



REPAIR

REsource Management in Peri-urban AREas: Going Beyond Urban Metabolism

D6.5 Cross Analyses of Decision Models

Version 1.2

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Acronyms and Abbreviations

A/N	Author's Note
AS-MFA	Activity-based Spatial Material Flow Analysis
CE	Circular Economy
C2C	Cradle-to-Cradle
CDW	Construction and Demolition Waste
DTs	Decision Thresholds
e.g.	exempli gratia
EIS	Eco-Innovative Solutions
FA	Focus Area
GDSE	Geodesign Decision Support Environment
GDSE VC	GDSE Visualisation Chart
GIS	Geographical Information System
HCU	HafenCity Universität
i.e.	id est
LCA	Life Cycle Assessment
MCA	Multi-Criteria Analysis
MFA	Material Flow Analysis
MSW	Municipal Solid Waste
NGO	Non-Governmental Organisation
NUTS	Nomenclature of Territorial Units for Statistics of EU
OW	Organic Waste
PA	Public Administration
PULL	Peri-Urban Living Lab
PULL-M	PULL Meeting
PULL-WS	PULL Workshop
R&D	Research and Development

SDSS	Spatial Decision Support System
WM	Waste Management
WP	Work Package

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Glossary

Circular Economy_it is referred to a broad and slightly recent concept included in several fields of operation:

- a. Circular Economy is an economy based on renewability of all resources – energy, materials, water, topsoil (for food production) and air – while retaining or creating value, promoting positive systemic impacts on ecology, economy and society, and preventing negative impacts.
- b. Circular Economy accommodates resources to flow through man-made and natural systems in renewable ways, creating or retaining value through “slowed, closed or narrowed loops”, rather than rapidly destructing value through the creation of waste. This value can manifest itself in monetary principles as well as other social, ecological or economic principles, taking account of potential trade-offs. Important in this notion is the establishment of production-consumption-use systems built on restorative resources in optimal flows. Optimal flows imply that cycles are closed or connected at spatially and temporally favourable conditions i.e. where and when most appropriate (highest possible value). Moreover, changes in one part of the system should not incite negative externalities. Of particular interest for REPAiR in this respect are impacts on spatial quality. From that perspective REPAiR also includes the notion of waste-scapes (open spaces as well as built form) into the equation (European Union 2017; Ellen MacArthur Foundation 2013).

Closed loops_through recycling, the loop between post-use and production is closed, resulting in a circular flow of resources (Bocken et al. 2016).

Eco-innovative solutions (EIS)_The definition of an EIS will be provided soon in the Deliverable 5.4.

Living Lab (LL)_LLs are 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. In LLs different areas of expertise from diverse partners are needed for a good development of the activities, with the aim to meet the needs of the stakeholders by innovation (ENoLL).

Peri-urban_is the area of an urban region, where built and unbuilt patterns intermix (Forman 2008: p.7). Peri-urban areas have not the features of urban compact city nor the suburban village ones; their features, often unprecedented, are in turn defined as: urban sprawl, dispersed urban development, widespread city (città diffusa), territories in-between, etc. These are “areas where new functions, uses and lifestyles arise as a result of the ongoing interaction of urban and rural elements. They cannot solely be explained as an intensification of urban functions in the rural environment, but have specific spatial and programmatic features that set them apart” (Wandl et al. 2014). Moreover, because of (former-round, widespread, increasingly polynucleated) structure of contemporary urban regions, peri-urban areas are not matching with the intermediate areas around the city. Then, peri-urban is a specific condition of contemporary settlements in the urban regions; it has a widespread and scattered nature and can be recognised both by landscape readings both by quantitative analysis. The landscape-reading shows

territories characterised by high fragmentation, lack of urban and ecologic continuity, hybrid (not-rural, not-urban) condition, dispersion of sense of places caused by continuous overlapping of sectorial elements and flows. That is a not-isotropic spatial structure; it is determined by iterations, rips, spatial accumulations of scattered uses and buildings. From a quantitative point of view, peri-urban settlements can be recognised by way of several indicators: someone depending on physical features (number of buildings and surface they cover, built-up volume, parcel fragmentation, etc); other ones deriving from the way in which target areas are used (inhabitants, workers, infrastructures and their uses) (Own 2017).

Resource_a source of supply or support (Merriam-webster). Within REPAiR, 'essential resources' can refer to: energy, materials, water, topsoil, food, and air.

Slowed loops_through the design of long-life goods and product-life extension (i.e. service loops to extend a product's life, for instance through repair, remanufacturing), the utilisation period of products is extended and/or intensified, resulting in a slowdown of the flow of resources (Bocken et al. 2016).

Sustainability_the balanced and systemic integration of intra- and intergenerational economic, social, and environmental performance (Geissdoerfer et al. 2017).

System_an interconnected set of elements that is coherently organised in a way that achieves something. A system must consist of three kinds of things: elements, interconnections and a function or purpose (Meadows 2008).

Value_the regard that something is held to deserve; the importance, worth, or usefulness of something (Oxford Dictionaries). Value can, amongst others, be expressed in material or monetary units.

Waste_any substance or object that the holder discards or intends or is required to discard (European Union 2008).

Wasteland_an unused or neglected area of land that has become barren or overgrown (Oxford Dictionaries).

Wastescapes_patches of landscape related to waste-cycles both by functional relations and because they are "wasted lands", areas not included in the peri-urban development scenarios, becoming neglected spaces. Therefore, with the term 'wastescapes' we refer to peri-urban elements of urban regions known both as Drosscapes and Operational infrastructure of waste (UNINA Team 2016).

Publishable Summary

The Deliverable 6.5 Cross analyses decision models follows the methodology that was explained in D6.4 and D6.6. D6.5 analyses the decision process in all six cases. The main focus is on the decision processes and the methods that were used within the PULL processes of all six cases. This includes the information exchange, discussion and decision processes with the support of the GDSE, MFA and LCA. Further categories of the analysis are the types of stakeholders that were involved or not involved, types of decisions that were taken or not, different methods that were used to make decisions. Based on the case-by-case examination, initially a cross case analysis was planned. As the 6 cases developed dynamically and vary considerably, a cross case analysis would not fulfil its purposes. Therefore D6.5 focuses on specific differences of the cases in the decision making process. Furthermore it gives an overview of activities outside the PULL process that were influenced by the PULL process (compare the co-governance section in WP5). Also another outcome of the work in WP6 is included in D6.5. As WP6 was responsible for governance topics, an important outcome was the observation of the dynamic of circular economy development during the REPAiR project's lifetime. All 6 case regions experienced changes with regard to a transition towards more circularity. This observation was to a large extent possible, because of the intensive cooperation with different stakeholders, who provided the research team with information on new developments (e.g. new regulations, planned projects). In order to structure these observations and make them useful for the scientific debate as well as for practitioners, the WP6 team aimed at developing an assessment tool to benchmark the transition of a city or region towards circularity. At least a beta version of this tool was achieved and tested in workshops with the user board and other stakeholders from the 6 case regions and the tool was also presented and discussed during the final REPAiR event. It is planned to further develop the tool with the WP6 core group after the official end of REPAiR.

1. Introduction and background

REPAiR has explored the spatial effects that actions towards implementing Circular Economy imply. WP6 has observed the decision-making dynamics that are supposed to support and steer this process by aiming at a governance structure that should be multi-level, multi-actor and multi-sector (Obersteg et al. 2019).

This deliverable aims at describing and summarising all decision-making-related tools and methods that were used in the four years of REPAiR in relation to the co-creation process of the eco-Innovative Solutions (EIS). Co-creation was supported by Peri-Urban Living Labs (PULL): the living labs are a form of workshops, which act as test-beds where diverse stakeholders cooperate to develop, and if possible implement, solutions. The co-creative work took place within the PULL framework, yet supported by the PULL organisers with the preparation of inputs for the workshops.

More precisely, WP6 built a framework (GDSE VC - see REPAiR 2019) for showing visually the PULL process in relation with the methods and tools developed for REPAiR. Additionally, decisional momenta are identified as turning points for enhancing the process within and outside the PULL.

A qualitative questionnaire was developed to gather impressions and feedback from the participants of the PULL and the organisers to draft conclusions on the methods and tools that support decision-making within the framework of co-creative processes.

Additionally, within WP6 an assessment tool was developed to examine the status quo in the transition to Circular Economy in the six urban regions. This work responded to the calls for defining a Circular Economy assessment framework (see for example Elia et al. 2017). This tool - the Circular Economy Transitions Assessment Tool - was designed in the last months of the project, tested in pilot runs in all of the six REPAiR's case study regions. The results of these pilot runs were presented and discussed with participants representing the public, the private and the scientific sector in the final conference of REPAiR. In this deliverable, we outline the rationale for the tool, its main concept and features and describe the results from its pilot application. The benchmarking tool is supposed to be further improved and applied in our six case study areas beyond the REPAiR's time frame.

This deliverable is therefore divided into three main sections. The first provides a quick background on decision-support methods and tools and how those were declined for the REPAiR methodological framework. The second reports on the questionnaire development. The third part summarises and discusses the main findings from the questionnaire to understand how far the tools supported the decision-making in the PULL process. Based on the discussion draft common

recommendations for decision-making and governance frameworks in the context of Circular Economy are derived.

2. Tools, methods and decision-making

In this chapter we refer to the theoretical background for the main tools and methods that were selected for the REPAiR project. These are namely 1) Living Lab, 2) Spatial Decision Support System, 3) Material Flow Analysis, and 4) Life Cycle Assessment. Each method/tool is presented with a brief historical introduction and its main features in relation with decision-making and decision support.

