



REPAIR

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

D6.3 Decision model pilot studies

Version 1.8

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Acronyms and Abbreviations

AEB	Afval Energie Bedrijf (Waste and Energy Company)
AMA	Amsterdam Metropolitan Area
AMS	Amsterdam Institute for Advanced Metropolitan Solutions
A/N	Author's Note
ANT	Actor Network Theory
APs	Application Points
ASIA	Azienda Servizi Igiene Ambientale Napoli (Hygienic and Environmental Services Company in Naples)
AS-MFA	Activity-based Spatial Material Flow Analysis
ATO	Ambito Territoriale Ottimale (Optimal Territorial Area)
BKG	AMA Central Administration
CE	Circular Economy
C2C	Cradle-to-Cradle
CDW	Construction and Demolition Waste
CRA	Campania Region Authority
CRW	Construction and Renovation Waste
DM GDSE VC	Decision Model GDSE Visualisation Chart
DTs	Decision Thresholds
e.g.	exempli gratia
FA	Focus Area
GDSE	Geodesign Decision Support Environment
HCU	HafenCity Universität
i.e.	id est
Ms	Methods
MAN	Metropolitan Area of Naples
MCA	Multi-Criteria Analysis
MSW	Municipal Solid Waste
OW	Organic Waste
PA	Public Administration
PULL	Peri-Urban Living Lab
PULL-M	PULL Meeting
PULL-WS	PULL Workshop
SA.P.NA	Environmental System Province of Naples
SDSS	Spatial Decision Support System
SIN	Sites of National Interest
SWC	Separate Waste Collection

SWOT	Strengths, Weaknesses, Opportunities and Threats
TU Delft	Delft University of Technology
UNINA	Università degli studi di Napoli Federico II
USAID	United States Agency for International Development
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).

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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_are influenced by the site specificities; depend on policies/resources (managerial, economic/financial, administrative capacity, etc.); depend on stakeholders: different people, queries, communities, economies are involved in eco-innovation process; do not have a single scale, they cross multiple scales, different dimensions, grain and scale of the territories of innovation. The combination of eco-innovative solutions produce integrated strategies: mixable instruments and solutions for new systemic relations (Authors 2017).

Peri-urban_is the area of urban region, where built and unbuilt patterns intermix (Forman 2008: 7). Periurban area 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 area is not matching with the intermediate area 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 recognized both by landscape readings both by quantitative analysis. The landscape-reading shows territories characterized by high fragmentation, lack of urban and ecologic continuity, hybrid (not-rural, nor-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 recognized 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) (Authors 2017).

Peri-urban living lab_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).

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 (Team UNINA 2016).

Publishable Summary

REPAiR develops, tests, and implements strategies for improved urban metabolisms in six peri-urban living labs (PULLs) in the case study areas of Amsterdam, Ghent, Hamburg, Łódź, Naples, and Pécs. In the frame of REPAiR a geodesign decision support environment (GDSE) will be developed and first tested in the PULLs.

In REPAiR's Work Package 6 "Developing and implementing decision models" decision making processes will be analysed and decision models for all six case studies will be developed in order to be implemented in cooperation with stakeholders in the six case study areas feeding into the GDSE.

This document includes the outline of the decision model for the pilot cases. It represents the result of a joint effort between the teams of WP2, 5 and 6; furthermore, it considers the inputs coming from the deliverables of WP2, 3, 4 and 5 and put them in relation with the decisional steps of the decision model presente. The sum of these efforts is depicted in the DM GDSE Visualisation Chart, attached to this document. This chart is composed of two parts: the first three rows show the contributions from the other WPs; the last two are the decision model, i.e. the decisions that must be made along the process. It is important to point out that the decision model proposed in this document has been designed and moves around the GDSE, which configures itself as a decision support tool.

After the introductory chapter, the theory linked to decision-making is outlined in the second: here, the aim is to provide general theoretical background on the topic of decision, governance, policy and actors' network as well. The third chapter is a short guide for the description of the project proposals in the case study areas. The focus moves on decision support in the fourth chapter, providing theoretical background and methods that are going to be used in the context of the decision model designed for REPAiR. Aim of Chapter 5 is to set common definitions for the decision model and the various phases linked to the GDSE. The Chapter 6 host the in-depth description of the entire model and in Chapter 7 the first results from the two pilots are presented, namely the PULLs already conducted and the list of the stakeholders' objectives. Conclusions are drawn in the 8th Chapter which provides an overview on the next steps as well.

