REPAiR

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

D2.4 Handbook for Geodesign Workshops

Version 2.0

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Change control

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2.0	04-02-2019	Alex Wandl	TUD	Final Version

Acronyms and Abbreviations

AMA	Amsterdam Metropolitan Area
AS-MFA	Activity-based Spatial Material Flow Analysis
CA	Consortium Agreement
CE	Circular Economy
CFS	Certificate on the Financial Statement
DMP	Data Management Plan
DoA	Description of Action
EB	Executive Board
EC	European Commission
ECA	European Court of Auditors
ECAS	European Commission Authentication Service
EIS	Eco-Innovative Solution
EU	European Union
FSIGN	Project Financial Signatory
GA	Grant Agreement
GAP	GDSE Application points
GDSE	Geodesign Decision Support Environment
GF	Guarantee Fund
LCA	Life Cycle Assessment
LEAR	Legal Entity Appointed Representative
LSIGN	Project Legal Signatory
NACE	Statistical Classification of Economic Activities in the European Community
OLAF	European Anti-Fraud Office
PaCo	Participant Contact
PM	Person Month
PO	Project Officer
PULL	Peri-Urban Living Labs
SC	Steering Committee
SP	SharePoint
UB	User Board
UoR	Use of Resources
WP	Work Package

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Publishable Summary

This document presents a handbook containing guidelines and stepwise instructions for Peri-Urban Living Lab (PULL) leaders in charge of planning, organising, documenting and communicating a series of collaborative Geodesign workshops that are part of a PULL for all case study areas of REPAiR, and in which the REPAiR's Geodesign Decision Support Environment (GDSE) is used as the main support tool.

The deliverable describes in detail the four application points through which the GDSE should be used in the PULL process to achieve the aims and results presented below.

The main aim of the GDSE application point #1 is to support two tasks, namely:

- the development of a common understanding of the territory (including for example the mapping of wastescapes and stakeholders);
- the categorisation and definition of the main challenges and objectives.

The main aims of the GDSE application point #2 are:

- identify, map and visualise key activities and actors in the value chains that should be included in the discussion and development of Eco-Innovative Solutions (EIS);
- identify specific Circular Economy (CE) challenges in the study area;
- identify and map actor networks for each individual EIS development.

The results of GDSE application point # 3 include:

- a ranking of objectives per (small) decision-maker group;
- a set of resource flow targets the group wants to achieve;
- one strategy per small group;
- an assessment of the changes in terms of flows the strategy achieves in relation to the targets set.

The results of GDSE application point #4 include:

- a discussion, clarification and common understanding of the differences and similarities between the ranked objectives per stakeholder small groups;
- a discussion on the flow indicators that were used for setting targets for specific objectives;
- a discussion and common understanding of the differences and similarities between the strategies implemented and corresponding related solutions across the stakeholder groups, individual stakeholders in the groups, and across locations of EIS implementation;

- an understanding on which processes in the value chain of the key flows contribute to the different impacts of the Areas of Protection (AoP). Particularly, the extent to which the developed strategies modify the key flows and meet the various target set;
- a discussion on the potential sustainability assessment of the strategies developed by individual small groups;
- an understanding among all stakeholders of agreement and disagreement (i.e. consensus level) on objectives, targets, related strategies and where the selected EIS have been implemented for all key flows.

This is the first version of the Handbook, which will be applied to the pilot cases in spring 2019. The lessons learned from this application process are going to be integrated into deliverable D5.9 Final Handbook: How to run a PULL.

1. Introduction

Aim and structure of the deliverable

The aim of this deliverable is to provide the organizers and facilitators of the Peri-Urban Living Labs (PULLs) with a guideline to execute the process of the previously defined Geodesign Decision Support Environment (GDSE) application points (GAP) (see Deliverable 5.4), and of all the other PULL phases, and connect them with the different phases of Geodesign. It enables the effective use of the GDSE models supporting the PULL phases of co-exploration, co-design, co-production, co-decision, and co-governance.

This deliverable explains how the hardware and software of the GDSE, and the methods developed in WP5 - Design of Eco-innovative Solutions (EIS) and Change Strategies, WP6 - Decision Making, and WP4 - Sustainability Assessment are brought together to support the decision makers in the PULLs in jointly developing strategies for an integrated spatial development towards circular resource management.

The deliverable is structured as follows. Chapter 2 recaps and updates, in reaction to the lessons learned in the pilot cases, the steps of the PULL process defined earlier by other work packages (WPs). Chapter 3 describes the aim, process and related methods and sections of the GDSE for the co-production phase. Chapter 4 does the same for the co-decision phase. Chapter 5 describes the state of data delivery that has to be reached in order to start using the GDSE in PULL workshops and will provide guidelines for data preparation and upload. Chapter 6 gives an outlook for further work, which is also related to the other WPs.

2. The five phases of the PULLs and data requirements

2.1 The five phases of a PULL and their relation to the GDSE

Table 1, which is retrieved and updated (listing the steps of each application point) from the Deliverable 5.4, illustrates how the five PULL phases address the six Geodesign questions, and how these phases are linked with the four GDSE application points. Each application point is dedicated to the activities involved in one PULL phase. Moreover, Table 1 links each phase to a number of activities involved in establishing the related models and what the outputs of using the GDSE in the application point are.

Table 1. Link between PULL phases, Geodesign questions and Geodesign phases

PULL PHASE		GEODESIGN QUESTION	GEODESIGN PHASE	AIMS and RESULTS
1	Co-Exploration	*How should the study area be described?*	Representation Model	Definition and mapping of Region - Focus, and Sample Areas
				Definition and mapping of Wastescapes
				Definition of stakeholders and experts
		How does the study area operate?	Process Model	Selection of key resource flows
				Definition and mapping of material flows and waste management system
		GDSE Application Point 1		
				Common understanding of the territory developed
				Categorised and defined main challenges / problems and objectives established
2	Co-Design	*Is the current study area working well?*	Evaluation Model	Sustainability assessment of the status quo
				Assessment of the status quo's resource flow circularity
		How might the study area be modified?	Change Model	Definition and common understanding of what constitutes an EIS

PULL PHASE		GEODESIGN QUESTION	GEODESIGN PHASE	AIMS and RESULTS
				Characteristics and effect of EIS on the process model
		GDSE Application Point 2		
				Identified, mapped and visualised key activities and actors in the value chains that should be included into the discussion and development of EIS
				Identified specific challenges and problems
				Identified and mapped actor network for individual EIS
3	Co-Production	*How might the study area be modified?*	Change Model	EIS and Eco-Innovative strategies Expert meetings on EIS
		How should the study area be changed?	Decision Model	Relating EIS to objectives
				Ranking of objectives
				Pairwise comparison of the relative importance of sustainability indicators
				Defining the targets
		GDSE Application Point 3		
				Ranked objectives

PULL PHASE		GEODESIGN QUESTION	GEODESIGN PHASE	AIMS and RESULTS
				Weights of the sustainability indicators
				Set and assessment of flow targets
				Selected EIS and defined Eco-Innovative Strategies
4	Co-Decision	*What differences might the change cause?*	Impact Model	Sustainability and flow assessment of Eco-Innovative Strategies
				Aggregation of sustainability indicators according to given weights into impact categories
		How should the study area be changed?	Decision Model	Designing rules of system
				Establishing and documenting the agreements and conflicts between different interests and groups of decision makers
				Triggering future local development and supporting decision-making processes
		GDSE Application Point 4		
				documented and discussed: rankings of objectives across small groups comparison of the

PULL PHASE		GEODESIGN QUESTION	GEODESIGN PHASE	AIMS and RESULTS
				small group strategies; comparative flow assessment of all small groups comparison of sustainability assessments of small group strategies overview of commonly used solutions and space of how they were applied to.
5	Co-Governance	*How should the study area be changed?*	Decision Model	Delivering decision making models Handbook release

Application points #1 and #2 were already described in detail in deliverable 5.4 and are here only briefly iterated. This deliverable addresses the GDSE Application points (GAPs) #3 and #4 in more detail.

The use of the GDSE at application point #1

The main aim of the GDSE application point #1 is to support two tasks, namely:

- the development of a common understanding of the territory (including e.g. the mapping of wastescapes and stakeholders);
- the categorisation and definition of the main challenges and objectives.

The capabilities of the GDSE can be used to show and discuss interactively the status quo of the study area (i.e., the process models), and thereby help constructing a common knowledge among local research teams and other participants of the PULLs. Moreover, the GDSE can support (groups of) stakeholders to jointly start defining challenges and objectives as well as start thinking about paths for developing Eco-Innovative Solutions as well as Strategies. Figure 1 shows the five GDSE steps (Study Area, Status Quo, Targets, Strategy, Conclusions), together with the sections covered in each step.

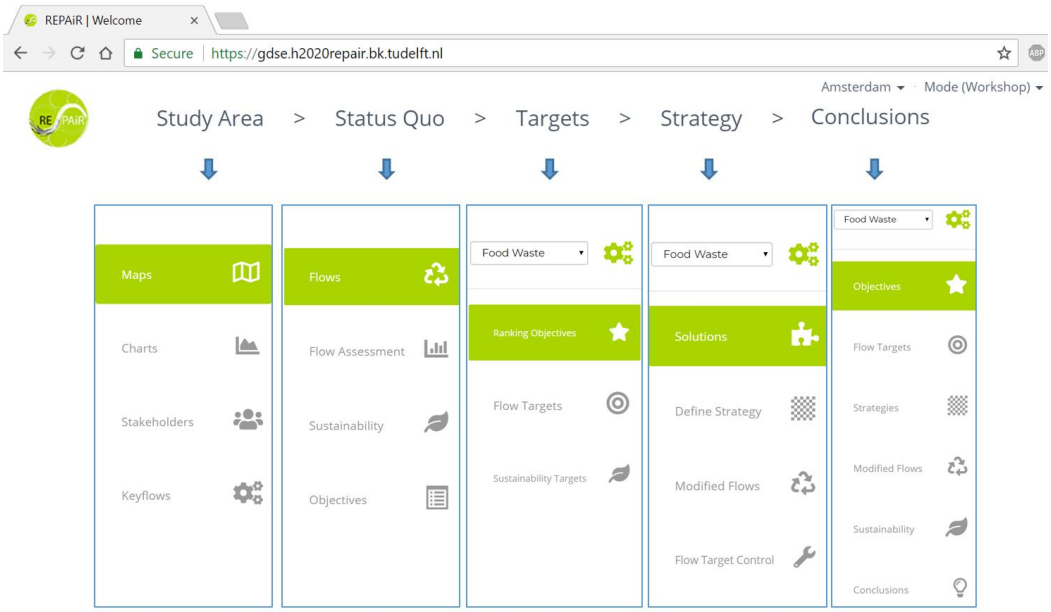

Figure 1: Screenshot of GDSE showing five Steps (top) and Sections (box under each step).

The GDSE allows to overlay the AS-MFA (Activity-based Spatial Material Flow Analysis) information with the spatial and social analyses. At application point #1, all sections of the GDSE step 'Study Area' can be used (Maps, Charts, Stakeholders and Key flows). Section 'Flows' in the "Status Quo" step displays detailed data of the AS-MFA concerning the flows and stocks in the status quo of a PULL case study using interactive maps and Sankey diagrams linked to these maps.

The GDSE helps to interactively answer questions, such as 'which are the key actors in a specific value chain?', 'where are they located?', 'what are the amounts and material compositions of relevant product/waste flows between them?'. For example, which actor produces waste that can be used as a secondary raw material by another actor, like the use of stale bread to brew beer.

The GDSE allows to filter and display available data based on the activity groups, activities, specific actors, materials or relevant spatial units. Ideally, the sections 'Flow assessment' and 'Sustainability' are also available at this stage, but experiences from the pilot and first follow up cases showed that this may be too data-collection intensive, and it is better to support the PULL activities without this information instead of waiting too long for it, and risking to lose the participation of stakeholders in the process.

The use of the GDSE at application point # 2

The main aims of the GDSE application point #2 are:

- identify, map and visualise key activities and actors in the value chains that should be included in the discussion and development of EIS;
- identify specific CE challenges in the study area;
- identify and map actor networks for each individual EIS development.

