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Arianne ACKE [*], **Sue Ellen TAELMAN** [**], **Jo DEWULF** [**]

A MULTI-STAKEHOLDER AND INTERDISCIPLINARY APPROACH TO WASTE MANAGEMENT AND CIRCULAR ECONOMY: THE CASE OF FLANDERS AND GHENT, BELGIUM

Abstract. In 2016, the Flemish Government adopted the transversal policy paper "Vision 2050, a long term strategy for Flanders". It has set the ambition for Flanders for 2050 and has paved the way for a transition to a Circular Economy. It provided new objectives and confirmed the ambition to further reduce the total amount of (residual) waste by closing the loop and reducing the use of primary resources. More than before, prevention and reuse have been an integral part of materials management. The impact of waste behaviour needs to be measured against environmental and social priorities. In this context, the REPAiR project developed a multi-stakeholder and interdisciplinary methodology. Building on this methodology, this paper explores how governance in Flanders and Ghent has been affected by this transition and draws lessons to address these challenges.

Key words: Resources and waste management, circular economy, organic waste, Flanders, Ghent, Living Lab, Eco-innovative solutions.

1. INTRODUCTION

As European cities are heavily dependent on land and resources beyond their borders to sustain their e.g. consumption patterns and energy demands, etc. (Unmüßig *et al.*, 2015), the transition from a linear economy towards a circular model is nowadays a concern of the European Commission (EC, 2015). There has been an attempt to push this transformation by stimulating circular economy (CE) strategies in Europe, whereby the Circular Economy Package is set up.

[*] Arianne ACKE, OVAM – Public Waste Agency of Flanders, Stationsstraat 110, 2800 Mechelen, Belgium; e-mail: Arianne.acke@ovam.be, ORCID: https://orcid.org/0000-0003-0403-6580

[**] Sue Ellen TAELMAN, Jo DEWULF, Ghent University, Faculty of Bioscience Engineering, Sint-Pietersnieuwstraat 25, 9000, Gent, Belgium; e-mails: SueEllen.Taelman@UGent.be, Jo.Dewulf@UGent.be, ORCIDs: https://orcid.org/0000-0002-4954-7686, https://orcid.org/0000-0003-1870-4930

Notwithstanding a supportive environment and favourable government policy for circular economy, either at local, regional or European levels, and an increasing number of initiatives that consider the entire value chain, including prevention and the reuse of waste, many initiatives remain small scale and locally embedded. There is an important gap to bridge between local civic initiatives on the one hand and commercial waste producers and the waste treatment industry on the other. This hampers the potential for up-scaling locally embedded initiatives.

In this context, the REPAiR-project[1] examines whether an interdisciplinary and multi-stakeholder approach, supported by a spatial, waste flow and life cycle analysis, based on environmental, economic, and social indicators, can help entities to overcome some of these challenges, and further decision-making to make the transition to a circular economy.

A prominent example of the transition from conventional waste management to an integrated resources' policy is the Flemish case. Although Flanders is a relatively small region in Belgium with approximately 6.5 million inhabitants, it is a particularly interesting case because it is one of the best performing regions in terms of household waste reduction and recycling in Europe (De Jaeger *et al.*, 2011). Flanders has the exclusive authority to develop its environmental policy and waste/resources management. This includes the development of international relations and foreign policy on waste/resources, all within the broader European legislation. However, there are challenges to go beyond proper waste management towards a real circularity. While offering overview of those, this article is structured as follows: after theoretical insights and a short presentation of the method and materials, the paper gives an overview of the recent status quo of the case study area. Afterwards, the process and the results of a co-creation work in the living lab format are presented. Finally, the conclusion indicates what aspects are missing for a real circular transition.

2. THEORETICAL INSIGHTS

The concept of a Living Laboratory appeared in Europe around 2000. Since then, the idea has become widespread in planning processes across the world bringing together stakeholders from different positions with different knowledge backgrounds, providing them with a methodology for co-creating innovation (Lepik *et al.*, 2010; Steen and van Bueren, 2017; Dąbrowski *et al.*, 2019).

[1] http://h2020repair.eu – More details about the REPAiR project can also be found in the Foreword of this Special Issue, by Viktor Varjú.