2.1 Living Lab approach

The term Living Lab is a rather broad concept referred to the act of testing in a real-life laboratory an ad hoc methodology built for a certain co-creative process. It is therefore a tool that enhances participation by bringing different stakeholders together, normally based on a series of iterative steps. Characteristics of living labs are a) a clear link to the geography of the place, b) experient and learning process, c) participation, d) leadership and ownership, and d) evaluation and refinement (Voytenko et al. 2016). Thus, it also allows for a certain degree of flexibility: in fact, the methodology designed for the process can be changed and adapted according to progress (or setback) done. Living Lab is a phenomenon that is globally identified as a tool to address environmental related challenges, i.e. requiring the interface of many and different stakeholders at all governance levels. At European level, the ENoLL (European Network of Living Labs) states the importance of the living lab approach as key for establishing trust and direct participation of all (ENoLL 2016). Nevertheless, applying systematically the complete methodology of the living lab approach is not easy (cf. Steen & Baueren 2017) and requires a huge amount of effort, resources, and time.

The Living Lab approach can be seen as the setting in which co-creative decisional processes are facilitated and conducted. Within this environment, a set of instruments and methods are available to convey information, data and results but also to support dialogue, exchange and foster cooperation.

2.2 Spatial Decision Support Systems (SDSS) and Geographical Information System (GIS)

Computer-based tools are technologies that have been developed relatively fast in the last two decades. In particular, Spatial Decision Support Systems (SDSS) are targeted as important devices that facilitate and support informed and effective decision-making with a strong relation to the spatial dimension of the decision. The introduction of the variable space derived from the necessity to

promptly react to emergencies and the needs of citizens participation (Keenan & Jankowski 2019). Some of these systems are based on Geographic Information Systems (GIS). These instruments are useful for assessing and visualising impact assessment (Eedy 1995; Sholarin & Awange 2015) but are seldom applied for sustainability analysis. GIS is often linked to space and spatial planning (de Wit et al. 2009) and therefore makes it suitable for support planning activities, and therewith, participation. An example of the application of GIS technologies connected to stakeholder involvement can be found in the concept of Participatory GIS (PGIS). Tools built upon the PGIS concept enable groups of stakeholders (also citizens) to participate in decision making processes for “shaping their communities”, as a potent tool for city planning (Jankowski 2009: 1966). In this sense, GIS have gone through a reshape process which led to the modelling of GIS technologies with a focus on “geonarratives, qualitative/mixed methods, storytelling and synthesis” (Sui 2015: 1). Hence, in response to a more just and social equality, the GIS tool should be used to connect different stakeholders to consider place and people involved during the planning process (Steinitz 2012).

2.3 Material Flow Analysis (MFA)

In the context of Circular Economy and, more generally, sustainable development, it is key to understand how material and energy flows are organised within the city. Urban Metabolism is an approach to analyse these flows at city level and beyond which is based on the understanding of the city as an entity a) to which materials and energy is delivered for its sustenance; b) in which materials and energy are stocked, consumed and eventually reused; and c) from which wastes flow out. To analyse these dynamics, Material Flow Analysis (MFA) stands out as a comprehensive methodology able to systematically assess the state of the art and changes of materials and energy flows by identifying their origins, pathways, intermediate steps and destinations (see REPAiR 2018). As stated in Brunner & Rechberger (2016), MFA is a methodology suitable for decision-support in the fields of resource and waste management and related environmental policies. The need of understanding always more precisely the spatial organisation of the activities involved in materials and energy flows has brought to a development of the MFA methodology by including a geolocalisation of these activities. This additional information can be useful for instance for producing targeted policies for specific urban areas (Roy et al. 2014). The localisation of activities allows to build a Network-based spatial MFA (Vivanco et al. 2012). In this way, additional information for the assessment can be included, such as an estimation of transport distances.

A further layer is the social dimension. Wallsten (2015) claims that the social aspects are still neglected in the Network-based spatial MFA, yet of great relevance. With social aspect he refers to the necessity of adding a qualitative explanation of the quantities visualised and assessed by the methodology. This additional ‘sociotechnical’ analysis is expected to complete the understanding of

the flow systems by considering “politics, organisations, [and] regulations” among others (Wallsten 2015: 745).

2.4 Life Cycle Assessment (LCA)

Life Cycle Assessment (LCA) is a family of standardised assessment methodologies that focus on describing the impacts of products and services through their complete lifetime (from production to waste) compared with a reference scenario (baseline or status quo). It can be used for any products or materials for which an analysis of its flows was conducted (see Crawford 2011 for construction and demolition products and Tonini et al. 2018 for organic waste). Hence, the LCA can be understood as a logically consequent analysis of the MFA (see previous paragraph).

Originally, mainly environmental impacts were considered. Nowadays, also economic and social impacts are included, yet not entirely explored. In general, LCA is a technical assessment tool based on four main steps: a) goal of the analyses, b) creation of the inventory, c) definition of the impact categories, and d) interpretation of the results (see ISO 14040). LCA results can be used as inputs in a decision-making process, as the ultimate goal of the assessment is to support an informed decision-making (Life Cycle Initiative 2019: 54). Due to the complexity of the analysis, an extensive and time-consuming data collection is required to perform the assessment. Consequently, LCA results are often cryptic for non-expert stakeholders. In this sense, the deployment of LCA techniques needs a certain mediation to be understood by all participants, yet represented in an easy-to-read way. To address these issues, LCA has been modified and complemented with other methods (see Jeswani et al. 2010 and Life Cycle Initiative 2019). As an example, Life Cycle Costing (LCC) or Social LCA (SLCA) are two of the declinations of the LCA methodology specific for economic and social issues respectively.

2.5 REPAiR and the decision-making within the PULL framework

The methodologies and tools for decision-making support described in the previous section were used as a basis to steer the co-creative process in the PULL.

Based on the Network-based MFA, REPAiR has developed the Activity-based Spatial Material Flow Analysis (AS-MFA) with the main aim to geo-localise flows and related infrastructure and the identification of the type of economic activities involved in the flow chain (see REPAiR 2018). The LCA performed in REPAiR is the result of a joint effort between the project partners in the selection of indicators to measure the impacts of the solutions in the case study areas. Particular attention was kept on spatial-related (e.g. distances, disamenities due to proximity, odours ...) and on social-related indicators (e.g. behavioural change, stakeholder involvement ...). The LCA framework for REPAiR is described in D4.4

and Taleman et al. (2018). A Geodesign Decision Support Environment (GDSE) was programmed as the main digital vehicle for sharing and visualising the results from the solution design, the AS-MFA and the LCA. It belongs to the SDSS family and it is GIS based (see REPAiR 2020a).

The AS-MFA, the LCA and the GDSE are the decision-support tools used for facilitating the design of the eco-innovative solutions (EIS) involving different stakeholders. The co-creation process for the design and development of the solutions based on the living lab approach is composed of 5 phases: co-exploration, co-design, co-development, co-decision and co-governance. The content of each phase is explained in REPAiR (2020b). To proceed in the process, decisions must be made on specific topics or issues: these are called Decision Thresholds (DT) and described in D6.3. In order to link the contents of the phases with the necessary decisions and with the methods to be used for making these decisions, the so-called GDSE Visualisation Chart (GDSE VC) has been developed in the frame of WP6. The chart aims at visualising the connections between phases, activities, decisions and methodologies in order to facilitate the process development and its replicability. The GDSE VC is described in REPAiR (2019).

2.6 Circular Economy Transitions Assessment Tool

There were several reasons why a decision was taken to develop a tool for assessing Circular Economy transitions status quo. Firstly, recent literature increasingly puts an emphasis on the need to develop suitable metrics for Circular Economy transition. While many new methodologies for assessment are proposed (see Corona et al. 2019 for a review), they tend to focus on either assessing quantitatively how circular a system is; or on examining the degree to which circular strategies are in line with the Circular Economy principles. However, as Corona and colleagues argue, existing metrics do not reflect the complexity of the matter and are not integrated enough to effectively inform decision-making and avoid burden shifting (2019). In a similar vein, Pitkänen and colleagues are critical of existing approaches to assessing Circular Economy because of neglect of the social dimension of the transition (2020).

Second, since the launch of the REPAiR project in 2016 Circular Economy became a mainstream policy goal in Europe and beyond. During the four years the debate on Circular Economy has intensified, new policies were rolled out, knowledge on circular processes developed, and many innovations and experiments took place and awareness of Circular Economy principles among policy-makers, place-makers and citizens grew. It was thus deemed necessary to take stock of the status quo in our case study regions to be able to understand how it evolved since the start of the project and understand how the project contributed to this change.

Third, we identified a gap in the literature and the plethora of metrics and assessment tools available. They tend to put an emphasis on the technical

dimensions of Circular Economy, in relation to flows of materials, changes in production and consumption processes, but neglecting what it actually takes to govern a transition towards a fully Circular Economy. Research conducted as part of REPAiR's WP6 (see Obersteg et al. 2019) shed light on the huge magnitude of this challenge, identifying a range of governance challenges for pushing regions and cities towards more circular futures. There are no templates for a successful transition towards Circular Economy and no consensus of where to begin and how to steer this process. Moreover, achieving a transition towards Circular Economy would require to mobilise a vast range of stakeholders from along the value chains, operating in different sectors of industry and policy, at different geographical scales and different territorial levels, from local to regional and national and transnational. To put this simply, the Circular Economy remains a novelty requiring a deep shift in the ways in which businesses, policies, and consumers operate. Hence, there is a need for an assessment tool that allows for sketching a picture of where a given region or city is in terms of laying the foundations for and managing a Circular Economy transition and identifying the steps that need to be taken to achieve this. The Circular Economy Transitions Assessment Tool responds to that need.

The literature on (urban) sustainability transitions and transition management (Geels 2011; Loorbach 2010; Loorbach et al. 2017, Frantzeskaki et al. 2017) provided the inspiration and a starting point for development of this tool. There is a growing emphasis on moving from urban sustainability transitions to Circular Economy transitions, but there is also a major knowledge gap in this respect: the 'how' question (Fratini et al., 2019). In other words, we know transition is necessary, but there is a need to shed light on how to manage it. The literature to date tends to focus on socio-technological aspects of Circular Economy, missing the spatial (Williams 2019), governance (Obersteg et al. 2019) and societal aspects (Pitkänen et al. 2020; Moreau et al. 2017). Whereas to grasp the complexity of the challenge of a transition towards Circular Economy we need an integrative approach.