Ideally, the GDSE can be used to support two groups of tasks during the PULL workshops:

1. Identify, map and visualise the key activities and actors in the value chains that should be included into the discussion and development of EIS.
2. Provide an overview of the sustainability evaluation of the status quo and eco-innovative solutions including those activities and actors that contribute the most to sustainability impacts.

The first group of tasks is supported by the step Status Quo, sections Flows, Flow Assessment for mapping and visualising current flows (See Figure 1). The functionalities of the step Strategy and section Solutions allow to query the database of Actors (i.e., companies) of the area based on the commercial activity (NACE code - Statistical Classification of Economic Activities in the European Community) and therefore expected production or need of secondary raw materials.

The second group of tasks is supported by the step Status Quo (See Figure 1), section Sustainability. Both types of information are crucial for the further development of the EIS. The GDSE can already be used to store solutions, their descriptions and also the potential actors involved, together with their geo-locations.

The use of the GDSE at application point #3

GAP #3 will be organised in one or more workshops with small groups of decision makers, who have either a common interest or share the same spatial area of interest (e.g., municipality, province). The members of this group encompass a wider range of decision makers who were involved in application points #1 and #2. The aim of the workshops is to develop one eco-innovative strategy per small group and key flow as defined in the PULLs addressing the related objectives, which were also defined during the process of the PULL. According to Deliverable D5.4 Handbook 'How to run a PULL', an Eco-Innovative Strategy is “an alternative course of action aimed at addressing both the objectives and challenges identified within a PULL developing a more Circular Economy in peri-urban areas. The Eco-Innovative Strategy can be composed of a systemic integration of two or more elementary actions, namely Eco-Innovative Solutions” (REPAiR 2018, p.15). The participants are going to use the GDSE steps Study area, Status Quo, Targets and Strategy.

The results of GDSE application point # 3 include:

- a ranking of objectives per decision-maker group;
- a set of flow targets the group wants to achieve;
- one strategy per small group;

- an assessment of the changes in terms of flows the strategy achieves in relation to the targets set.

The use of the GDSE at application point #4

GAP #4 will be organised in one workshop with as many members of each of the small groups that were defined for GAP #3 as possible, and together in one room. During GAP #4, the GDSE step 'Conclusions' will be predominantly used.

The results of GDSE application point #4 include:

- a discussion, clarification and common understanding of the differences and similarities between the ranked objectives per stakeholder small groups;
- a discussion on the flow indicators that were used for setting targets for specific objectives;
- a discussion and common understanding of the differences and similarities between the strategies implemented and corresponding related solutions across the stakeholder groups, individual stakeholder in the groups, and across locations of EIS implementation;
- an understanding on which processes in the value chain of the key flows contribute to the different impacts of the AoP (Areas of Protection). Particularly, the extent to which the developed strategies modify the key flows and meet the various target set;
- a discussion on the potential sustainability assessment of the strategies developed by individual small groups;
- an understanding among all stakeholders of agreement and disagreement (i.e. consensus level) on objectives, targets, related strategies and where the selected EIS have been implemented for all key flows.

Ideally both GAP #3 and GAP #4 will take place within a short time period. Due to the complexity and data-intensity of the LCA-based (Life Cycle Assessment) REPAiR sustainability framework, there needs to be a period of two to three months between the two application points to process the data.

2.2. State of data delivery and process per GDSE Application Point

In order to facilitate successful GAPs, the following results need to be achieved and related data has to be uploaded to the GDSE database by the research teams of the PULLs.

All the data should be uploaded at least a few weeks prior to the workshop in order to ensure that the data is compatible with the GDSE data structure and possible discrepancies are solved before the workshop. Furthermore, the GDSE provides multiple means to visualise the data, which otherwise is only available in the form of tables. Exploring the available visualisations may also reveal possible errors and data gaps that can still be corrected before the PULL workshop takes place. Finally, the data upload procedure requires participation of multiple researchers, which can require more time to be completed.

The process of data upload is initiated by the PULL leader(s), who need to set data requirements for the upcoming PULLs based on their content (i.e., which GAP it is, which key flows and geographical areas are discussed) and the date of the upcoming workshop. Next, the person who has prepared the data (a Researcher) should forward the data to the Data Captain of the respective PULL case study. A Researcher should fill out the metadata form about the data being provided. The task of the Data Captain is to validate that:

1. the metadata form has been filled out correctly;
2. the provided files comply with the rules agreed in “D8.4 Draft Research Data Management Plan”, and;
3. the files are uploaded on the GDSE database.

Either an automated script or a GDSE interface is used to upload the data. This process can be supported by the GDSE Administrator who can help the data captain to find data discrepancies, which should in turn be reported back to the Researcher for correction purposes. Once the upload has been completed, the PULL leader can explore the data through the GDSE interface and verify that the data fits the needs of the specific PULL. The researcher should also check the available data visualisations and verify that the data is visualised correctly. Figure 2 illustrates this data delivery workflow.

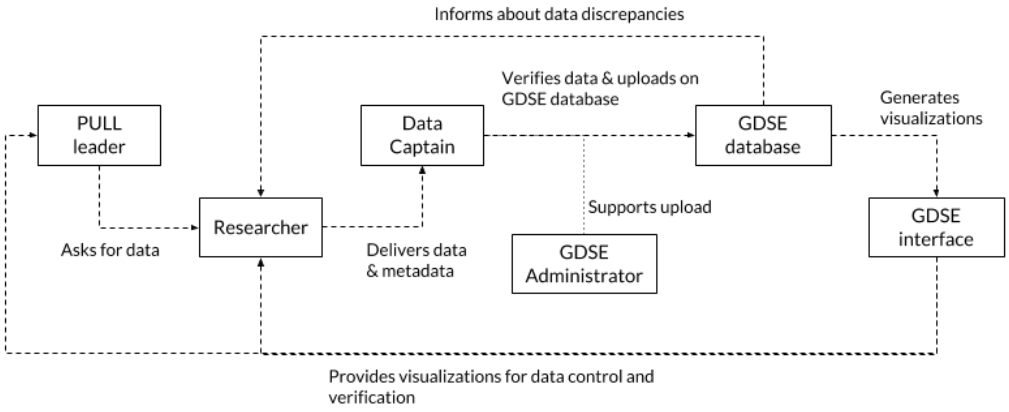

Figure 2: Data delivery workflow before the PULL meeting.

All data is uploaded using the 'Setup Mode' of the GDSE web-application interface. While the 'Workshop Mode' is the default access mode for all GDSE users during workshops, the Setup Mode is only accessible to the Data Captains. Only the AS-MFA data needs to be entered using a special mode called "Data Entry". The detailed instruction on how the AS-MFA data needs to be prepared and uploaded are available in the following living document called 'AS-MFA Data Upload':

https://mfr.osf.io/render?url=https://osf.io/2adh7/?action=download%26mode=render

Datasets necessary for GAP #3 include:

- Process models of the status quo, including AS-MFA of the existing situation, spatial analysis and related maps and diagrams relevant for the key flows (WP3).
- List of objectives and related challenge trees developed during the PULL workshops per key flow (WP6);
- Catalogue of EIS including their effects on flows (WP5).
- Sustainability assessment of status quo (WP4);
- A set of flow targets (WP3);
- A set of predefined flow views with selected actors and flows that help the decision maker to understand the flow (spatial) relations in the area.

For the GAP #4, additionally, the following is necessary:

- A comparative ranking of objectives across decision-maker groups (WP6 integrated into GDSE)
- A comparative assessment of flow targets across decision-maker groups (WP2);
- A comparative sustainability assessment of strategies (WP4);

3. Detailed description of Application Points #3 and #4

The use of the GDSE at application points #1 and #2 has already been described in the PULL - Handbook (D5.1), and revisited in section 2.1 of the present document. Application points #3 and #4 require a more detailed description which is presented in the following sections.

3.1. Co-production GDSE Application Point #3

The following section describes the different phases of GAP #3, from preparation of the workshop until the processing, analysis, and reporting of the workshop results. Expected results from GAP #3 are:

- A list of ranked objectives
- Weights attached to sustainability indicators
- A set and assessment of flow targets
- Selected EIS and defined Eco-Innovative Strategies

3.1.1 Workshop preparation

Decision-maker selection and group formation

The selection of potential decision makers to take part in the workshop should take place approximately a month before the workshop starts. Both the type and amount of stakeholders depend on the stage of the decision making, the topics of decision making, and the spatial locations of decision making. As such, the selection of decision makers can consist of stakeholders, who are either responsible for or affected by the implementation of solutions).

Approaching and inviting the stakeholders is the responsibility of each PULL- team. In this regard, more personalized and targeted invitations have proved effective to get certain stakeholders to attend to the PULL workshops.

With regards to group formation, in addition to the knowledge of participating stakeholders assigned to certain workshop topics, decision dynamics should be considered. First, a fair distribution between public and private actors to take part in a group should be made. Second, it should be taken into account that actors within a workshop group should feel free to express their thoughts and ideas. Third, a single actor working without a group should be avoided, since actor interaction is necessary to acquire, and prompt the exchange of, innovative ideas.

GDSE Preparation, spatial setup and roles of the REPAiR team members

The GDSE must be set up in advance of the workshop to make it ready for use by the small groups and for the plenary sessions. This involves setting up the data on the study area, information to be offered to the workshop participants, and workflow of workshop assignments. Data preparation for the workshop is done by

a PULL leader with the support of the data captain using the 'Setup Mode' of the GDSE. The GDSE Setup Mode allows PULL workshop organizers to enter data to be used in the workshop and relevant to the 1) PULL Study Area in question (specific map layers, CE charts, participating stakeholders, and visual description of key flows); 2) its Status Quo in terms of specific and relevant key flows (spatial and quantitative assessment), sustainability assessment and relevant CE objectives; and 3) the list of specific EIS to be used and discussed in the workshop. Moreover, PULL organizers use the Setup Mode to prepare a list of small groups to keep track of the tasks conducted by them during the workshop. During the actual workshop, members of small groups and roles are defined and all tasks are conducted using the 'Workshop Mode' of the GDSE.

3.1.2 Workshop structure and script

Workshop structure

Workshops pertaining this application point typically follow the five-part format of the Charrette System (Lennertz & Lutzenhiser, 2006):

1. Pre-workshop survey + introduction and goals;
2. Support information + GDSE demonstration;
3. Division in small groups and (cross-group) touch table assignment using the GDSE;
4. Presentation of results; and
5. Plenary session and discussion + post-workshop survey.

Once the workshop program is defined, the PULL workshop team prepares a document describing the workshop in more detail, which is to be used by the PULL workshop organization team as the workshop is run. This document is called *PULL workshop script* and contains information on the workshop, namely the title, date, venue, list of participants, materials, goal(s) and workshop agenda. Particularly, the workshop agenda part shows a table with a detailed timeline of all workshop activities, which describes the time interval, the activity(ies), the materials to be used, and the member(s) of the PULL team responsible for the specific activity. An example of a recently used PULL workshop script for the AMA PULL can be found in the link below:

https://mfr.de-1.osf.io/render?url=https://osf.io/h76c9/?action=download%26mode=render

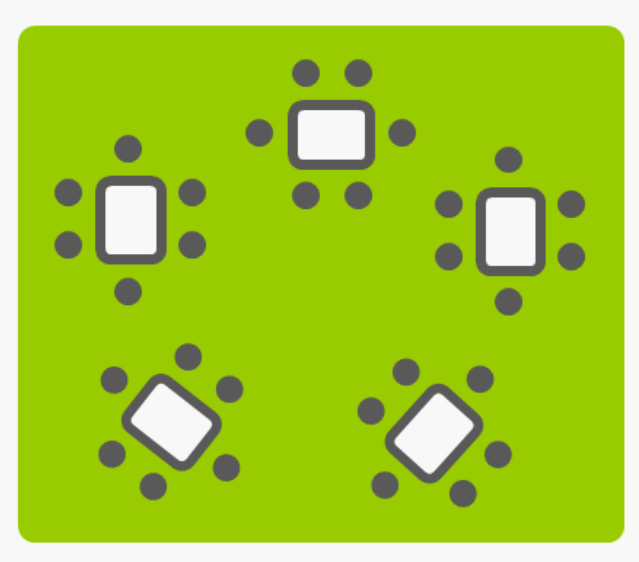

Figure 3: Workshop setup example: five small groups of participants, each working on one eco-innovative strategy, respectively, on five touch tables running the GDSE.