Living Labs (LL) are defined as physical and virtual environments in which public-private-people partnerships experiment with an iterative method to develop innovations that include the involvement of end-users (Pallot *et al.*, 2010). In Living Labs, different areas of expertise from diverse partners are needed for a correct development of activities, to meet the needs of the stakeholders by innovation. LLs are instruments that can be used to improve the innovation capabilities and competitiveness of territories.

Within REPAiR, Eco-Innovative Solutions (EIS's) are defined as creative and smart ideas aimed to innovate and improve a specific and fixed process in relation to the management of waste as a resource and Wastescapes (cfr. Amenta *et al.*, 2018). EIS's may include an implementation of new materials or processes in existing economic activities or adding new activities in value chains; a proposal of a modification to existing policies and governance or new policy/governance developments; or the development of spatial design proposals. These decisions will potentially lead to a modification of existing flows, the development of new material flows and processes and/or changing the physical design of areas, and will generate a change in the behaviour of stakeholders and inhabitants in an area.

Apart from innovation, thanks to the LL approach, policymakers can face the many socio-economic challenges of their territories, increasing social inclusion (Innovation Alcotra, 2013; cf. Russo *et al.*, 2017). Additionally, the user–centre design of Living Labs has the co-creative potentialities (that is also defined in the REPAiR[2] project), the awareness of users, and real-life settings (Dell'Era and Landoni, 2014).

The term **waste hierarchy** is often mentioned in connection with sustainable resources' management and circular flows[3]. In Europe, the concept of waste hierarchy was first introduced by a Dutch politician Ad Lansink in 1979 (Parto *et al.*, 2007). The waste hierarchy framework aims to dematerialise the economy as much as possible to approach circularity. It describes the order and priority of actions to be taken. The most recent revision in the European Union was implemented in the Waste Framework Directive 2008/98/EC which sets 1) the basic concepts such as end-of-waste criteria, Extended Producer Responsibility and the waste management hierarchy, and 2) definitions, e.g. by-product, waste, recycling, and recovery, all related to waste management. However, according to Van Ewijk and Stegemann (2016) and Gharfalkar *et al.* (2015), the waste hierarchy in its current form is an insufficient foundation for a waste and resources policy to achieve absolute reductions in material throughput. Resources and waste management must be combined to establish a fully circular economy. With the aim to dematerialise, the reduction of primary inputs is given priority over the reduction of secondary inputs but ultimately both are limited by the end goal. Apparently, there is a need for more efficient resources' management.

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[2] http://h2020repair.eu/

[3] An insight about the concept of circular economy can be found in the Foreword of this special issue by Viktor Varjú.

3. METHODS AND MATERIALS

REPAiR implements LLs for six European peri-urban areas or cities, one of which is Ghent-Destelbergen. The REPAiR team designed a scheme for implementing the so-called Peri-Urban Living Labs (PULLs), focusing on the important steps of the REPAiR format of an LL: co-exploration, co-design, co-production, co-decision, and co-governance (Amenta *et al.*, 2019). The format was applied in the follow-up cases of the REPAiR project (including Ghent) tailoring it to the local context. This paper covers the first three steps of the Ghent Living Lab.

The PULL in Ghent-Destelbergen counted four workshops, bringing together a good and balanced representation of different stakeholders concerned: the waste management sector, both operational and legal, public and private, covering different governance levels (city, region), academic partners, all with a good knowledge of the focus area. Citizens were involved indirectly, through a representation of participatory civil society organisations such as '*Gent en garde*'[4].

The main objectives of the PULL Ghent-Destelbergen were: 1) delineation and exploration of the area under study, 2) identification of key waste streams and priorities, and 3) co-creation of Eco-innovative solutions and strategies. The aim was to improve the recent situation in the Ghent area towards achieving circularity, and the PULL was used as a tool to achieve that. The objective of this article is to demonstrate how this was done in Ghent-Destelbergen.

The need to further reduce the amount of residual waste – one of the key objectives of the Flemish implementation plan for household waste (Flemish Government, 2016) – is a generally accepted objective, as confirmed by several stakeholders interviewed during the REPAiR project (cf. Obersteg *et al.*, 2017). However, opinions differ considerably regarding the method on how to realize this objective depending on the approach and insights of individual stakeholders. According to some, excessive emphasis was put on separate waste collection and valuations of selective waste flows, especially those which offered opportunities to develop an interesting and viable business case. While there has been an increasing interest in opportunities to valuate waste flows, less emphasis has been placed on prevention and the reuse of waste. Increasing emphasis on these goals will require cooperation and collaboration among a wide range of (different) stakeholders.