Against this background, REPAiR's Circular Economy Transitions Assessment Tool is proposed as a means to address those gaps and use co-creative engagement of stakeholders in a given territory to gain insights into where on the path to Circular Economy transition a region is, understand what barriers block progress and what steps are needed to create an enabling environment for the transition. Co-creative aspects, allowing for active engagement of stakeholders in elaboration of knowledge and solutions, are essential given the relative novelty of the topic, the said lack of templates, and the need for multiple perspectives of the variety of stakeholders critical for Circular Economy. Whereas other assessment tools tend to use quantitative methods and focus on material flows (see for instance Ecorys 2019), REPAiR's approach is more qualitative and focusing on the overlooked dimensions of awareness, institutions and governance, presence of tools for assessment of circularity and co-creative engagement of stakeholders.

Since the decision to develop the tool came towards the very end of the project, there was not enough time and capacity to conduct a complete research of the changing conditions for Circular Economy transitions (on local, regional, national, EU level). Therefore we decided to assess the state of the transition of our six urban regions towards Circular Economy. To this aim, we developed a tool and tested it in a pilot application across the six case study areas of REPAiR in a series of online workshops with the stakeholders of the PULLs.

Four stages of the transition

As a first step towards the benchmark, four stages of the transition (Figure 1) were determined as a means to assess progress and compare the state of play across different territories and aspects of the transition. The stages are:

1. **Ambition to go circular** - early stage of the transition, at which economy remains firmly linear, but stakeholders and policy actors express ambitions to shift towards circular economy and put forward ideas, plans, strategies to achieve this.
2. **Niche change** - as argued by Geels (2011), transition begins with changes and experimentation in niches, on the fringe of the predominant model of activity. Such experimentation is critical for identifying new solutions, new ways of doing things, methodologies, paving way for more widespread use of those.
3. **Accelerating change** - this stage corresponds to a situation where experimentation becomes widespread, institutionalised and widely supported, reaching a critical mass able to drive systemic change.
4. **Mainstreamed Circular Economy** - in this final stage of the transition, linear economy would be a song of the past, and circular processes would be fully mainstreamed as the predominant paradigm for production, consumption, or development of the built environment.

Naturally, these stages are not precisely defined, but rather 'ideal types' and serve the purpose of assessment, animation of the debate and comparison.



Figure 1. The four stages of Circular Economy transition. Source: REPAiR WP6 team. Icon sources: (1, 3, 4) Flaticon; (2) Vecteezy.

The four axes

Subsequently, indicators for assessing the transition were divided into four 'axes'. Each axis contains 3-4 indicators, with which one is able to assess the state of play in a given territory using a four-stage scale (from ambition to move beyond the linear economy to mainstream Circular Economy).



Figure 2. The four 'axes' of the tool. Source: REPAiR WP6 team. Icon sources: (3) Flaticon; (1, 2, 4) Noun Project.

The axes are the following (see Figure 2):

1. Governance: arenas, agendas, experiments for supporting and steering the transition.
2. Awareness: corporate awareness, awareness towards wastescapes, awareness towards policies, everyday practices of citizens.
3. Tools: tools for assessment of material flows, tools for urban mining (stock), and tools for enabling co-creation (of knowledge, solutions, strategies) with stakeholders.
4. Sustainability assessment: availability of data on waste and materials, the degree of stakeholder involvement in assessment, the degree of comprehensiveness of sustainability assessment (consideration of the pillars of sustainability).

More details on each of the axes are provided on Figures 3-6 below.

	Arenas <i>Long-term-oriented strategic activities and policies</i>	Agendas <i>Medium-term tactical activities (regulations, support tools and incentives)</i>	Experiments <i>Eco-innovative solutions for integration across flows and space</i>
1 - Ambition	... are being discussed between small groups of stakeholders.	... are being discussed (emerging).	... are isolated , most innovations are concerned with the improvement of waste management .
2 - Niche	... begin to be implemented at some of the territorial levels ... and cover only parts of the relevant territory , ... are not yet integrated vertically or horizontally ... are not yet integrated with spatial strategies.	... are in place at some territorial levels and cover some of the relevant territory , their impact remains limited to selected policy sectors are emerging based on the R-strategies , predominantly in the form of industrial symbiosis .
3 - Accelerating	... are implemented at all territorial levels ... and cover most of the relevant territory (municipalities), ... are integrated vertically across governmental levels OR horizontally across administrative boundaries OR across policy sectors AND in collaboration with knowledge and private sectors are in place at all territorial levels and cover most of the relevant territory , ... but they cover only some of the relevant policy sectors	... are reaching a ' critical mass ' ... emerge in form of circular urban and regional development initiatives (e.g. spatial planning integrating CE, like circular business parks or neighbourhoods).
4 - Mainstreamed	... are in place at all territorial levels ... and cover all the relevant territory , integrated vertically across those levels AND horizontally across administrative boundaries ... AND across policy sectors in collaboration with knowledge and economic sectors AND with citizens are in place at all territorial levels ... and cover all the relevant territory, creating an enabling environment for the transition.	... are spatially integrated and considered as standard (beyond experimental character) ... have reached a critical mass cutting across material flows AND are integrated with spatial strategies cutting across scales.

Figure 3. Governance axis. Source: REPAiR WP6 team (Marcin Dąbrowski, Andreas Obersteg), building on Wittmayer & Loorbach 2016; Heurkens & Dąbrowski 2021.

Level of CE	Corporate awareness	Towards Wastescapes	Towards Policy implementation	Ordinary life practices
1 - Ambition	Little own responsibility in separate waste collection can be found at corporate level (e.g. One or maximum two separation possibilities available for employees)	Citizens are aware of discarded areas in their territories	Citizens are interested in CE rules and opportunities	People start thinking about potentials of discarded objects. Most of the people are satisfied with separate collection
2 - Niche	In most of the companies, separate collection is available for employees, and the most of the company has a voluntary "green strategy" and a related education program	Citizens start to consider discarded areas as a potential	Citizens are partially able to be informed and to experiment with CE opportunities	Experiments are made in the recycling of materials/objects and in the field of education. People are trying to reduce their packaging use
3 - Accelerating	Most of the companies are working on reducing packaging, and looking for low-waste technologies. Service provider companies mainly use paperless and distance services	Groups of people start reappropriating discarded areas	Citizens start making use of policy implementation on CE	Groups of people start reusing disused materials/objects and also NGOs work in this field
4 - Mainstreamed	Most of the companies integrate reused parts in production and work on the extension of life of products. Paperless services. Companies mainly use renewable sources for electricity, heating and transport	People are actively involved in the recovery of discarded areas	Citizens are able to use CE rules and solutions, and to suggest new challenges for policies	People are actively involved in CE practices and open to new challenges. People mostly buy durable consumer goods. Repair and refurbishment are priorities

Figure 4. Awareness axis. Source: REPAiR WP6 team (Gilda Berruti, Viktor Varju)

Level of CE	Flow	Stock	Co-creating tools (e.g. Living Labs)
1- Ambition	A material flow analysis for a city/region on input output level is available for most materials and energy flows.	The development of urban mining models is being discussed .	Only limited participatory processes are established, like focus groups, consultation processes aimed at finding out people expectations and their needs.
2 - Niche	A more detailed MFA , either spatially or concerning qualities of materials and treatment of specific flows are available regularly.	A general urban mining model for the whole city has been developed once for a selection of materials .	Pilot projects that include co-creational aspects are running (user-centric ensemble).
3 - Accelerating	A comprehensive and detailed MFA is done regularly and used for policy assessment.	A more detailed , either spatially or concerning qualities of materials and specific stocks , model are available regularly .	Many experiments based on user-centered environments with results conveyed by actual users .
4 - Mainstreamed	A real-time material flow information system is available that provides sufficient information to establish a secondary raw material market .	Comprehensive and detailed urban mining model (supported by material passports for example) is done regularly and used for policy assessment.	Co-creational decision development of CE related policies are widely spread in management/planning processes and policy regulations.

Figure 5. Tools Axis. Source: REPAiR WP6 team (Alexander Wandl, Sue Ellen Taelman, Marcin Dąbrowski, Andreas Obersteg)

Level of CE	Data availability	Stakeholder involvement	Comprehensive sustainability assess.
1- Ambition	Data on waste management not directly available . Data gaps filled with data from literature, databases etc. and many approximations have been made. Many problems with confidentiality of data .	Stakeholders were not involved in the data collection.	A sustainability assessment has been done for the waste management system under study for 1 pillar (either social, economic or environmental) AND for one spatial scale (e.g. local).
2 - Niche	Data is available but limited . Data gaps filled ... and a few approximations have been made. Confidentiality issues of data might appear .	Stakeholders were involved in the data collection, as well as to contribute to the definition of the goals and scope of the sustainability study.	A sustainability assessment has been done for the waste management system under study for 2 pillars (e.g. social and economic) OR 1 pillar but covering multiple spatial scales .
3 - Accelerating	Data is available . Data gaps filled ... and a few approximations have been made. Many data is open access .	Stakeholders were involved in the data collection brainstorm about the goal and scope of the sustainability study and were engaged in the impact assessment (developing/selecting indicators).	A sustainability assessment has been done for the system under study for all three pillars (social, economic and environmental) OR 2 pillars but covering multiple spatial scales .
4 - Mainstreamed	Data is extensively available . Data gaps filled ... and almost no approximations have been made. Data is open access and /or fully available .	Stakeholders were involved in multiple steps of a sustainability assessment studies (incl. interpretation of results).	Model and framework in place to aggregate sustainability results (3 pillars and multiple spatial scales) and eventually a single score , providing decision support for policymakers.