Presentation of results

Each small group presents to the whole group their co-developed strategy, together with its final flow assessment, generated in each assignment. Each small group is asked to describe the various elements and locations involved in the strategy, together with the resulting flow assessment as compared to the status quo. A general discussion ensues.

Plenary session and discussion + post-workshop survey

In a plenary session, the resulting strategies are presented and compared on the basis of criteria, such as selection of EIS, spatial overlay of all solutions (conflict and/or cooperation), EIS effect on activities and actors, stakeholders involved, and EIS effect on flows. This is followed by a general discussion on common ground, legal framework, and ensuing implementations. At the end of the workshop, participants are asked to rate their workshop experience, GDSE support provided and the results achieved by specifying one level of satisfaction for a specific aspect using mostly a five-level Likert scale.

3.3. Small group session using GDSE

A small group session begins with a general introduction to the session, the CE objectives and the catalogue of selected EIS to tackle these objectives.

Small group session

1. Introduction to the study area
2. Understanding the status quo
3. Ranking objectives
4. Setting flow targets
5. Introduction to EIS

6. Strategy building
7. Assessment of flow targets
8. Iteration of 6 to 7

If multiple groups are also present, the following steps should be run through. In order to avoid repetition these steps will be explained in detail under GAP #4:

Session with all small groups:

A. Cross-group assessment of objectives
B. Cross-group assessment of strategies/EIS
C. Cross-group assessment of flow targets

ad 1) Introduction to the study area

The aim of this part of the workshop is to update the participants on the results of the PULL process and the decisions made during this process by making them familiar with the area, the selected focus area and the key flows.

The GDSE is used to provide the workshop participants with specific spatial information (a map layer or a combination of several), which is relevant for dealing with the key challenges and have been prepared by the research team using the step 'Study Area' > section 'Maps' (See Figure 4).

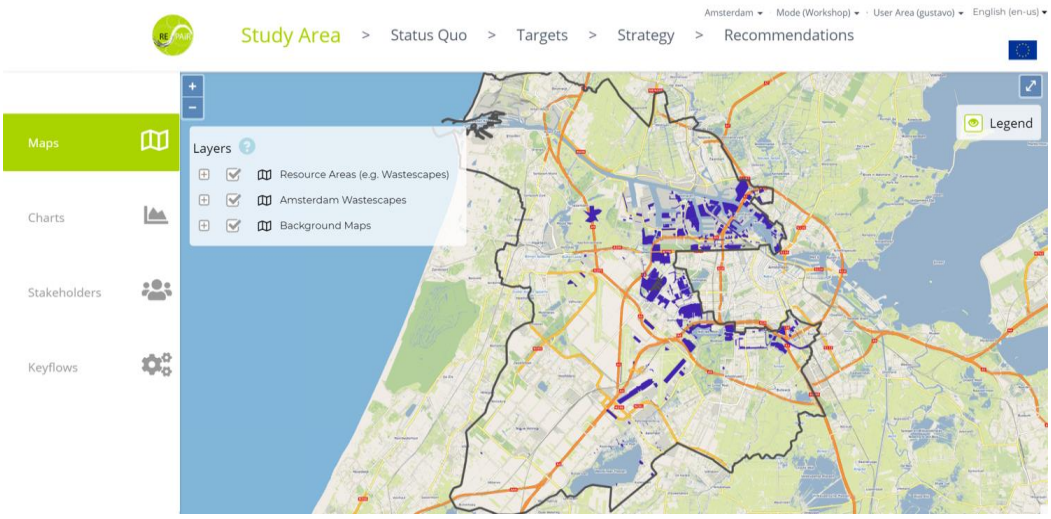

Figure 4: GDSE screenshot showing a map of the Amsterdam metropolitan area, with the focus area of the case study as well as polluted areas as additional information.

The GDSE step Study Area > section Charts (See Figure 5) allows workshop participants to display and review information and results generated previously in the PULL process. The charts are not interactive; chart information is uploaded as image files (e.g., JPEG) that can contain pictures, diagrams, schemes used in the PULL up to the workshop point.

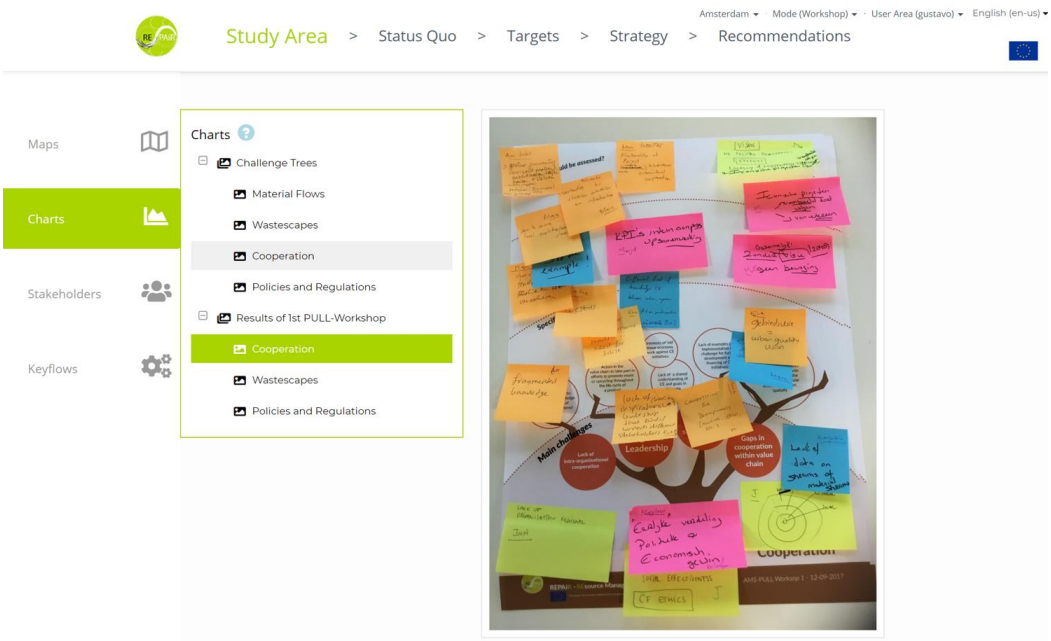

Figure 5: Chart showing a challenge tree as one example of agreements achieved during the co-exploration phase of the PULL.

ad 2) Understanding the status quo

Figure 6 illustrates this step, in which participants are first provided with, in a moderated form, an overview of the maps and analyses presented for the representation and process models (WP3) of the case study areas. Thereafter, participants are offered some of the previously prepared views on material flows and stocks in order to get an understanding of the system of actors and key flows in the region.

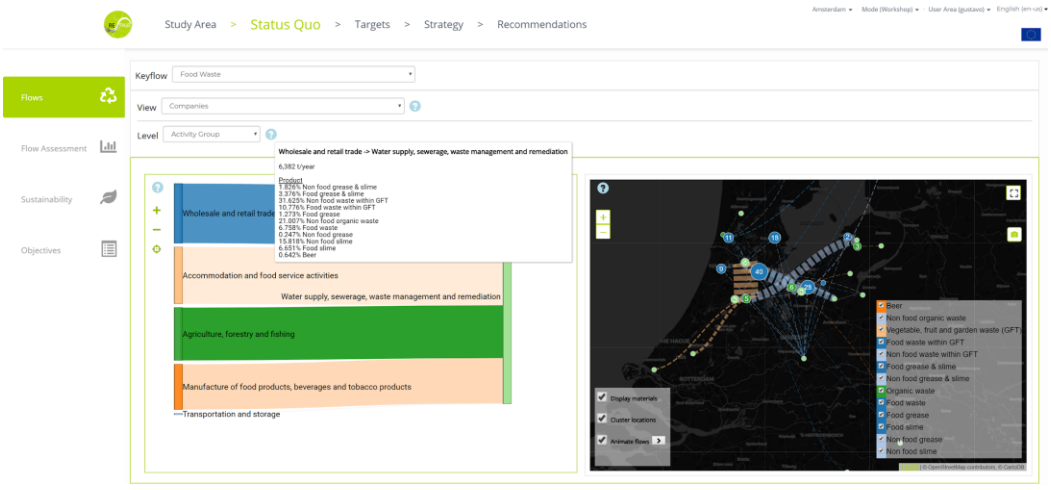

Figure 6: The overview of status quo, for the key flow 'food waste', for a selection of company-related activities as pre-prepared view.

ad 3) Ranking of objectives:

The aim of this step is to have the members of a small group discuss and agree on a relative order of importance of the objectives defined during previous phases of the PULL process for the specific key flow (See Figure 7).

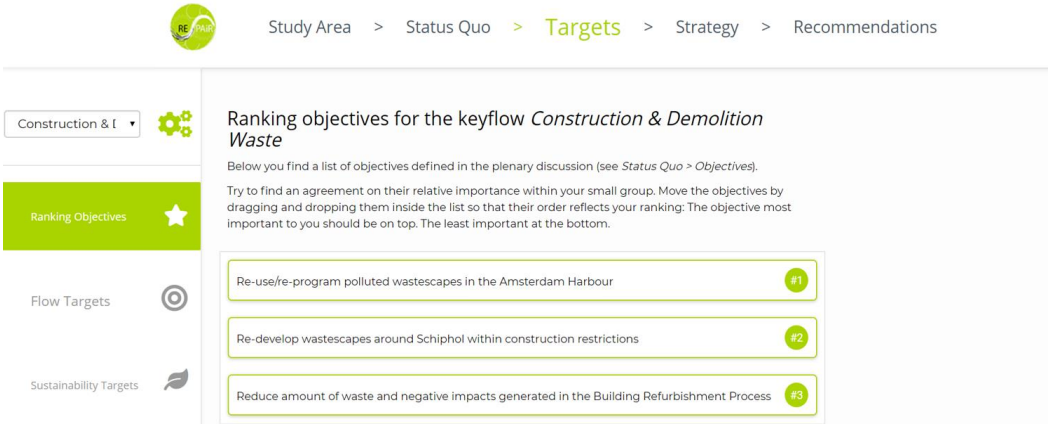

Figure 7: The 'Targets > Ranking Objectives' screen of the GDSE

The users drag and drop the objectives to achieve the order their small group agrees on. The workshop facilitator needs to make sure that this discussion does not take longer than 15 minutes.

This decision has two consequences:

6. It defines the order of objectives for the next screen (flow targets), which means that each group starts setting targets starting with their most important target.
7. It provides data that allows performing a cross-group discussion about differences and agreements according to the importance of the different stakeholder groups during the recommendation section.

This step is based on a methodology developed by WP6 and presented in Deliverable 6.3 'Decision model pilot studies', and further detailed in Milestone 26 'Decisional steps in the next PULL events'.

ad 4) Setting flow targets

The aim of this step is to allow workshop participants to set targets in relation to flows. The targets can be specified for each objective separately. The idea is to provide the participants with a possibility of instant feedback in the Conclusions step. It is important to provide the decision makers with a timeframe; for example what is your target for the next 5 years, or until 2025. Ideally this timeframe relates with existing goals provided in policy document of the region, state or European Union.

In order to assess the material flow in the metabolism of a city or a region, several indicators, adjusted from the research by Zhang et al. (2009), are proposed in the process:

1. **Flow amount**: the amount of each material flow. It can describe the size of the material imported or conducted in the city/region. Due to the material property changes, material input and output are usually calculated separately.
2. **Flow structure**: the percentage of the renewable material in each flow. A high flow structure value indicates that more renewable resources would be consumed to ensure urban development and less resource consumed from the external environment. However, it varies from material to material, thus some flows may not be applicable.
3. **Flow intensity**: the amount of each material flow consumed/conducted per person. It can indicate the standard of living of urban residents. A high flow intensity means that more natural resources would be consumed to satisfy the demand of a given population.
4. **Flow efficiency**: represents the relationship between economic factors and each material flow. A high value indicates that fewer material consumption by producing the same Gross domestic product (GDP) .
5. **Flow density**: represents the level of development pressure imposed by a city/region on its environment. It is a combination of flow amount and spatial distribution. The flow density indicates the material consumption / conduction to sustain urban development.