[4] *Gent en Garde* is an initiative of the City of Ghent making its citizens and visitors aware of the climate impact of food. *Gent en Garde* offers citizens, organisations and companies a participation platform in which they can find like-minded people, recognise shared interests, share their expertise with the outside world, and lift initiatives to the next level.

4. THE CASE STUDY REGION

4.1. Flanders' legal framework: an interplay of regional and local actors

Since 1981 OVAM, the Public Waste Agency of Flanders, has maintained Flanders' waste, soil and materials policy. With the adoption of the first **Waste Decree** in 1986, several instruments have gradually been used to move waste management up in the waste hierarchy, promoting prevention and resource recovery. Measures such as obligatory source-separated waste collection in urban and rural areas, subsidies for reuse centres, pay-as-you-throw schemes, producer responsibility, landfill and incineration taxes as well as selective bans and quotas on waste production per person have contributed to making Flanders' one of the most waste sensitive areas in Europe.

The **Material Decree** and its Implementation Order have paved the way for the transition from a waste to a materials or resources policy. The Material Decree assumed a complete view of the material chain. It determined the responsibilities of different actors in the entire life cycles of materials: from designers, through producers, distributors, consumers, waste companies to the government.

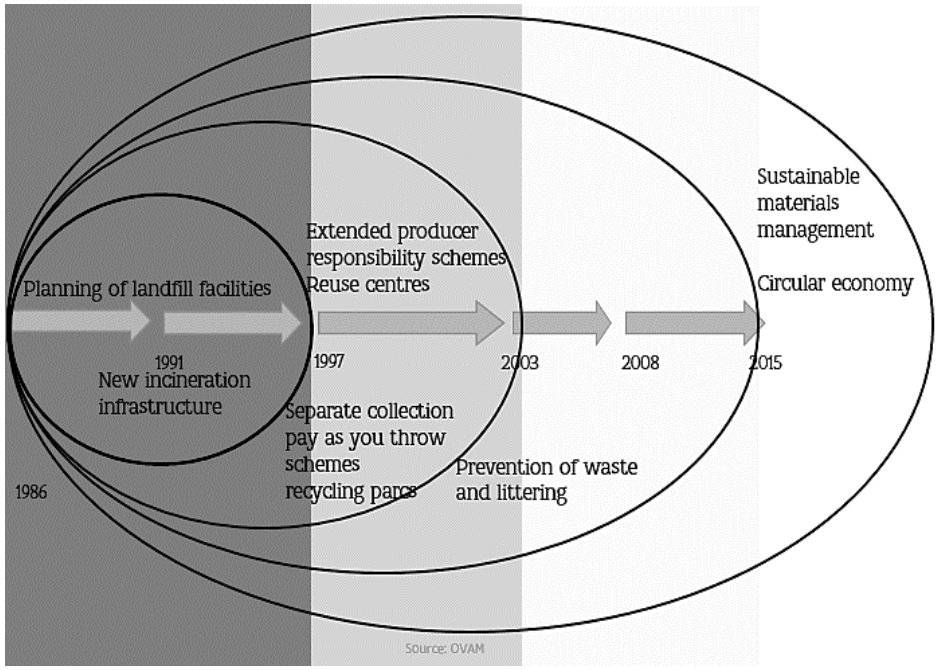

Fig. 1. Overview of waste management measures in Flanders
Source: OVAM.

The Implementation Plans complete the legal framework at the regional level, setting priorities, targets and general strategies to organise waste management over several years. These Implementation Plans are the result of intense consultations with different stakeholders involved in waste and resources management: federations of municipalities, of inter-municipal organisation for waste management, of waste collectors and treatment centres, and reuse centres. The current plan contains the main policy measures, targets and actions to further decrease the quantity of residual waste from households by 2022.

In 2016, the Flemish Government adopted the transversal policy paper "Vision 2050, a long term strategy for Flanders". This paper has set the ambition for Flanders for 2050 and paved the way for the transition to a Circular Economy, integrating materials, water, energy, land and food. It has opened opportunities for a broad multi-stakeholder and multi-disciplinary approach.