Figure 6. Sustainability Assessment. Source: REPAiR WP6 team (Alexander Wandl, Sue Ellen Taelman)

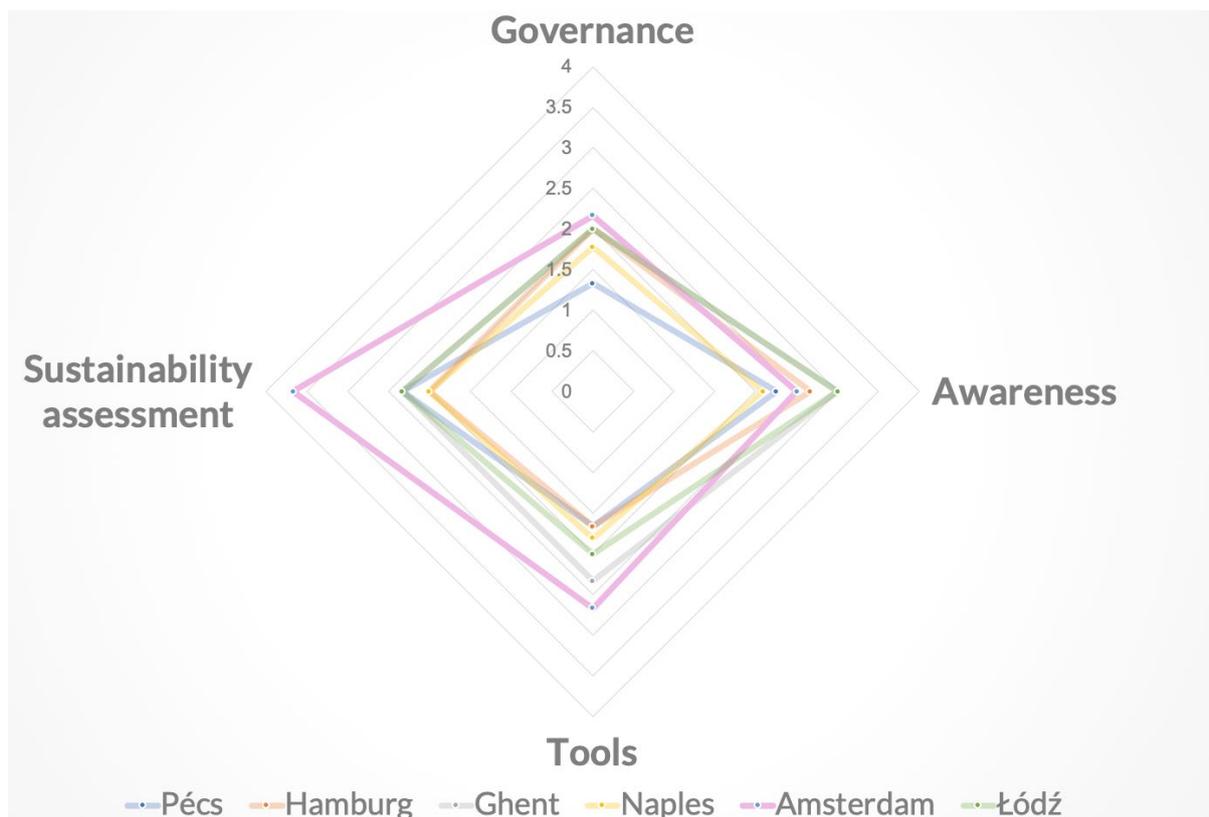
Application of the tool and results of the pilot

The tool was applied in a pilot conducted in September 2020 in a series of online workshops with PULL stakeholders from Pécs, Hamburg, Ghent, Naples, Amsterdam and Naples. Each of the PULL was represented by 3-6 participants, including the members of the project team and PULL stakeholders. The workshops for each case lasted for about 120 minutes and involved discussion,

consensus-building on a score (from 1 to 4, corresponding to the different transition stages, with possible in-between scores) and entering the scores into an online form.

Please note that in the pilot application, due to shortage of time and resources, it was impossible to organise sufficiently large and representative groups of stakeholders for the co-creative workshops. Therefore, the results presented below have to be taken with a proverbial 'pinch of salt' because they require further validation in each of the cases, through a series of larger workshops with a sound representation of regional Circular Economy stakeholders. In an ideal setting in future application of the tool, this should be done in a larger group representing the relevant Circular Economy stakeholders from the governmental sector, knowledge providers, market players and representatives of the civil society to ensure diversity and robustness of inputs.

After assessing each indicator in the workshop, scores were aggregated and visualised using radar diagrams illustrating the state of transition in a given territory by axis. The summary scores for each of the regions are represented on Figure 7 below.



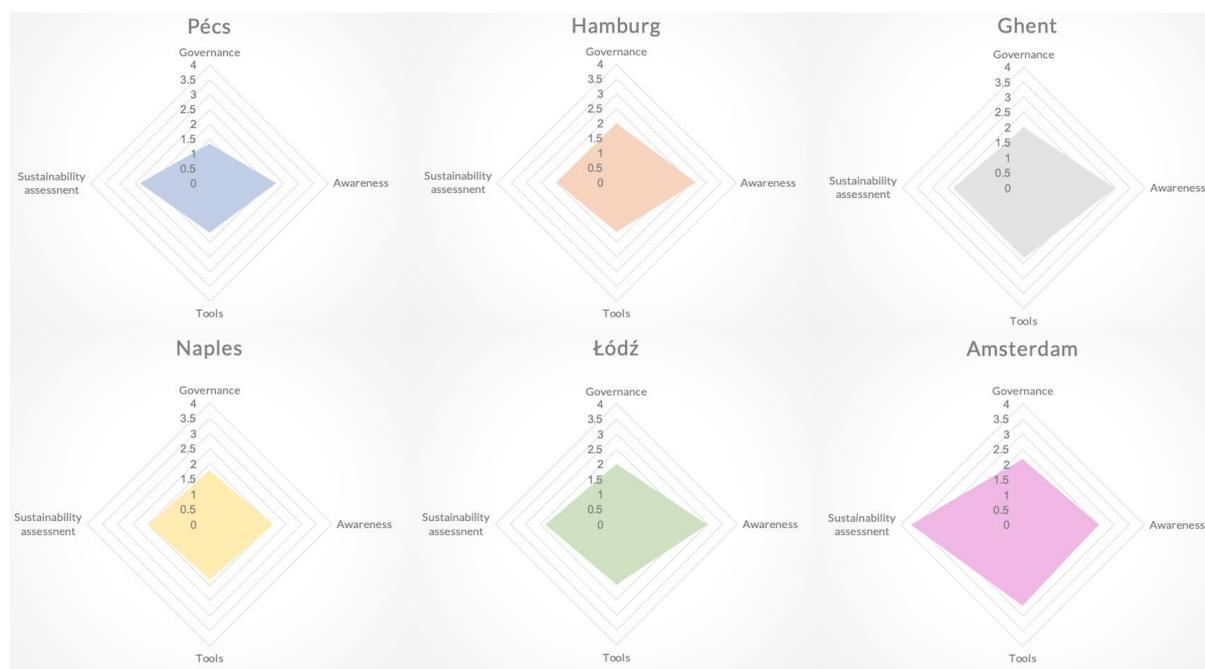


Figure 7. Summary scores for the six case study regions. Source: scores aggregated and elaborated by Viktor Varju and Marcin Dąbrowski.

Further development and application beyond REPAiR

During the workshops and during the presentation of the tool and the scores at the final event of the REPAiR project on 13 October 2020 feedback was gathered from participants. Overall, the feedback was positive and encouraging for further refinement and application of the tool in practice. Reservations were made with respect to the representativeness of the workshop groups, the need for ensuring that the participants have the needed expertise and insight, the need for more time to discuss the variables and scores in more depth and the sensitivity of comparative assessment. Participants also suggested developing the argumentation about the distinctiveness of this tool as compared to existing Circular Economy metrics and clarifying its purpose. All of these comments will be taken into consideration in refinement of the tool and its application in the six case study regions after the end of the project.

In sum, the Circular Economy Transitions Assessment Tool is a novel evaluative tool for assisting decision-making for transition towards Circular cities and regions. Importantly, the tool stands out from the existing benchmarks and metrics by offering a more integrative and co-creative means for identifying status quo, barriers, next steps, and comparisons between territories. It also puts emphasis on several of the overlooked dimensions of Circular Economy transitions, including governance and institutions, societal and corporate awareness, co-creative and material flow and stock mapping tools and comprehensiveness of existing sustainability assessment approaches. The tool will be further developed and applied in the REPAiR's six case study regions in 2021.

3. Methodology: survey and questionnaire development

To fulfil the aim of this deliverable, a questionnaire was developed to collect feedback from participants and organisers of the co-creative process conducted in the PULLs. The questionnaire focused on four main elements:

1) evaluation of the PULL content degree of satisfaction and comments from the participants and the reflections from the organisers in form of:

- Appreciated elements
- Problematics identified
- Suggestions for improvements

2) evaluation of the tools for supporting decision-making and sharing of information, such as GDSE;

3) evaluation of the methods for supporting decision and sharing of information, such AS-MFA and LCA; and

4) relation of and interaction between stakeholders within the PULL and the influence that the work within the PULL eventually has had on the work of the stakeholders' institutions outside the PULL

The questionnaire was translated in the five languages of the case studies (Dutch, Italian, German, Polish and Hungarian) and distributed among the PULL participants via the local PULL leaders (organisers).

As mentioned briefly before, the same questionnaire was submitted to the organisers of the PULL events in all case studies. Conversely to the participants questionnaire, this included an additional question on the impacts that the process within REPAiR had on other activities beyond REPAiR. The reason for this question is to provide elements for reflecting on the role of Research Innovation Action (RIA) European Projects such as REPAiR on the operational level.

The questionnaire has a total of 43 questions, of which 11 are multiple-choice. The remaining 33 are open questions (requiring brief or long answers). The questionnaire is therefore mainly built on qualitative questions. The reason for focussing on qualitative questions is that the PULL processes in the case studies vary too much from each other to compare them only in a quantitative way (see Introduction). Conversely, giving the possibility to the respondents to answer open questions sheds lights on communalities (positive and negative) among the PULL experiences which are described and discussed in the next sections.