The flow assessment indicators set the goals of each objective. They can be of several types:

1. Concerning amount: reduction or increase of generation of a specific waste flow, e.g., decrease of food waste produced by household by 10%.
2. Concerning structure: change of how the key waste flow is treated/cycled, e.g., minus 10% of incineration of food waste.
3. Concerning intensity: reduction or increase of generation of a specific waste flow per person, e.g., reduce waste production by person by 5%.
4. Concerning efficiency: optimising waste management cost of a specific waste flow, e.g., minus 10% of electricity consumption of dealing with 1 tonne of plastic waste.
5. Concerning density: increase or reduction of a specific waste collection point/waste flow amount in one spatial unit, e.g., add 5% the number of glass collection points per hectare.

The participants use the GDSE step Targets and section Flow Targets to set a target per objective (see Figure 8). They select a values for each indicator (flow amount, flow structure, flow intensity, flow efficiency, and flow density).

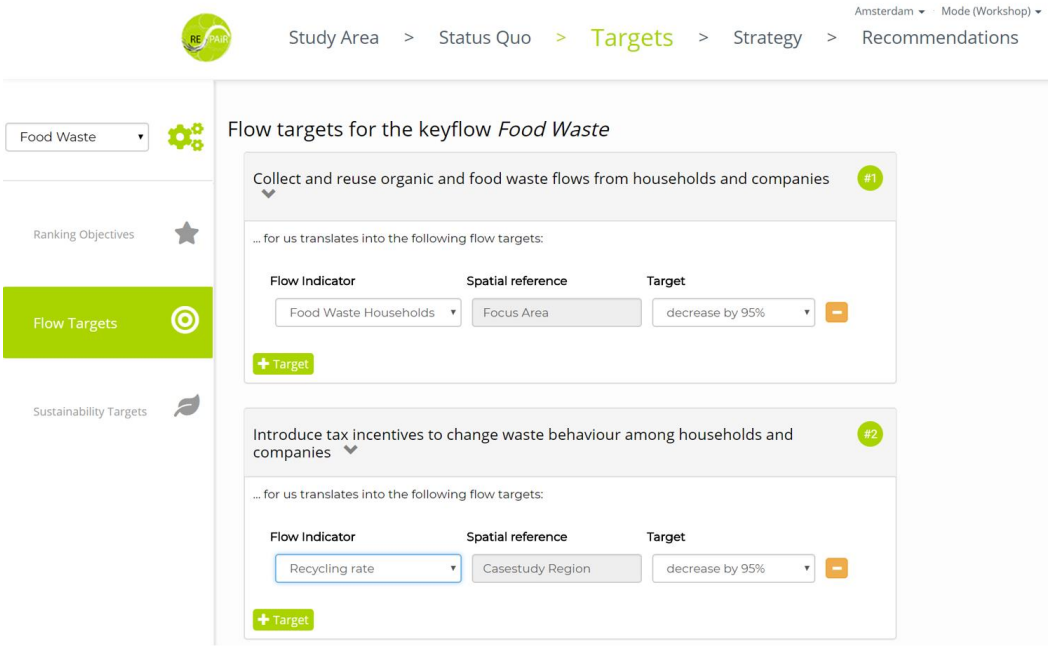

Figure 8: The 'Targets > Flow Targets' screen of the GDSE.

ad 5) Introduction to EIS

The step Strategy > section Solutions (Figure 9) presents to the members of the small groups the catalogue of eco-innovative solutions (for details, see deliverable 5.4 to 5.8), which they can combine into strategies.

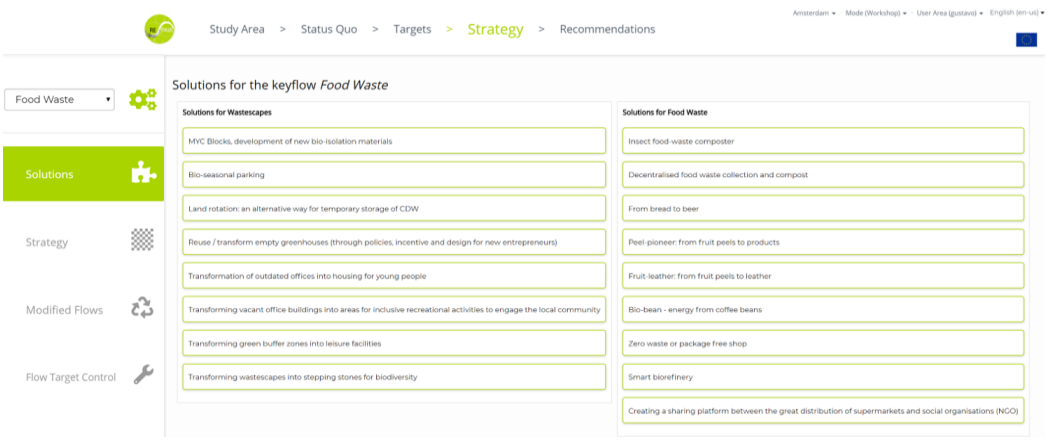

Figure 9: The GDSE showing step Strategy > Section Solutions for the key flow food waste in the case of Amsterdam

By clicking on one solution item, the user gets detailed information on the solution in the form of five tabs/screens (see Figure 10):

- *Description*, which outlines the solution in a textual manner;
- *CE-Diagrams*, which present two diagrams: one describing the status quo of the existing situation of the process model relevant to the solution and one that shows how the solution will change it;

- *Activities* lists of the economic activities, at the NACE code 4-digit level, and the system diagrams included, which could be used for implementation;
- *Actors* present a map with the locations of the individual actors (companies) from the above activities that are active in the region;
- *The suitability map*, which presents the areas to which the solution can be applied.

The small groups use these GDSE screens to jointly discuss the solution in order to develop an agreement on which solutions are the most useful for a strategy to change the study area. The moderator is available for questions and has to be familiar enough with the solutions in order to answer basic questions concerning them. The solutions have been developed in a long process by stakeholders and experts, therefore it is important that discussions on the feasibility of the solutions are avoided as much as possible. Instead, the discussion should focus on understanding the basic principles behind it and if a solution is relevant for the objectives. The solution screens should be used iteratively with the step strategy building.

Depending on the amount of small groups, it may be appropriate to introduce the solutions briefly in a plenary session with all workshop participants with a joint Q&A session on the solutions.

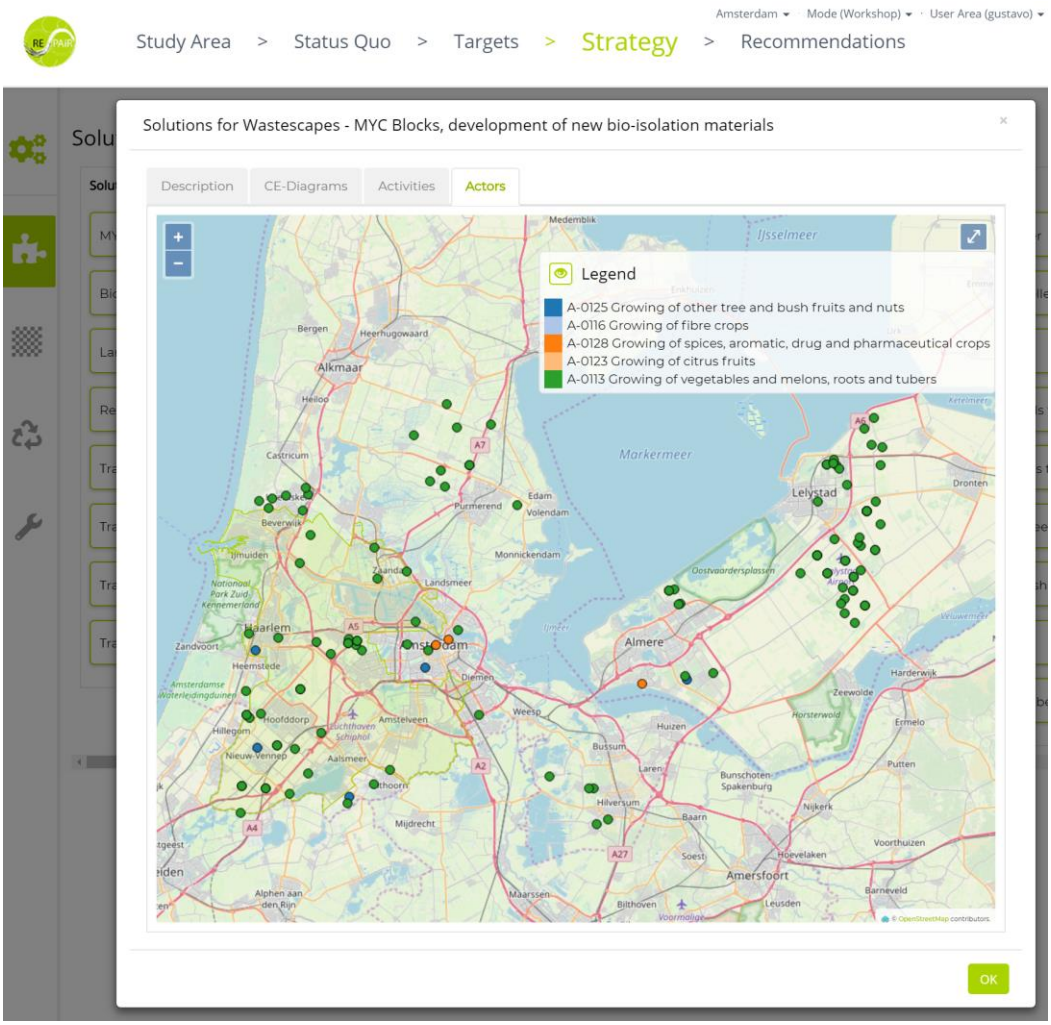

Figure 10: The Actors tab showing locations of relevant actors for one specific solution.

ad 6) Strategy building

Within REPAiR, eco-innovative strategies can be composed of a systemic integration of two or more place-specific Eco-Innovative Solutions. The GDSE step Strategy > section Strategy facilitates exactly this activity of combining eco-innovative solutions into a strategy (see Figure 11). In order to do so, one small group of stakeholders has to click on the implementation button.

A drop-down menu showing all solutions becomes available. The group jointly selects one solution they want to include into their strategy. The implementation area screen opens and allows to draw or select an area where the solution should be applied to. The map shows the suitability map for the solution as support. All maps involved in the solutions (included in GDSE step 'Study Area'), as well as actors' locations and pre-defined flow views, are available as background maps to support participant as they draw their EIS implementations.

In the next step the participants can, in case the solution allows and requires it (e.g. a number of glass collection points or a number of biodigesters), define the quantity of the solution. In the next window the group defines one or multiple actors which should lead the implementation of the specific solutions. The task of the moderator is to make sure that instead of endless discussions the groups should rather use the immediate feedback of the step 11 'Assessment of flow targets' to optimise their strategy. One hour should be sufficient for a small group to come to a joint eco-innovative strategy. In case a small group is unable to agree on a strategy the moderator should open up an additional small group that allows to develop and store two strategies.

