes occur in general only very gradually (unless in case of extreme events). We could see this level corresponding to the macro level in our circular economy monitor.
- the *regime* level: this is the level of culture (and the required cultural shift). It is composed of larger domains of habits and customs, that determine the 'normal' way things are being done in society.
- the *niche* level: this is the level where islands of experimentation exist in which (radically) new kinds of products and services are tried out. Here innovation particularly takes place, both with respect to technology and with respect to ways of doing business. This could correspond to the micro level in our monitor.

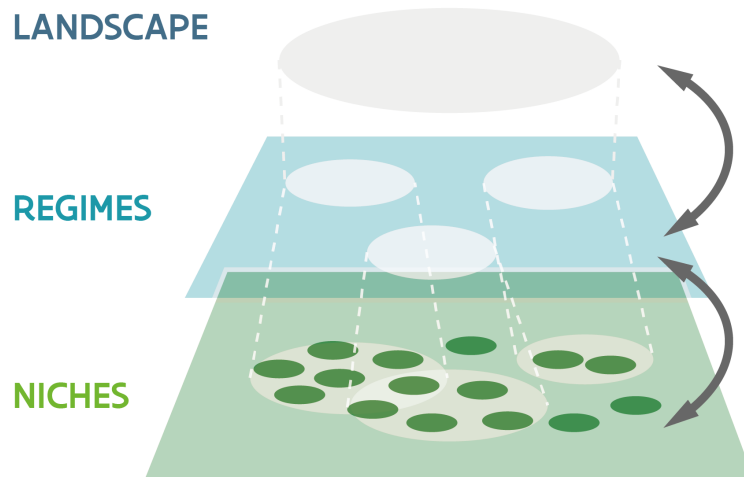


Figure 6: The multi-level perspective (adapted from Geels, 2002).

When a transition is making progress, the idea is that certain niche innovations are growing large to such an extent that eventually domains at the regime level are altered and new ways of providing products and services become more and more the generally accepted and applied ways. In the context of measuring circular economy, we tried to define domains of habits and customs in order to install the meso level in our monitoring. Starting from the example given in section 8.1, this could work as follows. When innovations in production and use of cars (e.g. electrical vehicles, car sharing) are growing larger, this will eventually affect the habits and customs in the wider domain of mobility: both the number of cars and the impacts of the cars that are used will change, and there will be effects as well with respect to other means of transportation. Generalising this example, the basis for the meso level in our circular economy monitor is to have a number of systems that show in a more direct way how we use products and materials to fulfill our needs and also the associated impacts of the material and product use. In this way the link from products and services up to the macro level will be provided, and, the other way around, deeper insights starting from the macro level will be available. As a general denominator for such systems, we have chosen for the perspective of fulfillment of societal needs. The fundamental and practical justifications for this choice are elaborated below.

The economy itself can be defined from a fundamental viewpoint as a way to fulfill our needs. With respect to circular economy, this means that the ways in which we use products and materials to fulfill our needs will have to be drastically altered. This viewpoint has been elaborated by Manfred Max-Neef already well before the appearance of the term circular economy (Max-Neef, 1992). In this work the explicit links between needs, so-called satisfiers and economic goods have been extensively described. Understanding the interplay between these three elements enables to reconsider how the economy, and more in concrete, consumption is to be organized.

Practically, the background of fulfillment of societal needs has been touched upon already in a number of recent publications about measurement of circular economy or of sustainability:

- In the spring of 2018 the so-called ‘circularity gap’ report has been emitted (de Wit et al., 2018). In this report global material consumption is described, not only overall, but

also one level deeper in what the authors describe as *key societal needs*. In the report they use a set of seven of such needs, like housing, nutrition and mobility, in order to map the resource footprint behind these needs. Together, this set represents the largest material footprint globally. One of the arguments for this choice is that depending on the need, different strategies will be required with respect to the respective resource footprints. Compare for instance the need for housing, where large amounts of building materials are involved, with the need for communication, which has at first sight a much lower material consumption but here the issue of rare earth metals is much more at the forefront.