4. Results of the survey

4.1 Introduction

In this section the results of the survey are presented consecutively for each case study. The four parts in which the questionnaire is organised are discussed, namely

- PULL phases
- Tools and methods
- Influence of the process on participants activities
- Interrelation of the stakeholders within and outside the process.

The graphics in Figure 8 represent the sectors to which the respondents belong for each case. Figures 9-13 support the discussion with numerical information showing aggregated responses.

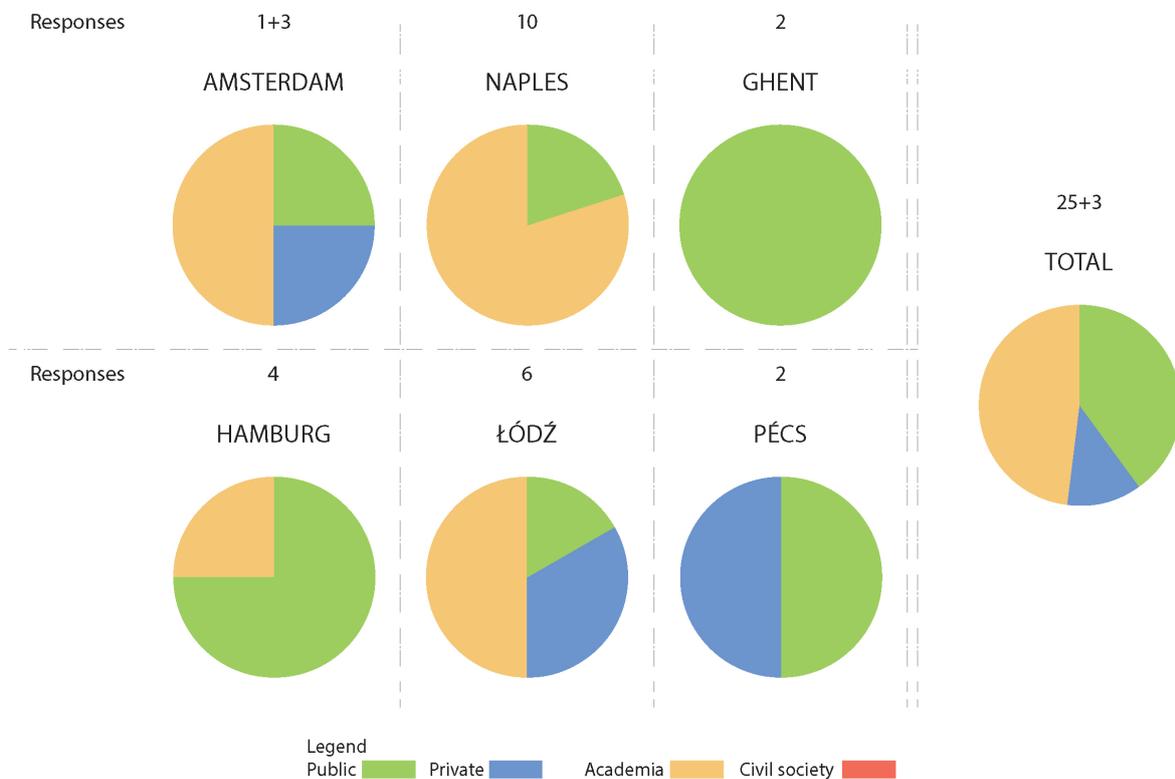


Figure 8. Sectors of the respondents for each case study. Source: Own elaboration.

4.2 Amsterdam

As shown in Figure 8, only one person from the public administration answered the questionnaire. Therefore, in the case of Amsterdam, also the 3 answers from the academic PULL organisers are included in the description.

With regard to the co-exploration phase the respondent from the public sector positively assessed the spatial analysis, while the organisers of the PULL saw the

exchange between different stakeholders and the flow analysis positive. They criticised that some stakeholders were not really participating while others dominated the discussion. As possible improvements, a clearer definition of flows, a better overview of stakeholders who need to be involved and an earlier usage of a fully functioning GDSE were proposed.

During the co-design phase the development of solutions, the support by the GDSE and that a good overview was reached, were appreciated. They criticised the problems of modelling some solutions. To improve the phase, the involvement of more stakeholders and especially those with decision-making power and also an earlier modelling of solutions was proposed.

In the co-production phase the visualisation of the EIS and the support by the GDSE were appreciated, which enabled different perspectives and supported profitable discussions. The lack of assessment information of the solutions and the limits of transferring solutions from other regions due to the different governance structures were regarded as critical. To improve the phase it is recommended to gather more information on the solutions, to better test them in the GDSE and to better compare governance and framework conditions when solutions shall be transferred from one region to another.

With regard to the co-decision phase the respondents positively rate the GDSE as a tool. They criticised that the results (strategies) could not be fully compared, also due to the lack of data and information that could have been integrated in the GDSE and to the limited time for discussion. As improvements, a stronger focus in the earlier phases on some of the solutions which then are more intensively analysed more solutions was proposed, as well as more time for discussion. Nevertheless, it was mentioned that for a prototype the phase worked relatively well.

With regard to the tools and methods used during the PULL process, the GDSE was rated very good as an information tool. Concerning the decision-making, the respondents recommended improvements to enhance the usability of the GDSE and to better adapt it to stakeholders' needs in the discussion process. The MFA received overall good ratings as an information method, but some participants regarded it as too technical. Concerning the decision-making, the respondents rated the MFA more as a supportive tool that needs to be combined to the GDSE to make it usable for stakeholders.

The LCA received mixed ratings. It was regarded as a good tool for sharing information and supporting the decision-making, but most respondents mentioned that it was used only in a very limited way and that its connection to the GDSE should be improved. All respondents want to use the GDSE to provide an overview on the gathered information to support decision-making. Half of the respondents want to use the AS-MFA in the future mainly for the analysis of flows and to develop hypotheses. Only the respondent from the public sector intends to use the LCA, all others assess it as too complex. As future users of the tools mostly territorial authorities (local), but also the private sector especially developers were mentioned.

The PULL process has influenced the work of all except one of the respondents. It inspired them to use data in a more connected and systemic way and it led to new forms of cooperation.

All except one of the respondents regard the tools and methods as favourable for the interaction between stakeholders. One person assessed the tools and methods as too complicated and argued that they did not support the exchange between participants.

The cooperation with stakeholders outside the PULL was mentioned by half of the respondents. Three of the respondents missed some stakeholders, namely the airport, the port authority and more waste management companies. As reasons for their non-attendance the respondents mentioned the academic character of the project which might keep practitioners away and the problem of timing who should be involved when during the living lab process.

4.3 Naples

As shown in Figure 8, mainly academia and public administration representatives answered the questionnaire.

Concerning the PULL phases, the first phase of co-exploration performed the most in terms of degree of appreciation. In particular, "raising awareness on waste management" and "interaction with stakeholders" were identified as key positive elements for the co-exploration phase. These two answers can be found in the other phases as well, in relation to the different thematics specific for each phase. In general, the common definition of problems, objectives and solutions during the process in connection with the territorialisation of the same was highlighted as very positive. Among the negative aspects, critiques referred to timing of each phase (too few or too much). Sometimes, the lack of key stakeholders hinder the setting of a good discussion and prevent effective solution design. Additionally, some respondents described the process as fragmented, probably due to the long timespan in which the PULL was conducted. One of the most pointed out problems was related to the fact that the GDSE tool should have been utilised since the very beginning. This was not possible being the tool still in the development phase. However, this statement shows how the use of the tool was welcomed with interest by the participants.

With regard to the GDSE, AS-MFA and LCA, most respondents signalised their interest for the GDSE tool as very useful for supporting information sharing on the project area and for showing simultaneously the various alternatives. Additionally, it was rated as a good tool for supporting interaction between participants, but still too complex to actually make decisions. However, many point to the fact that the tool should start being used constantly in decision-making to be incorporated in processes and exploit its potentials. The AS-MFA was considered to be a very good method to show quantities in relation to stakeholders. Together with the GDSE, respondents found very useful the visualisation of the flow information both for understanding the status quo and for supporting decisions among alternatives. Conversely, the LCA was not very

positively voted. Besides its potential and precision in showing the impacts of the alternatives, reading and understanding the LCA results is still too complex for the majority of the stakeholders participating in the process. Furthermore, managing the data needed for the assessment is also very onerous. Finally, an integration of the LCA in the GDSE was suggested by many respondents, though technically not feasible, unless a very simplified version of the LCA is performed (with a consequent loss of precision and information). Nevertheless, all these tools have shown their potential to be used as supporting decision-making in urban development processes in the frame of CE with a careful selection of stakeholders according to the topic and its degree of difficulty. It is noteworthy the fact that many respondents signalled they would have preferred to have seen a pre-session in which the GDSE functionality was explained. Hence, the GDSE is complex, but it has awakened the interest of many participants.

How did the PULL process influence the work in the participants' institutions? Regarding the questions in this section, 90% of the respondents answered positively pointed out the capacity of the PULL process of putting together various stakeholders; in managing new concepts such as CE. Besides, the experience of co-creation was very appreciated, as occasion to get informed, network with other stakeholders and discuss the solutions.

Stakeholders interaction in the PULL was a valuable add on of the process. In the case of Naples, it managed to bridge the gap between local and regional authorities, it brought together bottom-up initiatives and administrative bodies. The absence of economic stakeholders and experts of the sector was signaled by 60% of the respondents: this is linked to some critiques that the respondents provided regarding the unfortunately too little follow-up of the discussions in the PULL to the actual implementation of the solutions. However, this shows once again the great interest among the participants to the PULL methodology and in CE in general.

4.4 Ghent

Respondents from the Ghent case study were representatives of the public sector.