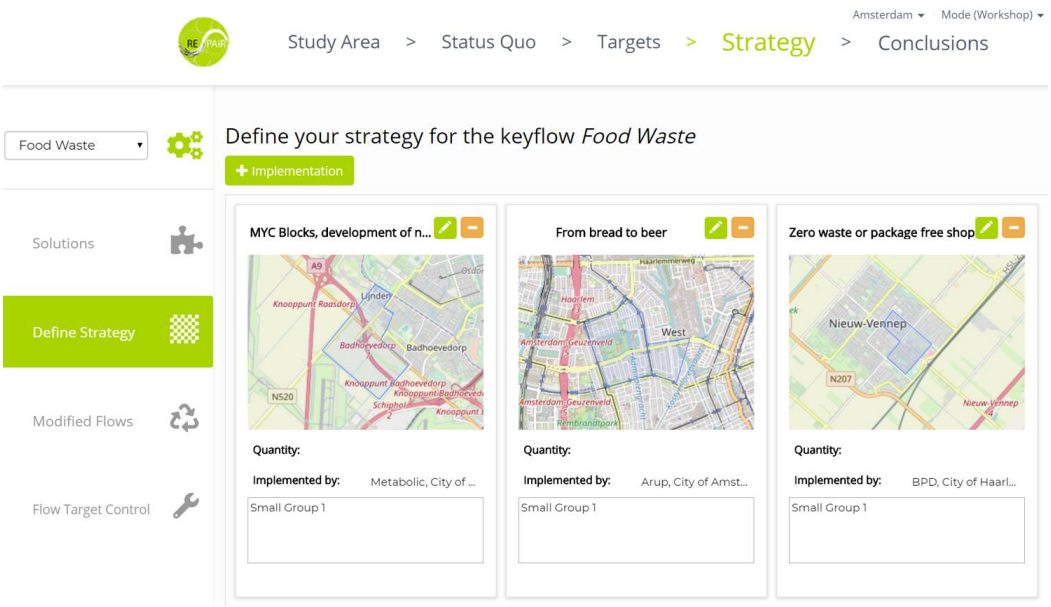

Figure 11: An eco-innovative strategy is composed of three EIS, each with their own area of application, list of actors that implement them, and additional comments.

The discussion on the strategy building is supported by two further screens, which provide immediate feedback to the participants, and are described in the following sections.

at 7) Assessment of flow targets

Section 'Modified Flows' is a duplicate of the screen Status Quo/Flows; however, it shows updated data based on the changes in actors as well as flows and their amounts, and materials.

Section 'Flow Target Control' provides the participants with an immediate response on how well they have achieved the flow targets the set by them under step 4.

3.2 Co-decision GDSE Application Point #4

This section describes the various phases of GAP #4, which include workshop preparation and execution, as well as processing and analysing the workshop results. Expected results from GAP #4 are the following:

- A concrete plan with detailed implementation actions for each eco innovative strategy;
- A list of actors and stakeholders to collaborate for the implementation of each specific strategy;
- A timeline for actual implementation of each strategy and the corresponding EIS.

3.2.1 Workshop Preparation

As indicated previously, this GAP features one workshop with as many members as possible of the small groups who participated in the GAP #3 workshops. The main aim of this co-decision workshop is threefold and includes:

1) To present to the stakeholders all the eco-innovative strategies co-developed by all small groups in the previous GAP #3 co-production workshops;
2) To present a full assessment and comparison of the strategies based on the results from the GAP #3;
3) To have the participants discuss these results in order to define actors and actor groups for collaboration, setting priorities and defining the timeline for the implementation of the eco innovative strategies.

GDSE Preparation and roles of the REPAiR team members

In previous GAP #3 workshops, the small groups used the GDSE to co-develop a number of eco-innovative strategies, each consisting of spatial implementations of a number of EIS. Prior to this GAP #4 workshop, the GDSE needs to be prepared so as to present and compare all strategies based on the assessment of their impacts. This is done using the GDSE step 'Conclusions' by a PULL team member with administrator rights (so all strategies can be accessed simultaneously), and involves preparing the following information:

- The list of Eco-Innovative Strategies co-developed by the small groups;
- List of addressed CE objectives for each key flow, ranked by priority set by the small groups;
- List of flow indicators used for setting CE targets for each key flow, ranked by indicator usage by the SG and target values set by the small groups;
- The list of selected EIS for each key flow, ranked by EIS choice by small groups;
- A map of locations of EIS implementations for each strategy developed by the small groups;
- A list of actor groups involved in the selected EIS for each key flow, ranked by actor group involvement;

- A list of stakeholders involved in the EIS implementation selection for each strategy, ranked by stakeholder involvement;
- A final list of Eco-Innovative Strategies co-developed by the small groups, ranked by assessment of each flow indicator;
- A final list of Eco-Innovative Strategies ranked by target achieved;
- A list of strategies ranked by sustainability assessment indicators;
- A report for each key flow with conclusions on general aspects, common ground and consensus level(in terms of objectives, targets and strategies), legal framework, waste management and further actions.

3.2.2 Workshop structure and script

Workshop structure

The workshop follows the following structure:

1) Pre-workshop survey + introduction and goals;
2) Presentation, using the GDSE, of the strategies developed by the small groups;
3) Presentation, using the GDSE, of the comparative analysis of the strategies;
4) Division in small groups to discuss implementation plan for specific strategies;
5) Plenary session and discussion + post-workshop survey.

1) Pre-workshop survey + introduction and goals

Participants arrive and are welcomed with lunch (if it is an afternoon workshop) and drinks. Participants complete a short questionnaire about their expertise and general workshop expectations. The workshop goals are presented, together with the state of the PULL; that is, the list of workshops already given and their outcomes.

2) Presentation on GDSE of strategies developed at GAP #3

The team presents to the participants all eco-innovative strategies co-developed during previous co-production workshops held at GAP #3. The strategies are presented to the whole group using the GDSE linked to a projector. For each strategy, it is presented: who developed it (small workshop group), which stakeholders/actors were involved, which solutions are implemented and the specific locations. This is done in the workshop mode, GDSE step Strategy. Alternatively, the strategies can also be presented as a slideshow.

3) Presentation on GDSE of comparative analysis of the strategies

The team presents the results of the comparative analysis of strategies using the GDSE step 'Conclusions'. The strategies are compared on the basis of priority of CE objectives addressed, impact on flows and target achievement, selectivity of EIS, spatial extent of EIS, actors and actor groups involved, stakeholder involvement, sustainability assessment indicators. Through this analysis it will be possible to identify common ground and conflict aspects for all strategies. More specifically, the results concerning stakeholders and actors will define how to carry out the

following step, in which the participants are divided into sub-groups to discuss specific strategies in detail. The specific steps of presenting this comparative analysis are explained in detail below in Section 4.3.

4) Division in small groups to discuss implementation plan for specific strategies
Based on the trade-offs, the entire group of participants are divided in sub-groups to discuss implementation path and timeline of selected strategies. The idea is to have one sub-group for each strategy. Each sub-group will discuss one specific strategy and will propose a timeline, actors to be involved, EIS implementation, cooperation plan and specific tasks. Each sub-group will sit at the table with a GDSE computer showing the specific strategy. The discussion will be structured and facilitated by a PULL team member. Note that the results of the discussion in the form of an implementation plan could be composed freely by the sub-groups. The GDSE provides opportunities for uploading these results in the form of pictures.

5) Plenary session and discussion + post-workshop survey
Each sub-group presents their co-developed strategy and its final flow assessment to the whole group. Each small group is asked to describe the various elements and locations involved in the strategy, together with the resulting flow assessment as compared to the status quo. The resulting strategies are compared on the basis of criteria, such as selection of EIS, spatial overlay of all solutions (conflict and/or cooperation), EIS effect on activities and actors, stakeholders involved, and EIS effect on flows. This is followed by a general discussion on common ground, legal framework, and ensuing implementations. At the end of the workshop, the participants are asked to rate their workshop experience, GDSE support provided and the results achieved by specifying one level of satisfaction for a specific aspect using mostly a five-level Likert scale. They are also asked how likely it is that they will promote the strategy developed in their daily profession.

3.2.3 Comparative analysis of Eco-Innovative Strategies developed during GAP #3

The GDSE plays a crucial role in this part of the workshop. The strategies can be compared using the GDSE step ‘Conclusions’ in the workshop mode. More specifically, this comparison is displayed and discussed following the seven steps presented below.

1. Introduction to the final set of strategies
2. Ranking of CE objectives and key flows per small group
3. Discussion on Flow Targets
4. Strategies
5. Modified Flows
6. Sustainability
7. Conclusions for all key flows

ad 1) Introduction to the final set of strategies

The aim of this part of the workshop is to present to the participants all eco-innovative strategies co-developed by the small groups in previous individual co-production workshops. The GDSE step 'Strategy' > screen 'Define Strategy' is used for selecting and displaying one strategy at a time, together with the EIS implemented in that strategy. The button 'Edit solution'  is used to display specific features of the EIS in the strategy, namely extent of implementation area, flow quantities involved, stakeholders involved in implementation, and additional notes made by the small group participants (See Figure 12). It is required that this is done by a PULL team member with full GDSE administrator rights with access to all strategies developed by the small groups.

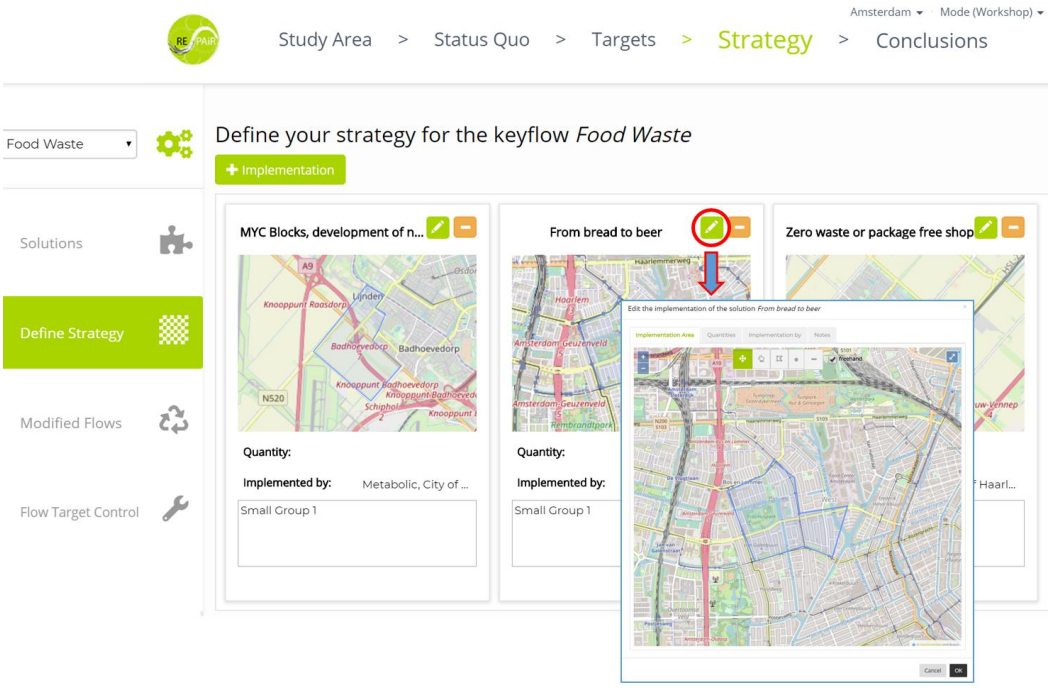

Figure 12. Displaying Strategies and specific features of EIS involved. The EIS in the middle is edited in a separate window to display specific features as tabs.

ad 2) Ranking of CE objectives and key flows per small group

This part of the workshop deals with the CE objectives addressed by the EIS that were co-developed previously by the small groups. The objectives are presented for each key flow, along with a priority ranking made by the small groups in previous GAP #3 EIS co-production workshops. The GDSE step 'Conclusions' > 'Objectives' is used to display this information (See Figure 13). For each key flow, it is shown how the objectives rank 1) on average by all groups, and 2) according to each specific small group. The goal of this part is to identify those objectives which are shared by the small groups and those which are not. The comparison of the objectives ranking provides actors with an indication of consensus among small groups about which objectives could be prioritized when setting objective-specific Flow targets, as wells as selecting Eco-Innovative Solutions.