- In another source the term *life functions* has been used, as a way to analyse sustainable consumption issues (Hertwich, 2003). The list is very similar to the needs described in the previous bullet: housing, mobility, nutrition, clothing, health and leisure. The idea of life functions here is that they can be seen as components of lifestyles, fulfilled by products and services.
- In the somewhat different context of the Asia-Pacific Low Carbon Lifestyle Challenge, a number of *drivers for consumption* have been listed in the detailed explanation on the website of the initiative (OECD, 2018). The elaborated examples are food, home, goods, transport and leisure. Here the idea is as well about a sustainability transition and the provision of more in-depth input as anchor point to the participants. The source also mentions 'lifestyle' as a central point: everything we consume is part of our lifestyle, and this means that extraction and production are required, and emissions and other environmental harm can take place. Creating sustainable lifestyles is then about rethinking the way of living, in which consumption is a central part.
- At the EU level the Basket of Products indicators have been recently developed in the context of measuring consumer footprints (Notarnicola et al., 2017). For this purpose, 'consumption' has been split up in five key areas: food, housing, mobility, household goods and electric/electronic appliances. These indicators deliver composite scores based on LCA data obtained from extensive samples of products.

Moreover, we can also see for some of such systems to fulfill needs a certain degree of alignment with particular policy domains, e.g. the system mobility can be reflected in the policy domains on mobility, traffic and/or infrastructure. In this way, direct matches with the interests of policy makers are expected to be smoothly available as well.

It is clear from the above that a focus on systems to fulfill needs comes down on a perspective clearly from the consumer side. This means that consumers as actors and their actions will be recognized the most directly. In fact, consumers are clear enablers of circular economy, and are in that role often missing in the story of circular economy (Kirchherr, 2017). As circular economy has a clear cross-sectoral nature, we expect the consumption perspective better suited compared to a sector-based perspective on monitoring. On the other hand, a risk of this perspective is that companies and industrial sectors, which are providing the largest share of products and services, would not directly recognize their actions or possible contributions to circular economy via a monitor based on fulfillment of needs. This will need further consideration in the elaboration of the circular economy monitor. At least the production side

will have clear and prominent occasion to appear in those parts where the monitoring of particular products and services comes at the forefront. For instance if mobility is to be monitored as a system, this could take place by considering cars as concrete products, and any actions of the involved industries may become apparent there.

8.3 The meso level in the circular economy monitor

Next question is which systems to fulfill needs to include in the circular economy monitor. Several ways to look at human needs have been elaborated elsewhere already in fundamental ways, e.g. in the work of Manfred Max-Neef described above or the so-called pyramid of Maslow (Maslow, 1954). In the current context, we do not plan to redo this work, rather we need a pragmatic approach to make choices for further selection of what to appear in the monitor. We do not aim to be fully complete in making sure that all products and services are somehow covered by providing a system to connect them with. Rather, we want to compose a set of needs that sufficiently meets the purposes of circular economy monitoring. From section 8.2, housing, mobility and food could be suggested as candidate systems, as they evidently summarize activities with large amounts of materials needed and associated impacts. In a next phase of the development of the monitor, the question which systems to select will be treated in more detail. For instance, the following criteria could be relevant in order to come to a further selection of possible systems in the circular economy monitor to be developed:

- amounts of products and materials consumed;
- size of the associated impacts;
- size and rate of the required changes in the context of the circular economy transition;
- part of the cycle taking place in Flanders;
- importance of the associated industrial sectors in Flanders;
- link to important policy domains and strategies, and potential to have an impact via Flemish policy;
- socio-cultural importance in Flanders;
- alignment with the Sustainable Development Goals;
- availability of data.

Upon selection, an important point of attention is to provide clear definitions of the scope of the systems listed for the monitor. For example: road infrastructure could be part of mobility but as well of the built environment. There are reasons to argue for the two options, but the more relevant is to make clear where this item will be considered so as to make sure this important part is addressed somewhere and to avoid double counting.

8.4 A preview on the circular economy monitor

In the previous sections we have been explaining the decisions and considerations in the course of the development of our concept for circular economy monitoring. This has resulted in a proposal for a monitor consisting of a macro, a meso and a micro level. In order to show how this concept could bring added value compared to current monitoring frameworks, we will elaborate in this section an exemplary outlook on how mobility could be monitored as a system to fulfill needs in terms of circular economy achievements.