In general, the process in Ghent saw the participation of a variety of stakeholders, which were able to provide a broader view and set of inputs. The experimental character of the PULL allowed for more creative ideas. Even though not immediately feasible, this provided more inspiration for the participants. As the process had advanced, it became more concrete, close to an action plan. However, critiques in the last phases are related to the lack of key stakeholders and other relevant expertise to properly discuss the solutions. In general, the time was considered to be insufficient for conducting the tasks proposed in each PULL event. Finally, the respondents demonstrated to be interested in the sustainability assessment and pleased with methodology used.

The tools and methods used during the PULL process were in general positively rated, yet some critiques arose. Firstly, there are some doubts on the availability

of data, the lack of which would hinder strongly the capacity of the GDSE tool to share information and support decisions. Some concerns on the added value brought by the GDSE in the decisional process were highlighted as well. The AS-MFA is a useful tool to visualise data and their quantity, on the basis of which decision can be weighted. The scale of the application of the AS-MFA is decisive to evaluate it as a good supporting method: in fact, it requires much data and might not be worth the effort for a small scale analysis. Conversely, the LCA method was rated to be very useful for supporting decision-making. Finally, the functionalities of mapping and comparing were pointed out as positive aspects of the tools, but their effectiveness very much depends on the availability of data and their level of confidentiality.

The PULL process did not influence the work of the respondents nor the one in their institutions. The non-alignment of the PULL process with the internal decisional process of one of the institutions was highlighted: a better adjusted combination could have resulted in a more valuable result.

Respondents considered the methodology as a whole useful to support interaction between stakeholders, but the ones involved in the process were already communicating among themselves, e.g. through consultation platforms. The link between space and waste management was a new topic and emphasised as interested and innovative. As previously mentioned, respondents stated the absence of some key stakeholders, such as more representatives from the City of Ghent and from the rural municipalities. Lack of time, interest and resources were adduced as main reasons for their absence.

4.5 Hamburg

As shown in Figure 8, mainly public administration and academia representatives answered to the questionnaire.

With regard to the co-exploration phase the stakeholders positively assessed the exchange between different stakeholders especially concerning the problem understanding. The lack of reliable data was criticised, but also considered as a problem that could not be solved by the project. During the co-design phase again the mix of stakeholders was appreciated, but also the lack of cooperation between scientific and practitioner partners was criticised. Although the material that was used was regarded as supportive of the process, the limited useability of the GDSE and the separated work steps of problem and objective development were rated negatively. The co-production phase was influenced by the Corona restrictions. Therefore the stakeholders criticise the limited development of strategies and the lack of discussion of alternative solutions. Similar critique was expressed concerning the co-decision phase especially the lack of comparison of strategies.

Regarding the tools and methods used during the PULL process, the GDSE was rated best both for information exchange and decision-making. The AS-MFA has mixed ratings, while the LCA is regarded as too complicated and making too much effort by the practitioners, while the scientists also appreciated the LCA as a

method to exchange information and make decisions. Overall the importance and challenge of data availability was mentioned.

Some of the practitioners from the public sector intend to use the GDSE and the LCA, while the scientific stakeholder plans to use AS-MFA and LCA. The use of the tools is intended for upcoming projects.

The PULL process has influenced the work of half of the stakeholders who answered, mainly because it enabled them to test things and to start a process that encouraged follow-up activities.

All stakeholders regard the tools and methods as favourable for the interaction between stakeholders. Firstly, because stakeholders came together who normally do not interact directly; secondly, the process and tools offered a good basis for discussion.

The cooperation with stakeholders outside the PULL was mentioned only by one respondent.

Half of the respondents missed some stakeholders namely the ministry for the environment at Hamburg level (BUKEA) and environmental and consumer associations. As reasons for their non-attendance a lack of time and lack of addressing them were mentioned.

4.6 Łódź

As shown in Figure 8, 3 persons from academia, 2 from the private sector and 1 from the public administration answered to the questionnaire.

With regard to the co-exploration phase the stakeholders positively assessed the exchange between different stakeholders and the combination of participation and spatial analysis. They criticised the difficulties of understanding or connecting objectives with problems, as well as the lack of reliable data. As possible improvements they propose materials for preparation for the participants. During the co-design phase the mix of experts was appreciated which led to creativity and innovation. They criticised the too little presence of the private sector and that over the different phases not all stakeholders continuously participated. Also a comparison of the different solutions was missed. To improve the phase a categorisation of the solutions in a matrix was proposed. In the co-production phase the creativity and the linkage between solutions and spaces were appreciated. Other stakeholders criticised the lack of embedding and spatialisation of the solutions into the real circumstances in Łódź. To improve the phase a matrix with challenges and expectations of the solutions and examples from other cities were proposed. With regard to the co-decision phase the stakeholders positively rate the GDSE as a tool to show and compare a variety of strategies also between different interest groups. They criticised that many solutions were not fitting well to the local context. As improvements, more solutions, a better visualisation and more workshops were proposed.

With regard to the tools and methods used during the PULL process, the GDSE was rated good by most participants. But it was criticised that the tool needs to

be adjusted better to the needs of the country or region where it is used. The AS-MFA received overall good ratings, but some participants regarded it as too complex. The LCA received mixed ratings, one half of the participants saw it as a good tool for sharing information and supporting the decision making, while the other half regarded it as too complex and complicated. Most participants who replied want to use the AS-MFA in the future mainly for the analysis of flows, this is followed by the GDSE that is seen as a possible tool for strategic planning on local and regional level. Other participants considered the GDSE as a too complicated tool to be used. Only one participant intends to use the LCA, all others assess it as too complex. As future users of the tools mostly territorial authorities (local, regional), but also the private sector were mentioned.

The PULL process has influenced the work of all except one of the stakeholders who answered, because it inspired to use new methods for strategic analysis, enabled information exchange with practitioners and inspired new activities.

All except one of the stakeholders regard the tools and methods as favourable for the interaction between stakeholders. Firstly, because the cooperation and interaction between stakeholders worked well; secondly, because solutions were jointly developed. One participant emphasised that the individual development of solutions is underestimated by decision makers.

The cooperation with stakeholders outside the PULL was mentioned by half of the respondents.

Only a third of the respondents missed some stakeholders, namely more private companies and actors from the metropolitan area. As reasons for their non-attendance a lack of interest and of understanding the challenges were mentioned.

4.7 Pécs

Answers from the Pécs case came from the business sector and the public sector (Figure 8).

Generally, the PULL process was positively rated. Particularly, respondents found the process good for getting informed about waste management in general. The process in Pécs had a positive learning effect among participants, especially to get to know about alternatives and new solutions. Main issues were related to the reliability and availability of data to support the interpretation of the findings and to develop the solutions further. In some phases, a larger set of stakeholders was preferable to enhance the quality of the discussion. Some concerns arisen refer to the limited number of local opportunities for implementing the PULL results.

Concerning the GDSE, the tool was generally appreciated. However, for its optimal use a more intense and continuous work with the tool is necessary to understand all its functionalities. Due to its capacity of showing the complexity of the interrelation between different datasets, it can be considered for the development of more complex strategies on a broader area. Conversely, the

tools were not considered fully suitable for the municipal level. Both AS-MFA and LCA were rated as supportive and illustrative methods. Yet, the respondents seem not to be willing to use the methods further, mainly due to their complexity. No specific information is given concerning the influence that the PULL process had on the stakeholders involved.

The respondents agree on the fact that the co-creation process in the PULL encouraged cooperation with other stakeholders, highlighting the character of the PULL to help sharing and discussing jointly. In general, economic stakeholders (e.g. companies) were not involved: the explanation seems to lay on the fact that the circular economy topic and the related stakeholders were still not completely identified.

5. Discussion and conclusion

In the previous Chapter the responses for each case studies are presented. As mentioned before, the experiences in the six co-creation processes differ significantly with regard to types of problems, choice of solutions, and stakeholders involved. Nevertheless, common patterns can be recognised and these are explained afterwards.

In relation to the first group of questions (i.e. the PULL phases), while generally the process in all cases was assessed positively (see Figure 9), some critical points were raised. In particular, participants addressed the issue of time in 4 out of 6 cases as being not enough to discuss conclusively all the points planned for each phase. Furthermore, it is noteworthy that in some cases (e.g. Naples) respondents pointed out the discontinuity and fragmentation of the process as additional difficulty to follow consistently the entire process. In other words, not only more time within the PULL should be planned, but also the time between the PULL events should be reduced, as some respondents reported to have forgotten what was done in the previous PULL session. Additionally, not all key stakeholders participated in every PULL event, contributing to the fragmentation of information and inputs.

Concerning the tools and methods deployed during the PULL events, respondents provided a generally positive feedback. GDSE, AS-MFA and LCA were particularly appreciated as information vehicles, gathering and visualising the data in support of the discussion. However, these tools and methods require to be understood by the users: for instance, respondents demanded for a dedicated session to learn how the GDSE works. Furthermore, these tools and methods should be used systematically to get the proper confidence to reach the desired results and to be updated constantly with the latest data. Regarding this last point, almost all respondents reported issues with the data to be found and inserted in the GDSE and to perform the AS-MFA and LCA: most of the time (e.g. Pécs and Łódź) the unavailability of specific data hindered the total comprehension of the context; in other cases, the collection of data was limited by data protection regulations or the confidentiality of some data provided by the project partners (e.g. Hamburg). The AS-MFA was the most appreciated among the three, because of its simplicity and immediacy in the visualisation of data. Conversely, the LCA, even though rated as very useful, was considered as too complex, both in its reading and in the provision of data for the assessment. An integration of the LCA in the GDSE was also mentioned to be highly desired. Generally, private companies, local and regional governments and public service providers were identified as potential interested stakeholders for applying the three tools and methods. Summing up, although all three tools and methods were in their testing version, they were rated as very supportive. For a full use, respondents mentioned that the data quality should be improved. Furthermore, it was regarded as necessary to better integrate the three tools and methods in order to exploit their full potential also for the decision-support. Finally, more

than half of the respondents highlighted the issue of scale: the tools and methods deployed seem very useful to describe a big area, going beyond the municipal boundaries; on the contrary, for small case interventions the tools and methods are supposedly too complex and require too much effort in terms of time and resources.