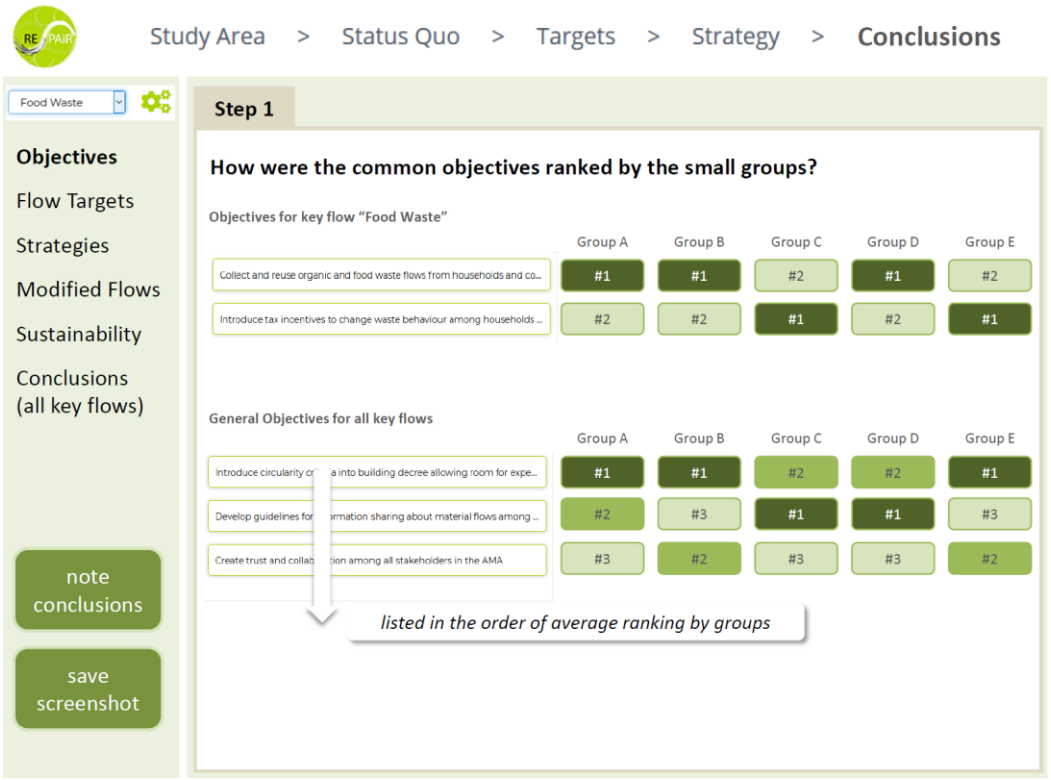

Figure 13. GDSE showing a priority ranking of CE objectives per key flow on average for all small groups (right) and according to individual small groups (right). Priorities set by small groups are color-coded using dark green to indicate high priority and light green to indicate low priority.

ad 3) Discussion on flow targets

Flow targets are discussed in two parts. In the first part the CE objectives are now presented in terms of the flow assessment indicators used by the small groups in previous workshops to set objective-specific targets. This is presented in GDSE step 'Conclusions'> screen 'Flow Targets' > tab 'Step 2' (See Figure 14). For each objective, it is shown how many small groups picked a flow indicator using a color-coded scheme (See Figure 14). Flow indicators colored with dark green were picked the most times by small groups. Flow indicators colored with light green were picked the least times. Next, the PULL team identifies both the flow indicators that were selected the most times and the CE objectives involved. This is followed by a discussion about how the CE objectives are addressed using the flow indicators and the implications of this on the further work on EIS and strategies.

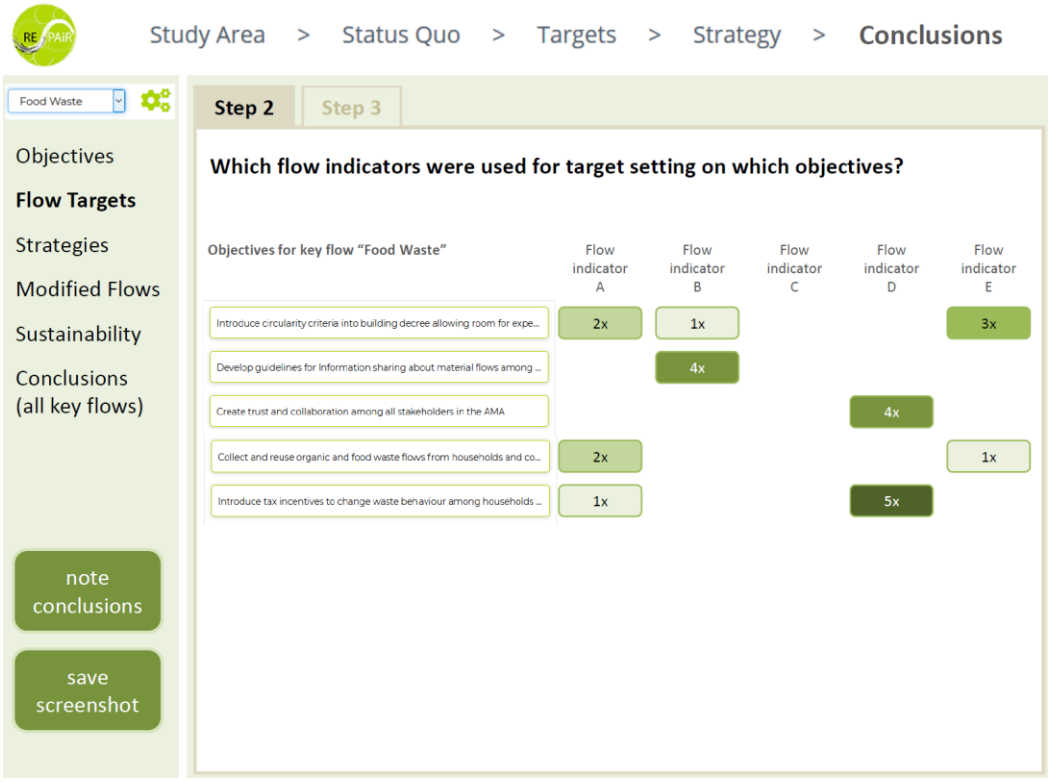

Figure 14. GDSE showing a ranking of CE objectives per key flow on the basis of selection and usage of flow assessment indicators for setting CE objectives.

The second part of this step concerns a discussion about the actual target values set by the small groups for each CE objective. The GDSE step 'Conclusions' > 'Flow Targets' > 'Step 3' is used to present the target values as color-coded percentages of change brought by the strategies co-developed by the small groups (See Figure 15). The aim of this part is to identify common ground regarding targets and indicators. In this way objectives are made more tangible and measurable, allowing for well-informed decisions by actors.

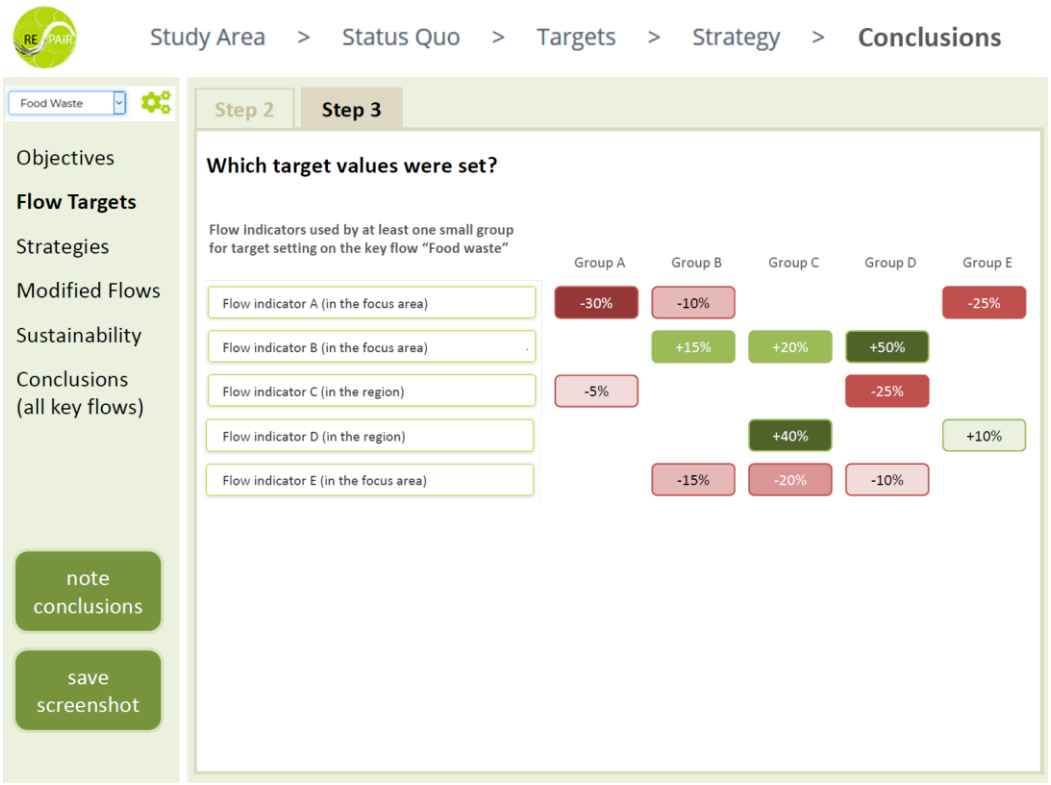

Figure 15. GDSE showing a CE objectives per key flow and the target values for flow assessment indicators. Target values set by small groups are color-coded using a red-to-green color ramp, in which red indicates negative change (value decrease) and green indicates positive change (value increase).

ad 4) Strategies

This part of the workshop deals with the EIS selected by the small groups to form their strategies. All EIS pertaining a key flow are listed and color-coded according to the number of times it was picked by a small group using a black-to-brown color ramp. The darker the EIS, the higher the number of times it was selected by the small groups. For each EIS a quantitative indication (e.g., tonnes, number of shops) in relevant units, corresponding to the solution, is shown. A blue color ramp is used to indicate quantities: darker blue indicates higher amounts, whereas light blue indicates low amounts. GDSE step 'Conclusion' > 'Strategies' > 'Step 4' is used in to communicate this information (See Figure 16).

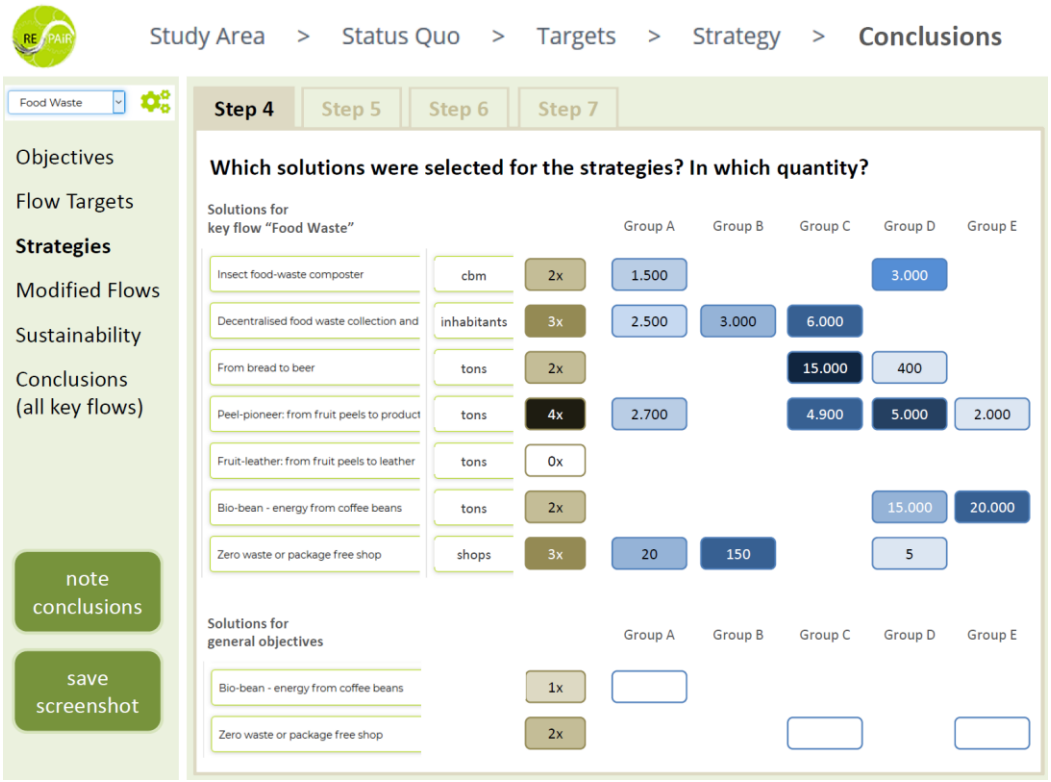

Figure 16. GDSE showing the number of times, and how much, an EIS was implemented into a strategy by the small groups for each key flow and general CE objectives. EIS (left) are colored on the basis of selectivity (middle) and quantities specified by the small groups (right).