At the local level, municipalities such as Ghent and Destelbergen have the legal responsibility to collect and treat household waste. Local authorities are responsible for an organised network of door-to-door collection or a bring-in system such as central collection points and recycling parks.

More than before the current Implementation Plan considers the differences between municipalities. While the plan still determines the waste fractions that each local authority is required to collect and its minimal frequency, it provides more flexibility as to the method of collection. While setting the residual waste targets, it adopts a tailor-made approach taking several socio-economic characteristics into account[5].

Most municipalities in Flanders delegate their authority for the collection and treatment of household waste to inter-municipal organisations. Today, Flanders counts 26 inter-municipal waste management organisations, each focussing on their geographical sector. This allows municipalities to organise their waste management jointly, take advantage of an economy of scale and rely on experts in an ever more complex and specialised sector. The long periods of the delegation agreements (initial up to 30 years) make negotiations about their revision a challenging exercise.

4.2. Waste generation/secondary resources production: facts and figures for Flanders

Through the combined efforts of local and regional authorities and waste and resource managers, the total amount of household waste generated in Flanders yearly has continued to decrease. In 2018, on average 470 kg of household waste was collected per inhabitant in Flanders, which is a reduction by 53 kg compared to 2013. Apart from the challenge to prevent waste from being generated, another goal is equally impor-

[5] The Belfius-index, used for this purpose, is based on 150 variables, clustered around 5 dimensions: the presence of facilities in a municipality, the living standard of the population, rural vs. urban area, the age pyramid, and economic activity. The typology was last updated in 2018 and it identifies 16 different types of municipalities, covering 9 different targets for residual household waste.

tant: to treat waste according to the highest levels on the waste hierarchy. Therefore, the collection needs to be organised in an intelligent way (Friege, 2017).

Waste in Flanders is collected per many different fractions which contain types of waste with similar properties. From the 470 kg/inhabitant total, about 146 kg is residual waste and the rest is selectively collected. Green waste (21%), paper and cardboard (19%), building waste (16%) and Vegetables, Fruit and Garden (VFG) (11%) waste are the biggest parts. The most common treatments are recycling (44%), incineration with energy recuperation (30%), and composting/anaerobic digestion (22%) (weight percentages). More details on the composition and shares of the separately collected waste streams that undergo specific treatment pathways are visualised in Fig. 2.

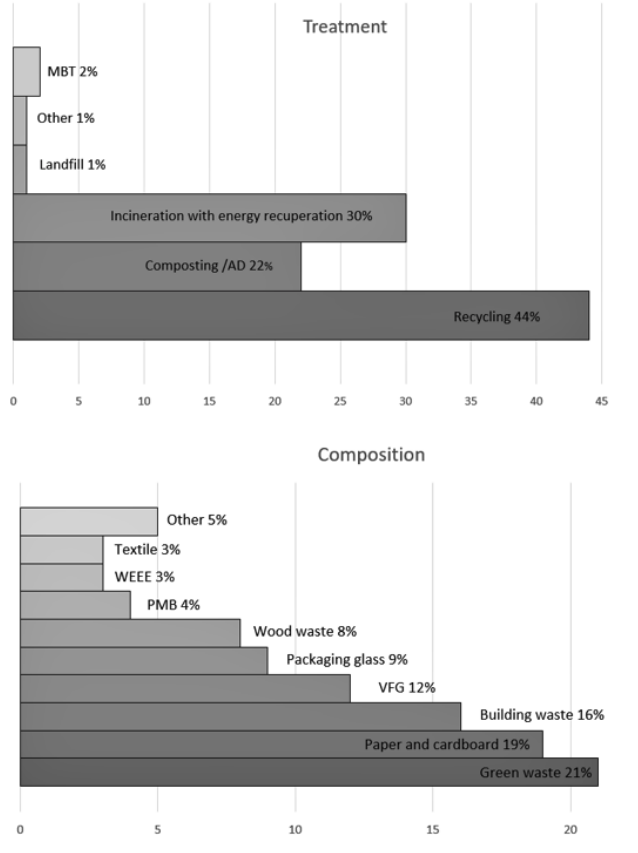

Fig. 2. Treatment and composition of separately collected household waste flows

VFG = Vegetables, Fruit and Garden, WEEE = Wasted Electric and Electronic equipment, PMB = Plastics, Metals and Beverage cartons, AD = Anaerobic digestion, MBT = Mechanical biological Treatment

Source: own work based on Statistiek Vlaanderen, 2018; VMM, 2018.