Concerning the influence of the PULL process on the stakeholders' work outside REPAiR, circa half of the respondents described that there were some impacts. Firstly, it influenced their view and understanding of certain problems. Secondly, some respondents mentioned they were inspired to follow up using the tools and methods also in their activities. In particular, in Naples the wastescape concept was rated to be very useful to describe the degraded conditions of their peri-urban areas. In Hamburg and Ghent, respondents were interested in the synergies between waste management and spatial planning that were explored in REPAiR. However, according to the other half of the respondents the PULL process did not have any sort of influence on their work. Reasons for this statement vary, with most respondents highlighting the complexity of the tools and methods as a limitation; others mentioning the uninterest of some key players (e.g. Pécs). Noteworthy is the impact that the project had on didactic: many courses, projects, and master theses were inspired by REPAiR activities within the PULL, especially, in Amsterdam, Naples and Hamburg, where the academic partners were stronger represented.

Concerning the last part of the questionnaire, in general the PULL process supported and inspired interaction between different stakeholders and some of them continued working together outside the PULL. In many cases, waste management practitioners and urban planning department representatives started exchanging information as a result of the spatial focus of the Circular Economy that REPAiR brought forward. However, respondents missed some stakeholders in the PULL process in almost all cases, but with some differences. In Naples and Pécs respondents reported that representatives from the third sector were missing. Conversely, Ghent respondents highlighted the desire to have seen more stakeholders from the public sector during the process. In Amsterdam, Łódź and Hamburg, further public and private stakeholders were missed. The mentioned reasons for the absence of these stakeholders were manifold, the most recurrent explanations were: the lack of clarity in communicating the objectives of the PULL process for those stakeholders who are mainly output driven; the lack of time of stakeholders to participate in the process, which often was linked to a possibly wrong communication strategy by the PULL organisers, but also to the lack of interest of some stakeholders; further, the lack of resources (timing and economic) of especially small enterprises and public sectors stakeholders. As a general statement, the involvement of stakeholders was regarded as a delicate process, especially concerning the choice of stakeholders to be involved for different tasks and at different steps of the process.

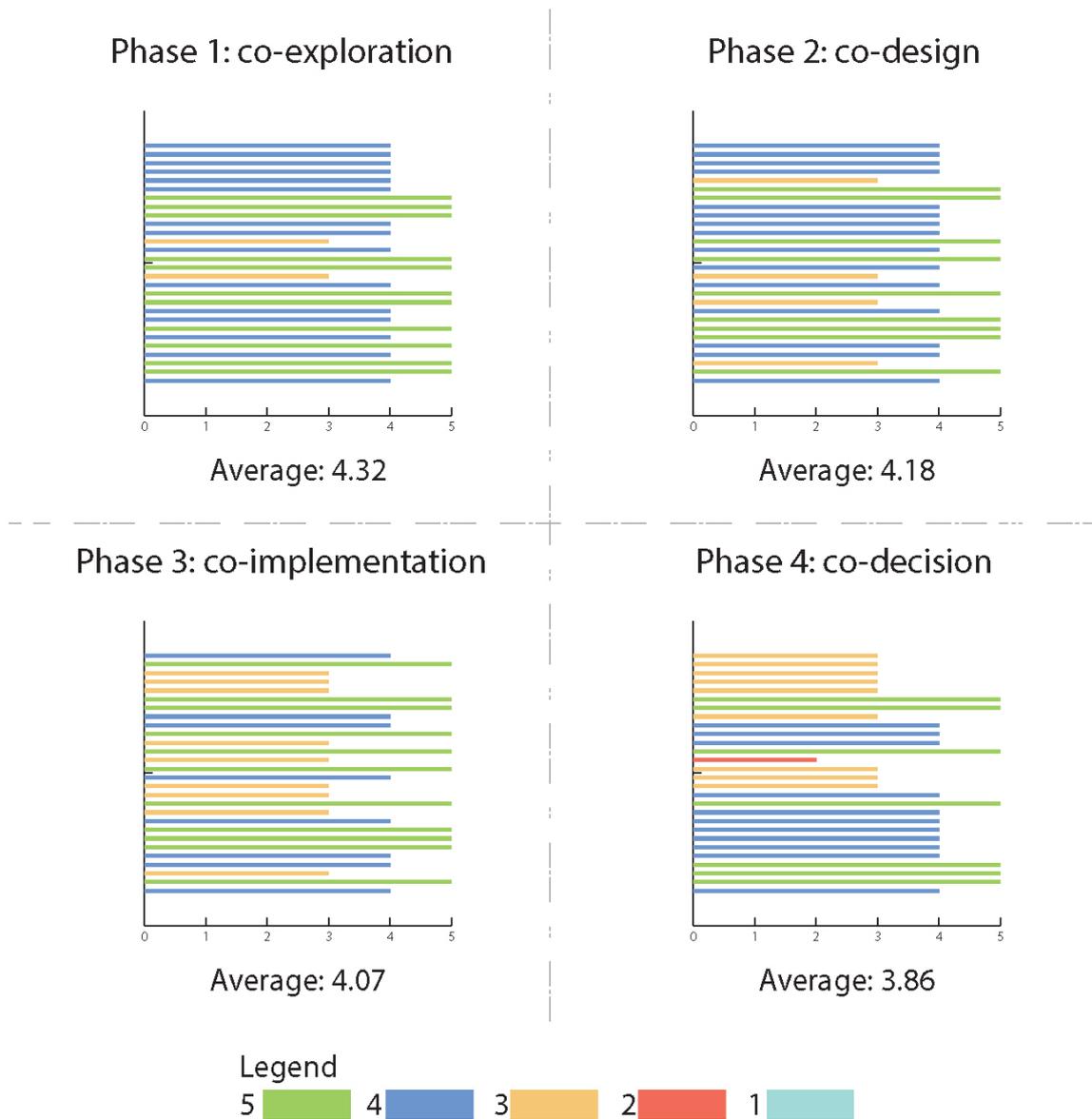


Figure 9. Evaluation of the PULL phases - aggregation of all cases. Source: Own elaboration.

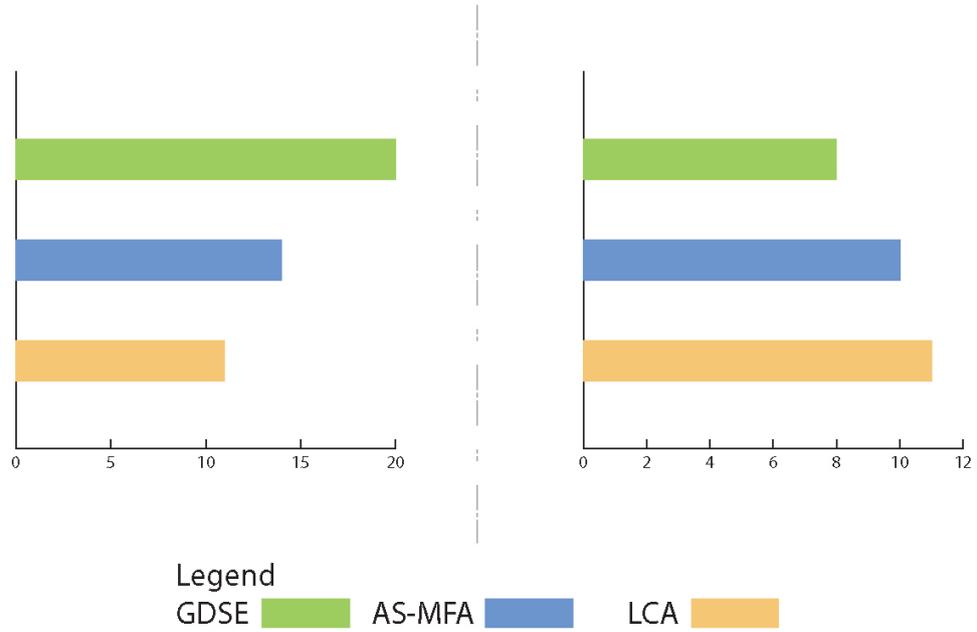


Figure 10. Interest of the stakeholders in continuing using the GDSE, the AS-MFA and the LCA outside REPAiR: positive (left) and negative (right) answers - aggregation of all cases. Source: Own elaboration.

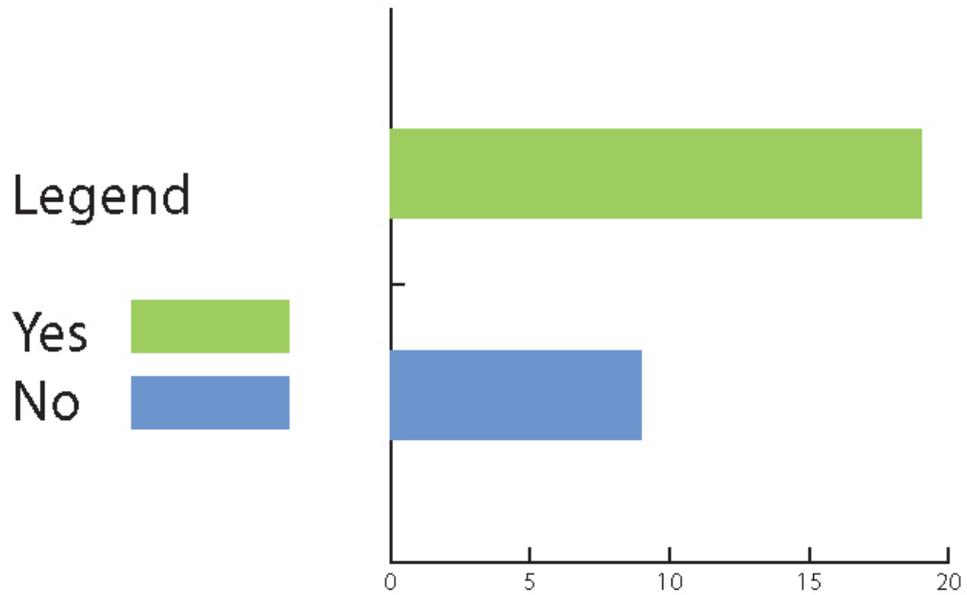


Figure 11. Impact of the process on the work of the respondents at their institutions - aggregation of all cases. Source: Own elaboration.