Attached to this document are to be found 6 Appendixes, namely the soft Delphi visualisation, an example of calculation for the prioritisation of the stakeholders' objectives, the DM GDSE Visualisation, the stakeholders' categorisation method and the reports of the PULLs from the two pilots, Amsterdam and Naples.

1. Introduction

In the context of the REPAiR project, the final result consists of the design, testing and production of a GDSE, a decision support tool that will be provided to municipalities when it comes to the formulation of a project/policy aiming at pursuing circular economy principles. The challenge of WP6 within REPAiR is to design a decision model with the aim of guiding the process that accompanies both the development and usage of a collaborative decision tool.

The aim of Task 6.2 is to “develop methods to relate the impacts of the change models with the priorities of the key actors” (European Commission 2016: 29). The wording “change model” refers to the solutions and combination of the solutions (strategies) that will be developed in both ongoing and future planned PULLs. The focus here is on the goals of the project (objectives), the specific actions that will be taken as part of it (solutions), and the anticipated impacts of those solutions. In order to reach this result, three elements are necessary:

- The project description (see Chapter 3)
- The methodology for generating lists of objectives and their prioritisation (see Section 4.1)
- The methodology for connecting the impacts to the solutions
- The methodology for prioritising solutions bundled in strategies (see Figure 1.1 and Chapter 5)

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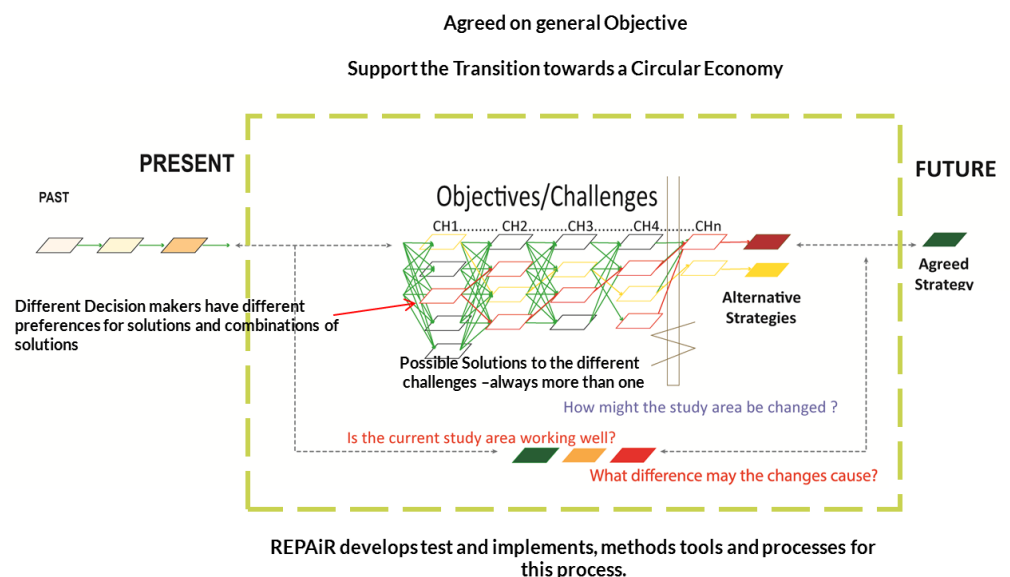


Figure 1.1: Conceptual illustration of the change models from the present to a strategy for the future (REPAiR 2017a).

The impacts are intended here as every modification of the physical and social environment (environment, urban tissue, participation, etc.), which then might lead or involve changes in the governance structure. The impacts will be derived from the REPAiR document *D4.3 - Complementarity analyses of local impacts (REPAiR 2017e)*. Such impacts are defined as typology of waste (A) correlated to the source (B) of such waste: this allows an immediate recognition of cause-effect relations. Speaking of which, see *D4.2 - Preliminary sustainability framework ready for testing the GDSE (REPAiR 2017d)*.

As key element of the decision model, the aim of this task is to provide a method that is able to assist decision-making among multiple objectives and challenges of a decision problem, and amidst alternative strategies to address them: the alternative strategy chosen, which can consist of one or more individual solutions, will have the most agreement among all stakeholders to reach the goal of the project in terms of high positive results and low negative impacts (Hakim 2000; Dente 2014). The theory refers to this process as “Bound Rationality”, which is the ability of actors involved in a project to decide rationally among alternatives to reach their goals (Simon 1972). However, stakeholders do not always decide rationally, but rather, unconsciously, according to their preferences (Hakim 2000) or their ideals, which cannot be ascribed to a rational and predictable behaviour (Dente 2014). Nevertheless, the attempt here is to design a decision model which also takes into consideration such variables in terms of attitude of the actors towards the project and their interests (see *Appendix D: Categorisation of stakeholders*).