In the following part, the spatial of EIS implementations is presented as a map. This is done using the GDSE step 'Conclusions' > 'Strategies' > 'Step 5' (See Figure 17). This map shows where one or more solutions were implemented by the small groups in the study area, and by whom (stakeholder/actor). Locations were drawn (and labeled) as polygons by the small groups in previous PULL workshops. The aim of this part is to identify overlaps of these implementations and to discuss these overlaps with relevant stakeholders in order to help defining further implementation steps.

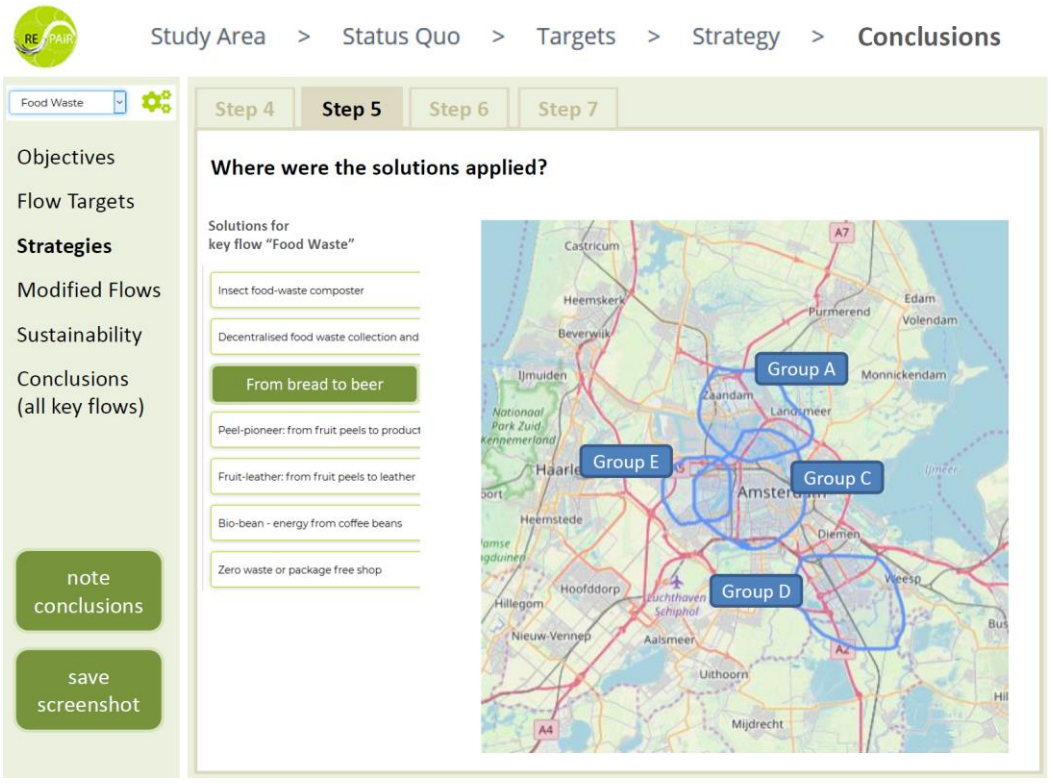

Figure 17. GDSE showing the locations of EIS implementations as drawn by the small groups. EIS 'From bread to beer' is selected (left) and the corresponding implementations by the small groups are mapped (right).

Next, the list of actor groups (i.e., activities) involved in the small group work is presented to the participants. For each activity, it is shown how often it was chosen by all small groups and specific small groups, and which groups were involved in each activity (Figure 18). GDSE step 'Conclusions' > screen 'Strategies', 'Step 6' is used to visualise this information. Involvement is portrayed using a brown color ramp, in which dark brown indicates high involvement and light brown indicates low involvement.

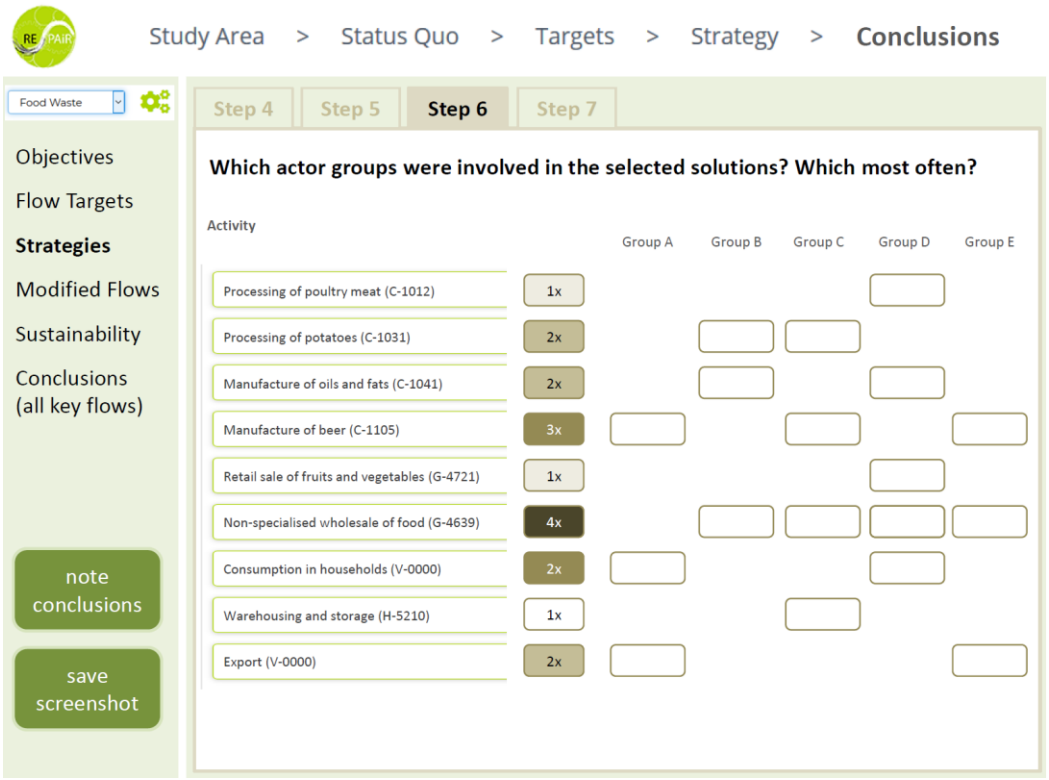

Figure 18. GDSE showing actor groups involved in the implementation of solutions by the small groups. Involvement is expressed as the amount of times an activity group is associated with an EIS by a small group.

The step 7 deals with the stakeholders involved in the implementation of EIS done by the small groups. This is shown in the GDSE step 'Conclusions' > 'Strategy' > 'Step 7'. For each small group (i.e., each strategy), it is illustrated which stakeholders (name, private/public) were chosen for implementing EIS (See Figure 19). This provides information about which actors are relevant to consult or include to potentially implement certain solutions.

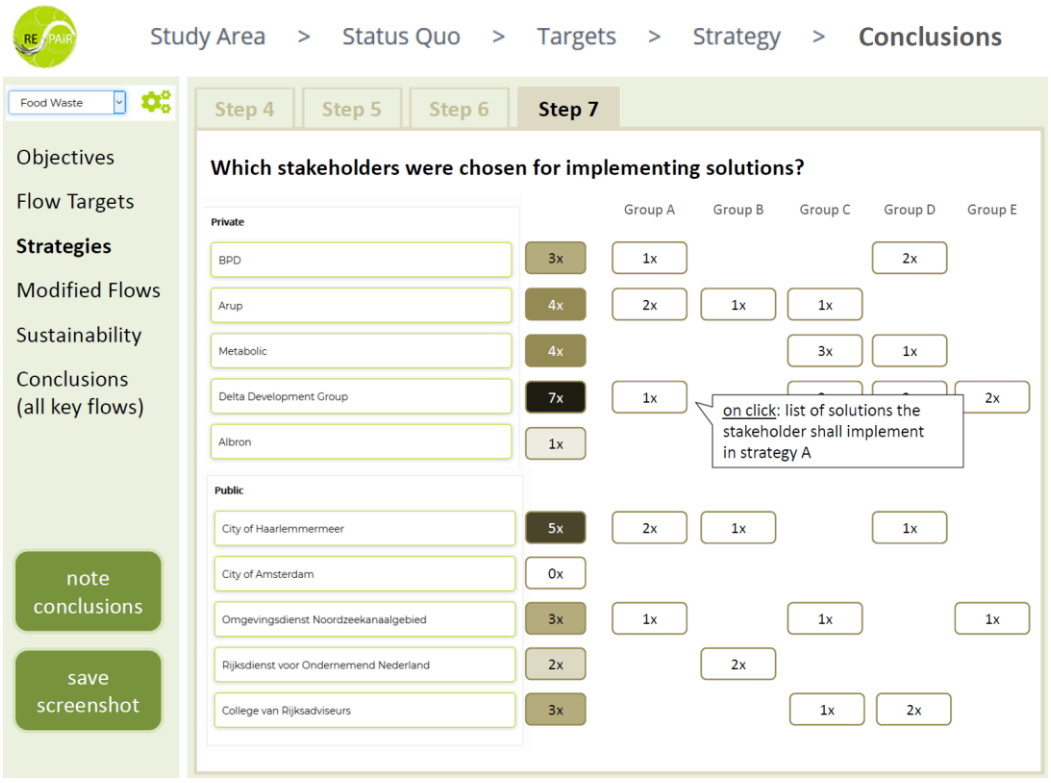

Figure 19. GDSE showing how often a stakeholder (left) was chosen in the implementation of the EIS developed by the small groups (right). Stakeholder choice (middle) is portrayed using a black-to-brown-to-white color ramp, in which black indicates high number and white low.

The next part deals with the crucial task of assessing the impact of small-group-developed strategies, which were developed by the small groups, on flows. The results of this assessment are presented using the GDSE step 'Conclusions' > 'Strategies' > 'Step 8' (See Figure 20). All strategies are compared with each other, on the basis of their impacts of all flow indicators. It is now possible to see which strategies contribute the most to improve circularity in the study area, and which strategies the least.

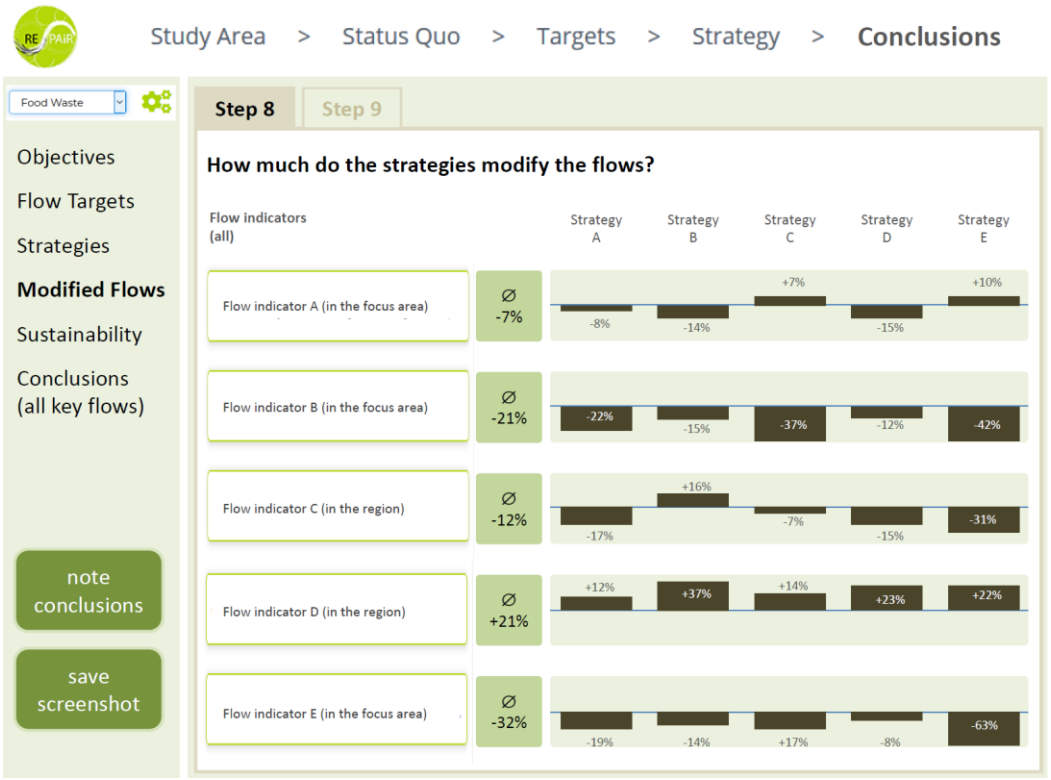

Figure 20. Flow assessment of eco-innovative strategies in the GDSE. Percentages of flow indicator impact is shown for all strategies.