The continuing progress in Flanders' waste and resources management is based on its multi-stakeholder approach and cooperation between different partners in the sector and at different governance levels. Empowerment of different actors in combination with a tailor-made approach have resulted in the optimisation of the waste collection and treatment schemes, and a far-reaching waste reduction.

4.3. The status quo of the case study area: Ghent-Destelbergen

The Ghent-Destelbergen area is identified as the focus-area within the REPAiR Project (Fig. 3). It covers two municipalities, each legally responsible for the implementation of their municipal waste policies. Both municipalities delegate their authority for the collection and treatment of waste to the IVAGO inter-municipal organisation.

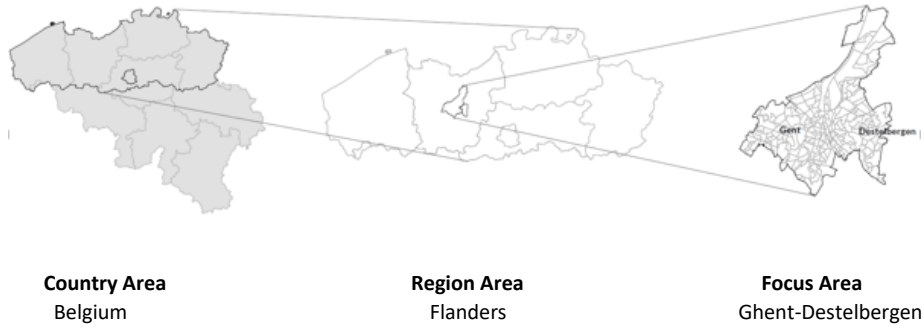

Fig. 3. Case study area as considered in REPAiR: country, region, focus area Ghent-Destelbergen
Source: own work in the REPAiR project.

With a population of 259,083 Ghent is Belgium's 3rd largest city. Its neighbouring municipality Destelbergen has a population of 18,051. Both areas are characterised by a high population density, with considerable difference between the densely populated inner city and more remote areas. Destelbergen is particularly eager to safeguard its 'open space'. However, due to its proximity to Ghent, Destelbergen is very much affected by the demographic evolution, mobility, and urban development in Ghent.

The urban fabric of the area is determined by its rich historical and industrial past, with its peek in the Middle Ages and during the Industrial Revolution. The historic city centre of Ghent features narrow streets and waterways. Beyond its medieval walls, factories were built along canals, waterways and railways and compact worker neighbourhoods appeared. In the 1960s and 70s, large infrastructure investments took place to attract new industrial activities and connect the city

with the hinterland (Van den Berghe, 2018). At the same time several neighbouring municipalities, absorbed by the growing city, formally merged with Ghent.

These spatial developments, the transport infrastructure, as well as housing are important factors to consider in waste management. Compact living forms and smaller housing constitute challenges for residents regarding storing different waste fractions indoors over long periods. The road infrastructure in the dense urban areas challenges the door-to-door waste collection. The efforts to reduce car traffic in the centre of the town and to stimulate the use of bicycles and public transport challenge the accessibility of existing recycling parks, mainly designed for delivery by car. The demographic evolution is another key factor. While Ghent has a better balanced age pyramid than Destelbergen, both face a growing number of small(er) households. On top of the considerable residential student population (over 30,000), Ghent needs to consider more than 1 million overnight stays in the touristic sector.

5. RESULTS AND DISCUSSION

The transition to a circular economy challenges us to go beyond the mere optimisation of existing waste and resource management schemes. The REPAiR project has created the opportunity to test a multi-stakeholder and interdisciplinary approach, involving waste management experts, urban planners, experts in Life Cycle Analysis (LCA), citizens and decision-makers. Based on the methodology developed in the project, and supported by the Geo-design Decision Support Environment (GDSE), participants in the LL developed Eco-Innovative Solutions and Strategies to make the transition to a circular economy by closing material loops and reducing the use of primary resources.

5.1. Identification of VFG as the key waste flow

In line with the EU target for recycling 65% of municipal waste by 2030, the PULL workshops in Ghent-Destelbergen focussed on bio and residual wastes from households. Since bio waste still represents a considerable fraction of the residual waste from households, increasing the separate collection of bio waste (and more specific vegetable, fruit and garden waste) contributes to the Flemish policy objective to further reduce the amount of residual household waste.