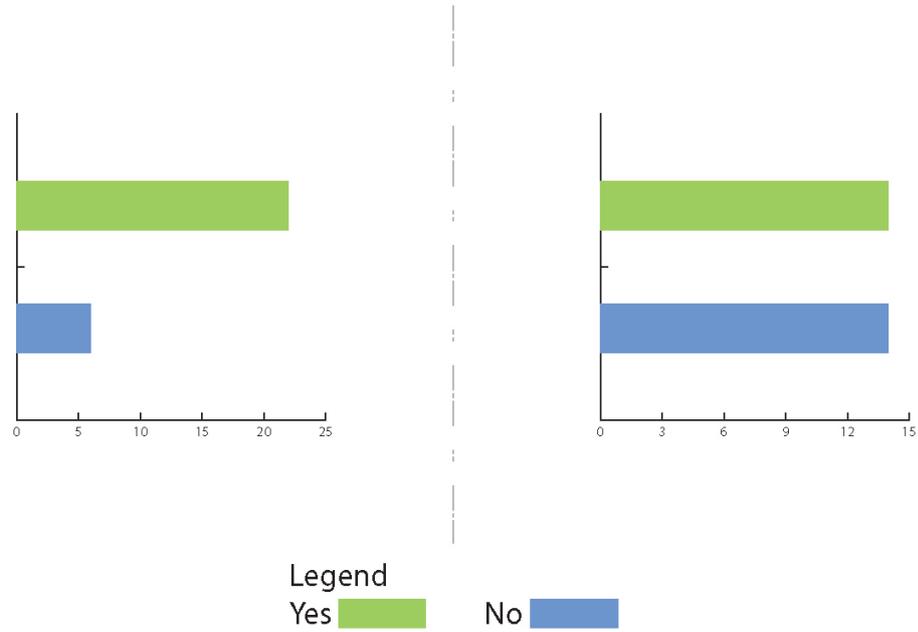


Figure 12. Capability of the methods and tools deployed in facilitating the interaction between participants within the project (left) and outside the project (right)- aggregation of all cases. Source: Own elaboration.

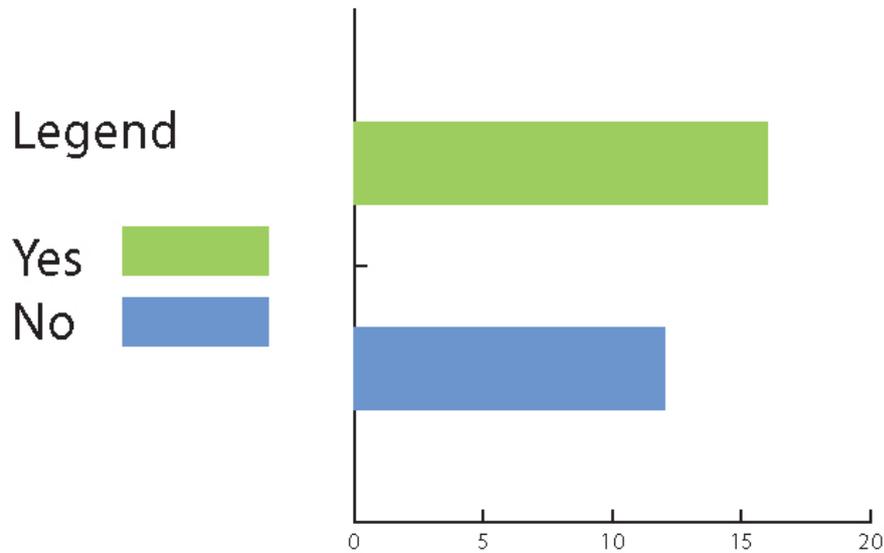


Figure 13. Evaluation of the absence of key stakeholders during the process according to the respondents - aggregation of all cases. Source: Own elaboration.

5.1 Impacts of REPAiR

The same questionnaire was filled out by the organisers of the PULLs in each city. Their answers were considered in the previous discussion as well. An additional question was posed to the organisers, i.e. “6. Please, mention the main activities outside the REPAiR project that were influenced by the results, findings and

activities conducted within REPAiR (ref. to third Poster WP6 REPAiR Exhibition)”. The answers are elaborated below.

In many cases, the PULL process was able to activate educational projects at university. In these occasions, students were involved in the analysis of the status quo (e.g. in Hamburg-Altona) and for the EIS design (e.g. Amsterdam, Naples and Hamburg). In some cases, the methods and tools were included in local strategies: for instance, in Naples the wastescape analysis on the peri-urban areas was reported in the Campania Regional Landscape Plan. In Hamburg, some solutions developed in the PULL process are now part of the Climate Action Plan of the District of Altona. The GDSE inspired a new Horizon project (Cinderela), started in 2018. From the process in Poland, the idea of the Circularity Centre Bzura was embraced for the local circular economy strategy. Finally, local projects were triggered: this is the case of URBACT III Sub in the Municipality of Casoria (Naples).

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7. Annex 1 – Questionnaire

Survey among the participants of the PULL meetings using an online questionnaire

Dear participant of the PULL (Peri-Urban Living Lab) meeting or meetings. With this survey we would like to receive your feedback on the PULL process within the REPAiR project and look beyond REPAiR, with the particular focus on decision-making elements (steps and tools). We thank you for your participation in the PULL and this survey!

***Required**

1a. Name of the organisation *

Your answer

1b. Which sector do your institution belong to? *

- Public
- Private
- Academia
- Civil society

2. PULL phases

The Peri-Urban Living Labs (PULLs) in REPAiR had four different phases. Please describe briefly the positive aspects and the negative aspects for each phase. Please leave the space empty, if you did not participate in a phase. If you think the selected phase did not happen, please write it in the "what did not work" part.

2a. Co-Exploration: Identifying and understanding the material flows, the spatial conditions and wastescapes of your focus area. Understanding and discussing the problems and objectives.



2a1. What did you appreciate most of this phase?

Your answer

2a2. What did not work during this phase?

Your answer

2a3. What could be improved of this phase?

Your answer

2a4. How do you evaluate the organisation of this phase? *

	1	2	3	4	5	
very unsatisfied	<input type="radio"/>	very satisfied				

2b. Co-Design: Development and discussion of solutions and ranking of objectives.

2b1. What did you appreciate most of this phase?

Your answer



2b2. What did not work during this phase?

Your answer

2b3. What could be improved of this phase?

Your answer

2b4. How do you evaluate the organisation of this phase? *

	1	2	3	4	5	
very unsatisfied	<input type="radio"/>	very satisfied				

2c. Co-Production: selection and geolocation of the solutions; bundling and combination of solutions into strategies.

2c1. What did you appreciate most of this phase?

Your answer

2c2. What did not work during this phase?

Your answer

2c3. What could be improved of this phase?

Your answer



2c4. How do you evaluate the organisation of this phase? *

	1	2	3	4	5	
very unsatisfied	<input type="radio"/>	very satisfied				

2d. Co-Decision: discussion and comparison of strategies and decision among alternatives.

2d1. What did you appreciate most of this phase?

Your answer

2d2. What did not work during this phase?

Your answer

2d3. What could be improved of this phase?

Your answer

2d4. How do you evaluate the organisation of this phase? *

	1	2	3	4	5	
very unsatisfied	<input type="radio"/>	very satisfied				



3. Tools and methods

During the PULL workshops we used different tools and methods: the Geodesign Decision Support Environment (GDSE), the Material Flow Analysis MFA, and the Life Cycle Assessment LCA. Please, give us your appreciation of these tools for a) Sharing information, and b) Making decisions. If the tool was not used, please leave the space empty.

3a1. Geodesign Decision Support Environment (GDSE) for sharing information

Your answer

3a2. Geodesign Decision Support Environment (GDSE) for making decision

Your answer

3b1. Material Flow Analysis (MFA) for sharing information

Your answer

3b2. Material Flow Analysis (MFA) for making decision

Your answer

3c1. Life Cycle Assessment (LCA) for sharing information

Your answer

3c2. Life Cycle Assessment (LCA) for making decision

Your answer



3d. Do you intend to use these tools (GDSE, MFA, LCA) in your future work?

	GDSE	MFA	LCA
YES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
NO	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3d1. If yes, please describe how you would like to use them.

GDSE

Your answer

MFA

Your answer

LCA

Your answer

3d2. If not, please briefly describe why you are not planning to use them.

GDSE

Your answer



MFA

Your answer

LCA

Your answer

3d3. Do you know of other institutions that might be interested using them?
Please, indicate the names.

Your answer

4a. Did the PULL process and / or its results influence your work or the work of your organisation (for example did you make use of results, did the PULL influence decisions in your institution)? *

Yes

No

4b. If yes, please explain briefly how *

Your answer

5. Stakeholders interaction

How was the interaction between you and the other participants during the PULL process?



5a. Did the methodology/tools favour the interaction or not? *

Yes

No

5b. If yes, in which way?

Your answer

5c. If not, why?

Your answer

5d. Did it encourage you to cooperate with the stakeholders outside the PULL? *

Yes

No

5e. If yes, with whom?

Your answer

5f. Were there stakeholders missing in the process in your opinion? *

Yes

No



5g. Who else should be (or should have been) involved?

Your answer

5h. Which could be the reasons for the absence of the aforementioned stakeholders?

Your answer

6. Please, mention the main activities outside REPAIR project that were influenced by the results, findings and activities conducted within REPAiR (ref. to third Poster WP6 REPAiR Exhibition)

Your answer

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