In this part the PULL team presents the aforementioned assessment of the strategies, together with a comparison with the targets previously set by the small groups. The aim is to compare all strategies, checking whether the targets set by the small groups are met by the co-developed strategies. For each flow indicator, it is presented which fraction of the targets are met by the strategies. This information is presented using the GDSE step 'Conclusions' > 'Strategies' > 'Step 9' (See Figure 21).

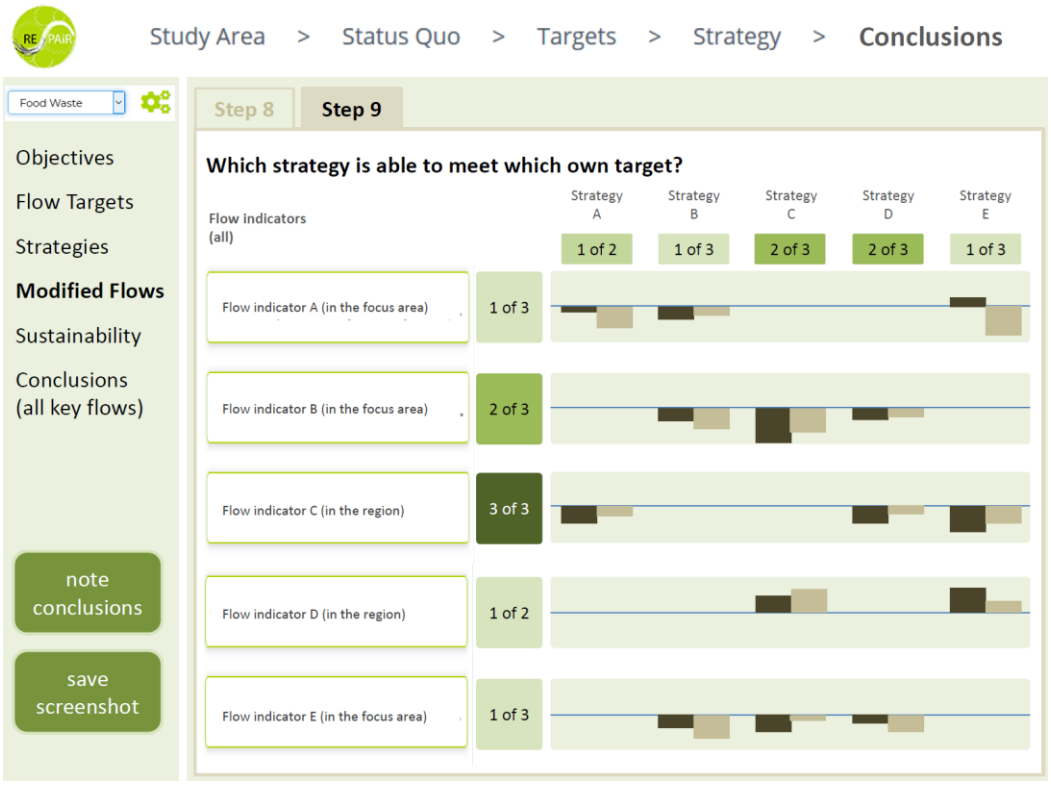

Figure 21. GDSE showing effectiveness of strategies in terms of flow assessment targets. A green colour ramp is used to indicate the fraction of targets met. Dark green indicates a big fraction of targets being met, while light green indicates a small fraction.

The sustainability analysis of all the eco-innovative strategies co-developed by the small groups is conducted in the period between the last co-production workshop and about a week prior to the co-decision workshop. This information is uploaded to the GDSE by a PULL member at the preparation phase of the workshop. The results of this sustainability analysis are presented as a slideshow in which one slide shows the indicator values of all strategies, for one sustainability indicator for all Areas Of Protection (AoP). These results are presented using the GDSE step 'Conclusions' > 'Strategies' > 'Step 10' (See Figure 22). The aim is to compare the sustainability effects of all strategies for all AoP, and identify both negative and positive sustainability effects of the strategies, focusing on trade-offs and the particular indicators for which the strategies do not perform so well. A discussion on this assessment (and individual indicators) ensues.

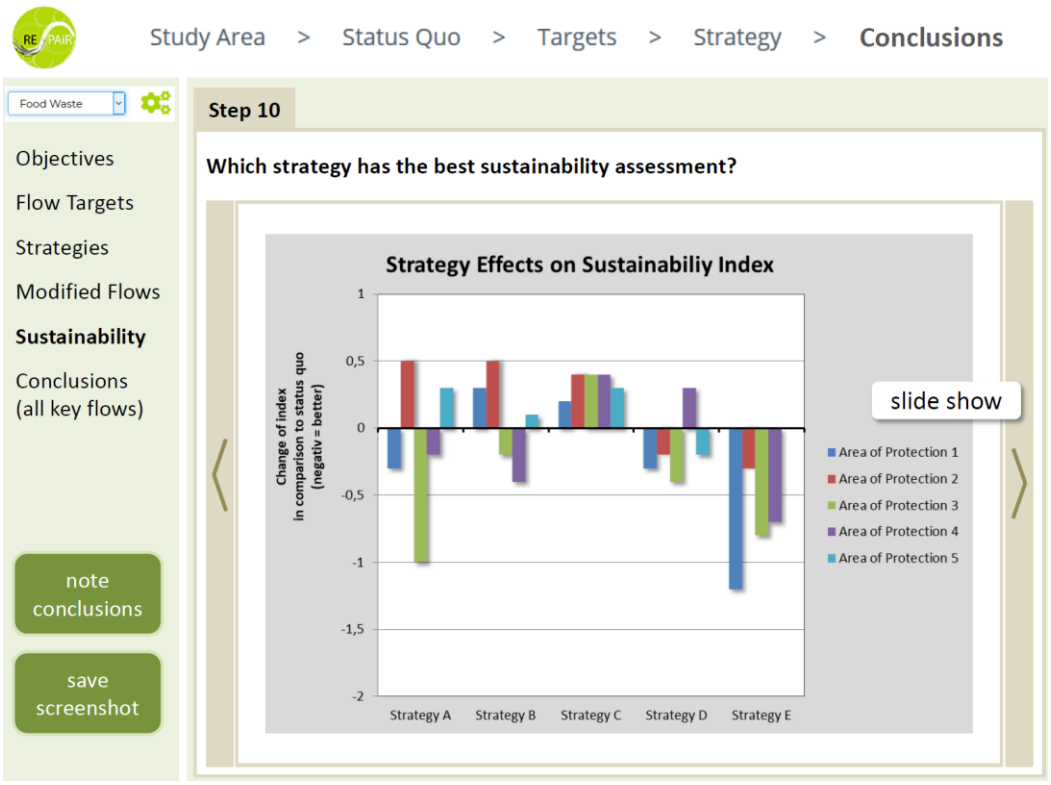

Figure 22. Sustainability assessment of eco-innovative strategies in the GDSE.

This part deals with the final conclusions drawn by the small groups. The PULL team presents this information for each flow and in terms of consensus level reached by the small groups at each GDSE step. This is presented using the GDSE step 'Conclusions' > screen 'Conclusions (all key flows)' (See Figure 23). The main idea is that the Conclusions focus on 1) Common ground reached by the users of the GDSE for different Sections, and 2) Matters that need to be discussed. The common ground aspects indicate the various aspects on which consensus has been reached by the different actors, which can be considered as supportive for making real decisions outside the setting of the GDSE. The matters that still need to be discussed indicate the aspects on which consensus has not been reached with the support of the GDSE. The differences observed in these aspects can be discussed amongst the small groups and actors present, possibly followed by a new round of decisions in the GDSE workshop to overcome differences and reaching consensus. Note that all GDSE's Conclusions provide workshop participants with opportunities and information to assess the common ground for strategies, supporting them to make decisions in real life.

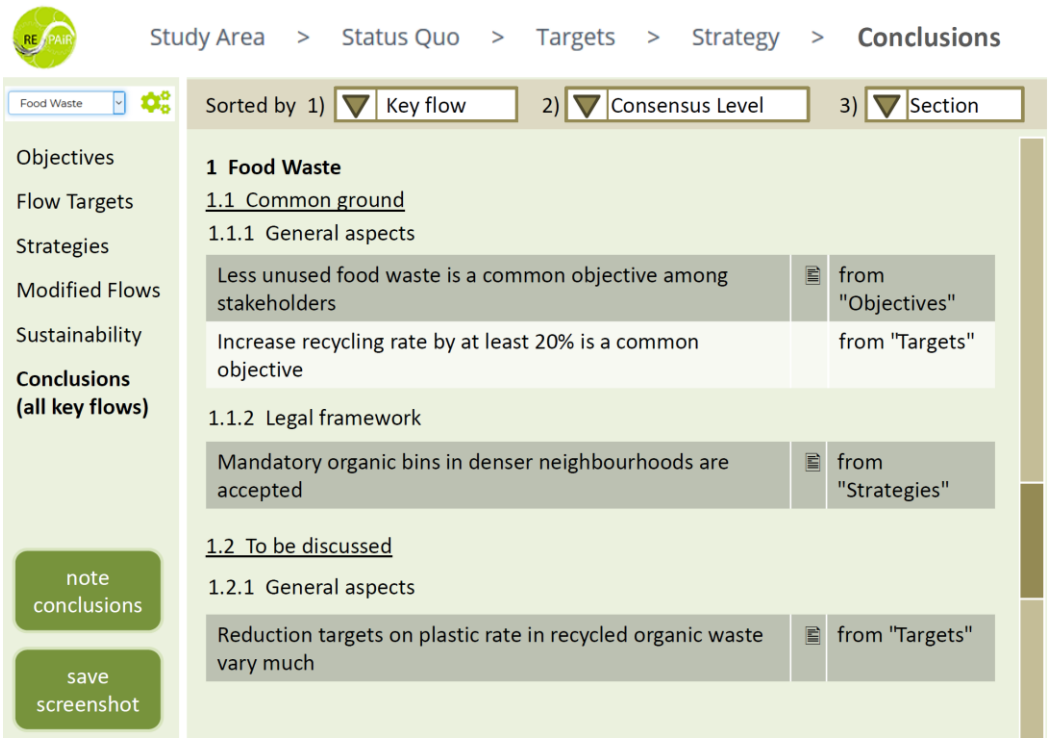

Figure 22. GDSE screen 'Conclusions (all key flows) showing the logbook of conclusions drawn throughout the workshop and across key flows.

3. Next Steps

This deliverable presented guidelines for structuring and running a REPAiR Peri-Urban Living Lab using the GDSE as the main support tool for structuring and facilitating the process of co-developing eco-innovative strategies that aim to address the Circular Economy objectives in a peri-urban area. The above describes, processes and methods which will be applied to the pilot cases during the spring of 2019. The lessons learned from this application process will be integrated into Deliverable 5.9 Final Handbook: How to run A PULL as well as in the application of the GDSE in the follow-up cases.

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