At first the system mobility needs to be measured as such. This could be done by counting the amounts of kilometers driven yearly per inhabitant, to be expressed as one aggregated number, and further subdivided based on the purpose (commuting, leisure, freight) and/or on

the modus (car, truck, train etc.). Such data are available in the administrations on a yearly basis, and updates are obtained much faster compared to the updating of input-output data used for macro level monitoring (Zijp, 2018). Consumption-based macro indicators can be added in the macro level of the monitor. By measuring mobility in this absolute way, it is possible to more correctly attribute any evolutions either to circular economy or to other developments. For instance, if there is an overall growth in car use, any developments in circular economy remain hidden; the former is revealed by monitoring the amount of kilometers driven.

Next, the amount of products and services used for mobility are to be measured. This can at first happen by counting the number of cars, trucks etc. used (divided by the total amount of kilometers driven), and also the degree of occupancy of these (number of occupied seats or truck volume), or the average mileage reached at the end of life stage. In this way, the impact of circular business models will become apparent in the monitor. For instance the materialization of the promises of car-sharing could be assessed here, in case it leads to less cars in use overall, and/or a higher mileage of cars at the end of life. Also, system effects will be visible, in case increased car-sharing would lead to increased car use at the expense of public transportation. Again, many of the required data are available in the administrations.

In next instance, the materials can be monitored, for instance the amounts of metal and plastic used in the production phase, the fuels and consumables in the use phase and the extent to which materials and components can enter consecutive cycles at the end of life phase. In order to monitor impacts, for instance process data on vehicle production will be needed. For the use phase, data on engine types and/or exhaust gases will be needed. It will not be feasible to exhaustively provide all the data for all the vehicle types, rather the focus will be on one or a few concrete vehicles. At this point a connection will have to be made to existing monitoring at the micro level, by giving circularity scores a place in circular economy monitor. Upon pointing out a few concrete products and services to be monitored more closely for each of the systems to fulfill needs, at the micro level a set of products and services will be composed that is able to representatively reflect the progress of circular economy.

By focusing on mobility in this way, a number of questions can arise. Is it better to focus on keeping existing cars longer in use, or on an accelerated introduction of new developments? Is it better for the end of life stage to rely on international cycles or on local processing? While the monitor will not be able to solve such issues, it is meant to have the data available to describe what is taking place. Overall, the idea of circular economy is to keep products and materials in use at the highest application level as long as possible while decreasing environmental impacts. The different manifestations of this will be visible in the monitor, and will be set against developments in the fulfillment of societal needs. In this way the role that circular economy will and can play in staying in the safe zone with respect to planetary and societal boundaries will be monitored.

9. Conclusions and next steps

In this document the concept for the circular economy monitor to be developed in the Policy Research Centre Circular Economy has been explained in detail. This concept is the result of combining academic expertise, literature insights, feedback from policy officers and developments at the international scene. It has been discussed with and accepted by an audience of policy and sector and societal stakeholders at a workshop held at June 27, 2018.

The circular economy monitor is essentially composed of three levels (Figure 7):

- A macro level composed of indicators focusing on society-wide material flows and associated environmental, economic and social impacts connected to the Flemish region, including the effects outside the Flemish borders.
- A meso level composed of indicators focusing on the achievement of circular economy in particular systems to fulfill needs.
- A micro level featuring a set of specific products and services, meant to establish a representative and broad sample of our daily consumption and that is also relevant considering circular economy transition.