IVAGO handles the collection of household (residual and VFG) waste in the entire case study area. However, it applies different schemes for collection due to the different waste policies of both municipalities with different targets for the maximum amounts of residual waste per inhabitant, different collection rates, and

different collection containers[6]. The spatial development of the area is another determining factor. The narrow streets in the centre, combined with intense traffic, limit the opportunities for kerbside collection using containers or underground collection points in the more densely populated areas.

In the territory of Ghent, IVAGO has two zones: the Z-zone (Dutch: Zakken, bags-zone), situated in the inner city centre, and the C-zone (Container-zone) in the more peri-urban and rural areas. In the Z-zone, residual waste is collected in garbage bags, which customers buy at a fixed price. In this zone, residual waste is collected once a week. Households within this zone can request a bin, enabling them to separate VFG voluntarily, in which case they collect it in kerbside green containers. In the C-zone, citizens dispose their waste for door-to-door collection in containers, a grey container for residual waste and a green container for VFG waste. Both are collected once every two weeks. The same applies to Destelbergen. In building blocks with more than 10 housing units, residents use garbage bags for their residual waste. They can opt for separate collection of their VFG-waste using small individual bins, left for kerbside collection.

In practice, only a limited number of households maintain their VFG-waste for separate collection. This results in the collection of 9,970 tonnes each year, 65% provided by the C-zone, 24% by the Z-zone, and 11% by Destelbergen (personal communication, IVAGO). Much VFG-waste still ends up in the residual waste bin. A sampling of household residual waste in the focus area revealed its composition: on average, 19.7% VFG, 20% other organic waste and 60.3% non-organic residuals were found (OWS, 2017a,b). Compared to other municipalities in the Flemish region, the result is average (Flemish government, 2016).

After collection, all separate collected VFG are first stored in the north of Ghent at a storage facility of SUEZ, a French environmental services company. From there, trucks take all the VFG to IVVO[7] in Ypres for anaerobic digestion and composting. Residual household waste goes to the incinerator of IVAGO in Ghent.

5.2. EIS from the PULL Ghent-Destelbergen

The existing VFG and residual household waste flows and current collection and treatment processes in the case study area were the starting points for exploring the eco-innovative solutions contributing to the transition towards a circular economy.

[6] Ghent is considered a 'large regional city' with a maximum amount of residual waste per inhabitant of 193 kg. Destelbergen is a 'residential zone with higher income' and a maximum figure set at 122 kg.
[7] The inter-municipal organisation IVVO is an association of 12 municipalities and aims to collect and treat household waste, as well as organic industrial waste.

During the PULL Ghent-Destelbergen, participants identified challenges, prioritised objectives, and developed EIS. In total, 20 EIS (cf. Taelman *et al.*, 2019a) were developed addressing 6 objectives with the highest priorities (Table 1).

Table 1. Top priority goals identified by the PULL participants

1. Prevent, reduce and reuse food surpluses
2. Favour highest possible value creation/retention of organic material
3. Increase participation in separate collection of organic waste
4. Create opportunities for innovative CE-initiatives
5. Legislation enabling a combined collection of kitchen and food waste with VFG waste fraction
6. Efficient collection system for organic waste

Source: own work.

While prioritising objectives and discussing EIS and strategies, participants in the PULL looked beyond traditional waste management. They easily made a connection to other policy domains such as environment, mobility, local economic production, and the quality of life in the city. Prevention of waste generation was high on the agenda. Some of the EISs focussing on the development of tools to help schools and households prevent food waste often applied to behavioural aspects. While it proved difficult to validate these aspects in a sustainability analysis (Taelman *et al.*, 2019b) due to their intrinsic quantification complexity, they were considered important by the stakeholders and as such documented in the GDSE. The same applied to some of the EIS creating a favourable environment to accelerate the transition to a circular economy or to increasing social cohesion in the city.

Some of the objectives and EIS identified during the PULL were very much in line with the ongoing debates at city or regional level. As such, they confirmed the urgency of the ongoing debates or brought new insights to the discussion. For example, the legal aspects in the collection of kitchen waste (objective 5) have been addressed since, owing to a revision of the sorting rules for VFG-waste at the Flemish level.