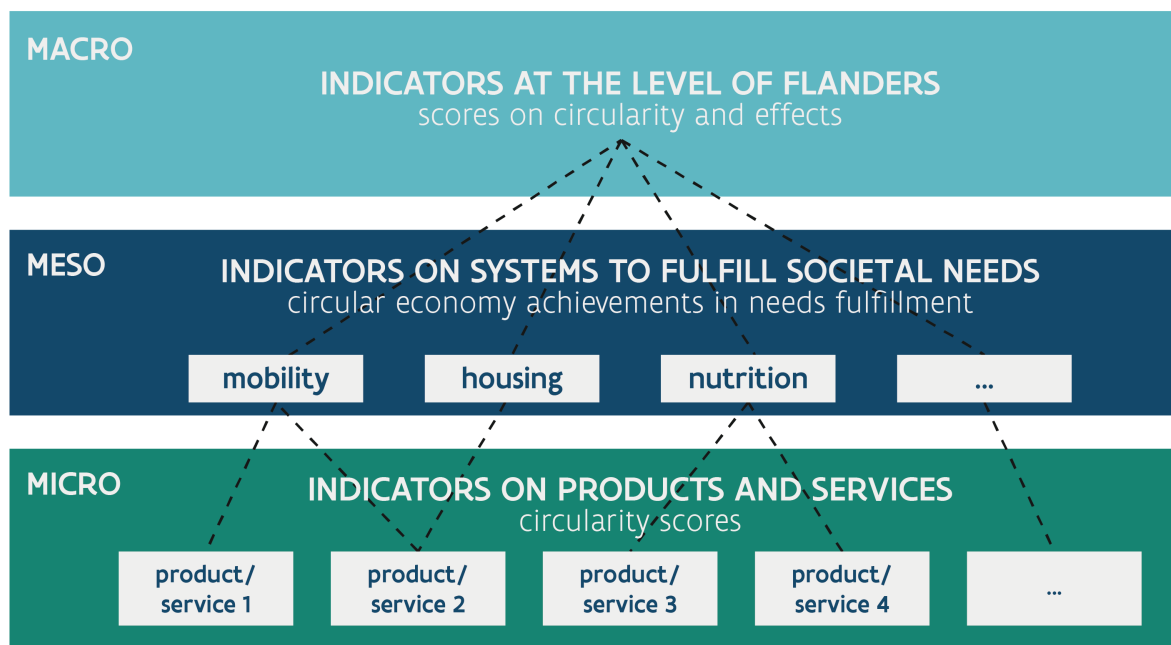


Figure 7: Outline of the circular economy monitor, to be nourished with indicators and data (adapted from Alaerts et al., 2019).

The central appearance of systems to fulfill needs in the context of circular economy monitoring is relatively new. They do not at all appear in current monitoring frameworks, and are only suggested a few times in literature, especially in the broader context of sustainable consumption. The concrete measurement of such systems has still to be developed. In this

sense it is an ambitious choice, but justified by the consulted sources and the opinions of stakeholders. There are a number of clear advantages of this perspective:

- As the fulfillment of needs is empowered by products and services, a bridge between the micro and the macro level is provided. This allows policy makers to trace the effects of innovation and policy that start at the micro level already in an early stage, and to see how the economy at a broader level will be affected over time.
- Models of production and consumption play a major role in the way products and services are used to fulfill needs. By a focus in the monitor on systems that fulfill needs, a clear position is created for circular business models, an aspect that up to now has received little or no attention in monitoring.
- Also, the consumer perspective is put at the forefront, an aspect that up to now has neither received much attention in the context of circular economy monitoring. Moreover, it is expected to reflect well the cross-sectoral nature of the circular economy transition. On the other hand, the production perspective is also present in the products and services that are to be considered more closely.
- The feedback obtained via the monitor is more direct compared to scores of existing macro indicators in which circular economy would only become visible from the moment it has grown substantially large, and which are updated infrequently and late. The suggestions for indicators in the exemplary elaboration of monitoring of mobility as a system are largely based on data that are available in the administration on yearly basis, and sooner after the closing of a year. Also, the link with the specific products and services in the monitor allows to detect evolutions at the micro level.

Overall, the idea of circular economy is to keep products and materials in use at the highest application level as long as possible while decreasing environmental impacts. The result of the different manifestations of this will be visible in the monitor, and will be set against developments in the fulfillments of societal needs themselves. In this way the role that circular economy will and can play in staying in the safe zone with respect to planetary and societal boundaries will be monitored.

The next question to be answered is how to practically fill in the three levels of the monitor with indicators and data. At the macro level, this will be based on the match between the available indicators and the concept of the monitor, and on the ease to obtain numbers for Flanders. At the meso level, a number of options for possible systems to fulfill needs for the monitor will be compared using a set of criteria, as described above. This will result in a set of systems for which in a next phase data gathering can start, and as well the selection of products and services to follow up more closely in the monitor. Stakeholders will be involved in this further development in similar ways as described above. Also, interactions with (international) developments on monitoring in the context of circular economy will be actively pursued, in order to maximally contribute to the ongoing policy developments with respect to circular economy at the level of cities, regions and countries.

References

- Alaerts, L., Van Acker, K., Rousseau, S., De Jaeger, S., Moraga, G., Dewulf, J., De Meester, S., Van Passel, S., Compennolle, T., Bachus, K., Vrancken, K., Eyckmans, J. (2019). *Monitoring circular economy: bridging micro and macro indicators*. Submitted
- Bachus, K., Pollet, I., Steenberghen, T., Huyse, H. (2018), *The SDGs as a lever for change in policy practices*. Research report commissioned by FRDO-CFDD, Leuven. Available online via https://www.frdocfdd.be/sites/default/files/content/download/files/hiva_sdgs_2018_final_report.pdf (accessed on October 2, 2018)
- Beyst, V., Daneels, A. (2016). *Hoe groen is de Vlaamse economie?* Flemish administration document, available online via <https://www.vlaanderen.be/nl/publicaties/detail/monitor-groene-economie> (accessed on October 2, 2018)
- de Wit, M., Hoogzaad, J., Ramkumar, S., Friedl, H., Douma, A. (2018). *The circularity gap report - An analysis of the circular state of the global economy*. Circle Economy. Available online via <https://www.circularity-gap.world/> (accessed on October 2, 2018)
- Du, X., Graedel, T. E. (2013). *Uncovering the end uses of the rare earth elements*. Sci Total Environ, 461-462, 781-4. DOI:10.1016/j.scitotenv.2013.02.099
- EASAC (2016). *Indicators for a circular economy*. Policy report 30. Available online via https://www.easac.eu/fileadmin/PDF_s/reports_statements/Circular_Economy/EASAC_Indicators_web_complete.pdf (accessed on October 2, 2018).
- EU Resource Efficiency Scoreboard (2015). Available online via http://ec.europa.eu/environment/resource_efficiency/targets_indicators/scoreboard/index_en.htm (accessed on October 2, 2018)
- European Commission (2018). *Measuring progress towards circular economy in the European Union – Key indicators for a monitoring framework*. Available online via <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018SC0017&from=EN> (accessed on October 2, 2018)
- Flemish government, *Visie 2050* (2016). Dutch version available online via <https://www.vlaanderen.be/nl/publicaties/detail/visie-2050-een-langetermijnstrategie-voor-vlaanderen> (accessed on October 2, 2018); English summary available online via <https://www.vlaanderen.be/en/publications/detail/vision-2050> (accessed on Oct , 2018)
- Geng, Y., Fu, J., Sarkis, J., Xue, B. (2012). *Towards a national circular economy indicator system in China: an evaluation and critical analysis*. J. Clean. Prod. 23, 216-224. DOI:j.jclepro.2011.07.005
- Ghisellini, P., Cialani, C., Ulgiati, S. (2016). *A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems*. J. Clean. Prod. 114, 11-32. DOI:10.1016/j.jclepro.2015.09.007
- Geels, F.W. (2002). *Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study*. Research Policy 31(8-9), p.p. 1257-1274. DOI:10.1016/S0048-7333(02)00062-8

Hertwich, E. (2003). *The seeds of sustainable consumption patterns*. Proceedings, 1st International Workshop on Sustainable Consumption in Japan, Society for Non-Traditional Technology, Tokyo 19-20 May 2003. Available online via https://www.aist-riss.jp/old/lca/ci/activity/project/sc/report/030319_document/S1-1-Hertwich.pdf (accessed on October 2, 2018)

Kirchherr, J., Reike, D., Hekkert, M. (2017). *Conceptualizing the circular economy: An analysis of 114 definitions*. Resources, Conservation & Recycling 127, 221–232

Magnier, C., Auzanneau, M., Calatayud, P., Gauche, M., Ghewy, X., Granger, M., Margontier, S., Pautard, E. (2017). *Ten key indicators for monitoring the circular economy*. Environmental Information Department, Ministry of the Environment, Energy and Marine Affairs, France. Available online via <http://www.statistiques.developpement-durable.gouv.fr/publications/p/2669/1539/10-indicateurs-cles-suivi-leconomie-circulaire-edition-2017.html> (accessed on October 2, 2018)

Maslow, A. (1954). *Motivation and personality*. New York, NY: Harper. ISBN 0-06-041987-3.

Material Economics (2018). *The circular economy, a powerful force for climate mitigation. Transformative innovation for prosperous and low-carbon industry*. Available online via <https://media.sitra.fi/2018/06/12132041/the-circular-economy-a-powerful-force-for-climate-mitigation.pdf> (accessed on October 2, 2018)

Max-Neef, M. (1992). *Development and human needs*. In: Ekins, P., Max-Neef, M. (Eds.), *Real Life Economics*. Routledge, London, UK, pp. 197–214.