5.3. Evaluating the process of the applied Living Lab

The result of the REPAiR methodology very much depends on the definition of the case study area and the participation of the stakeholders. For Ghent, the case study area was determined by the working area of the inter-municipal or-

ganisation IVAGO. This facilitated the collection of data, it was in line with the concept of peri-urban areas as determined by REPAiR, but it did not thoroughly address the issue of scale: should we have looked at Ghent within a broader region? While it is difficult to judge whether that would have affected the outcome, there is no doubt that it would have altered the process, involving more municipalities and several waste-treatment companies.

During the PULL workshops it proved challenging to involve stakeholders from Destelbergen. While there was an openness on their side to participate, the intensive consultation process was considered a major obstacle. This indicates the challenging and different realities of large cities and their often smaller, peri-urban neighbouring municipalities. Major cities such as Ghent have more means and are often more proactive to engage in new insights. Representatives of different departments of the city of Ghent (e.g. environment, urban planning, waste management, and food waste prevention) participated in the PULL workshop. In Destelbergen, most of these issues are handled by one (smaller) department. The urgency to make the transition from a linear to a circular economy could create an opportunity to get smaller municipalities on board, but this is not yet a reality.

6. CHALLENGES AND RECOMMENDATIONS FOR THE FUTURE

In the past decades, Flanders has made a successful journey from waste to resource management. Today, it prepares for the transition to a circular economy. The REPAiR methodology prove its potential to support the decision-making in this transition and strengthen ongoing processes.

The GDSE paves the way for a transparent and documented decision-making process. The involvement of the different stakeholders in the co-exploration, co-design and co-production process creates a strong common understanding of the challenges and a solid base for support for future solutions and decisions. Linking the REPAiR process to the existing multi-governance and participatory approach already practised both by OVAM (resources management) and the city of Ghent (e.g. environment, urban planning), offered a real added value, both in terms of content and of the process.

The EISs developed during the process covered aspects related to several phases in the value chain, from prevention, through reuse and recycling, collection and valorisation. They also applied to a broad spectrum of social issue going beyond mere resource management. The Eco-innovative strategies, combining several EIS, illustrate a more circular economy approach, addressing systemic challenges and going beyond a mere optimisation of existing practises.

The co-creative and interdisciplinary approach of the REPAiR-project, bringing together researchers, waste management practitioners, urban planners, decision-makers and students, clearly lifts the differences between the individual approach of each stakeholder, at different stages of the value chain. The LCA analysis proved to be a valuable tool in balancing efforts to implement EIS, against environmental, social and economic gains.

However, the REPAiR approach also has its challenges. The transparency of the multi-disciplinary and multi-level approach will need to be maintained in the drafting process when EISs and strategies are translated into legislation and policy. An acquired insight might be reconsidered when new stakeholders and considerations enter the discussion. The need to maintain a degree of uniformity and respect for the principle of equality at the regional level might interfere with some of the expectation and EIS, motivated by the local context. The review of regulations often requires a delicate balance between different levels of decision-making. Hence, the need to carefully consider the scope of the case study area from the start.

Financial implications are a determining factor in each debate on waste/resource management and circular economy. While the fact of reaching a circular economy might have a positive impact on the environment, it also comes at a cost. The benefits, from the recuperation of valuable materials, do not necessarily flow back directly to municipalities and their residents. Since this imbalanced cost-benefits model is one of the real political challenges for the transition to a circular economy, it is worth considering how this could be integrated into the REPAiR approach.

Regulations should equally provide support to balance the environmental impact against economical costs and social burdens to decide which are the most desirable options (Van Ewijk and Stegemann, 2016; Lavrysen, 2017). Although it is extremely relevant to cover the three pillars, lessons learned from applying the sustainability framework to European urban waste management systems (both status quo and EIS) show the huge primary data requirement due to its comprehensiveness, incurring substantial time-consumption and effort, far beyond a classic Life Cycle Analysis (LCA) that usually involves a more limited number of impact categories to be addressed. Although the confidentiality of information will remain an issue, it must be clear that we have to make the data and methods used within the project as much as possible available for the wider public, preferably distributed on an open-source basis, because transparency and reproducibility are key ingredients of excellent science, facilitating the sustainability assessment to other cities or regions in the world.

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