Moraga, G., Huysveld, S., Mathieux, F., Blengini, G.A., Alaerts, L., Van Acker, K., de Meester, S., Dewulf, J. (2018). *Circular Economy indicators: proposal for a classification framework*. Submitted.

Nassar, N.T., Du, X. and Graedel, T.E. (2015), *Criticality of the Rare Earth Elements*. Journal of Industrial Ecology 19, 1044–1054. DOI:10.1111/jiec.12237

Notarnicola, B., Tassielli, G., Renzulli, P.A., Castellani, V., Sala, S. (2017). *Environmental impacts of food consumption in Europe*. J. Clean. Prod. 140, 753-765. DOI:10.1016/j.jclepro.2016.06.080

OECD (2012). *Greenhouse gas emissions and the potential for mitigation from materials management within OECD countries*. ENV/EPOC/WGWPR(2010)1/FINAL. Available online via <https://www.oecd.org/env/waste/50035102.pdf> (accessed on October 2, 2018)

OECD (2018). *Asia-Pacific Low Carbon Lifestyle Challenge*. Available online via <https://www.unenvironment.org/news-and-stories/news/asia-pacific-low-carbon-lifestyles-challenge> (accessed on October 2, 2018)

Potting, J., Hekkert, M., Worrell, E., Hanemaaijer, A. (2017). *Circular economy: measuring innovation in the product chain*. Netherlands Environmental Assessment Agency The Hague. Available online via <http://www.pbl.nl/en/publications/circular-economy-measuring-innovation-in-product-chains> (accessed on October 2, 2018)

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*. Netherlands Environmental Assessment Agency, Den Haag, 2018. Available online via <https://www.cbs.nl/en->

[gb/publication/2018/03/circular-economy-what-we-want-to-know-and-can-measure](#) (accessed on October 2, 2018)

Raworth, K. (2017). *Doughnut Economics - Seven Ways to Think Like a 21st-Century Economist*. Ed. Cornerstone / Cornerstone Ras, 384 pages, ISBN 9781847941374.

Reichel, A., De Schoenmakere, M., Gillabel, J. (2016). *Circular economy in Europe, Developing the knowledge base*. European Environmental Agency, Report No 2/2016. Available online via <https://www.eea.europa.eu/publications/circular-economy-in-europe> (accessed on October 2, 2018)

Smol, M., Kulczycka, J., Avdiushchenko, A. (2017). *Circular economy indicators in relation to eco-innovation in European regions*. Clean Techn Environ Policy 19, 669–678. DOI:10.1007/s10098-016-1323-8

Tukker, A., Tischner, U. (2006). *New Business for Old Europe: product-service development, competitiveness and sustainability*. Ed. Sheffield Greenleaf Publishing.

Vercalsteren, A., Boonen, K., Christis, M., Dams, Y., Dils, E., Geerken, T., Van der Linden, A., Vander Putten, E. (2017). *Koolstofvoetafdruk van de Vlaamse consumptie*. Research commissioned by MIRA, Milieurapport Vlaanderen. Research report MIRA/2017/03 VITO/2017/SMAT/R/1160. Available online via www.milieurapport.be (accessed on October 2, 2018)

Vercalsteren, A., Christis, M., Van Hoof, V. (2018). *Indicators for a Circular Economy*. Research report of the Policy Research Centre Circular Economy. Available online via ce-centre.be (accessed on October 2, 2018)

Vizier 2030 – *Een 2030-doelstellingenkader voor Vlaanderen*. Flemish administration document, available online via <https://do.vlaanderen.be/visienota-vizier-2030-een-2030-doelstellingenkader-voor-vlaanderen> (accessed on October 2, 2018)

Zijp, M.C., Kok, L., de Valk, E. (2018). *Het effect van Maatschappelijk Verantwoord Inkopen*. Rijksinstituut voor Volksgezondheid en Milieu, report nr 2018-0002

CE CENTER
CIRCULAR
ECONOMY
POLICY RESEARCH
CENTRE

WE MAKE
TOMORROW
BEAUTIFUL
OVAM

DEPARTMENT OF
ECONOMY
SCIENCE &
INNOVATION

Disclaimer:

This publication reflects the views only of the author, and the Flemish Government cannot be held responsible for any use which may be made of the information contained therein.

ce-center.be