This information will be fed into the GDSE tool, which will be able to return values for status quo and solutions in a numerical manner: “methodologies which proceed through full aggregation of impacts to a ‘final score’, should not be used as an assessment technique, the results of which are intended for use by the decision-maker. Such an approach would remove the decision from those appointed or elected for that purpose and place it in the hands of the study-team.” (Thompson 1990). Role of this tool is not the one of returns the users the best options, but rather the one of supporting informed discussion and agreement of stakeholders during the PULL Workshops. Therefore, the GDSE configures itself as a decision support tool.

In addition to the development of the decision model described above, another task of WP6 is to link all these elements to the objectives of the stakeholders. A methodology for this is provided in Section 4.1 and the *Appendix B: Example of calculation for the prioritisation of stakeholders' objectives* describes an empirical calculation example. With this method, the GDSE can visualise **the solutions with**

the larger amount of agreement about its importance (cf. the work of Wallenius 1975 and Levine & Pomerol 1986) corresponding to the biggest number of objectives of stakeholders. This ranking will be the basis for the discussions occurring in the Application Point (AP) #4.

Before diving into the model, it is necessary to provide basic information on decision theory to set a foundation and provide arguments for the model itself. The second chapter aims to accomplish this task. The third chapter describes the methodology for reporting the changes to the status quo, basically the basis on which eco-innovative solutions should be built. The terminology included in the GDSE program is the subject of the fifth chapter and the following one - chapter six - in-depth analyses of all the phases with all its components. The last two chapters (seven and eight), report the description of the changes, the first results of the PULL workshops and the first list of stakeholders' objectives for the two pilot cases, namely Amsterdam and Naples. Conclusions are drawn in the ninth chapter.

2. The problem of the decision

When it comes to project design and development, the process behind the achievement of the result is arduous and far from being linear. Such processes are usually constellated by back and forth passages along a series of predefined steps, which represent a guide to not lose track in the jungle of actors, ideas, suggestions and so on. In this process, some key points are distinguishable, nevertheless: those are the moments in which it is necessary to gather all the information at disposal and decide on the path to take, how to go on and with which knowledge luggage (Dente 2014).

At this stage, making the most desirable decisions is fundamental (Dente 2014). The work of WP6 is to determine what can be done when actors in play achieve these points. Within REPAiR, to individuate and describe the points in which decisions are made is of vital importance.

The idea for a project derives, usually¹, from the identification of a problem. However, it is important to understand that decisions are made by humans, not computers: this characterises the decision as a subjective process (Howlett et al. 2009; Dunn 2016). This means that the identification of the problem and its definition “affects the success of all other phases of” the policy processes (Dunn 2016: 67; Howlett et al. 2009).

2.1 Environmental Problems and Public Policies

Decisions are made to tackle problems, but not all problems are the same. In particular, there is a typology of problem called ‘collective problems’ which consist of specially hard to solve ones because of certain characteristics, namely interdependency, subjectivity, artificiality, and instability²: those are identified as “an unrealised value, need or opportunity which, once identified, may be obtained through public action” (Dunn 2016: 67; ed. Dente 1995). Collective problems arising in the field of circular economy can be ascribable within the umbrella of environmental problems, which present much more complex characteristics (ed. Dente 1995; Bressers & Rosenbaum 2003; Reed 2008) and embrace a wider spectrum of issues (Hanf & O’Toole 2003) compared to normal collective

¹ It can also happen that policy formulation can sometimes precede agenda-setting as ‘solutions seek problems’ to which they can be applied (cf. Kingdon 1984; Salamon & Lund 1989).

² see Dunn 2016 for clarification of these terms.

problems: these differences lie in the global character of problems related to the sustainability concept, thanks also to the pressure on individual countries (ed. Dente 1995). In particular, one of the solutions suggested in the literature for tackling collective problems is through public policy (Dunn 1981; Dente 2014).

Defining and discussing about public policy would be too complicated and not absolutely relevant for the purpose of this deliverable. Therefore, the following definition is proposed: a public policy is “a set of interrelated decisions made by a political actor or group of actors concerning the selection of goals and the means of achieving them within a specific situation where those decisions should, in principle, be within the power of those actors to achieve” (Jenkins 1978, in Howlett et al. 2009: 6) with the aim of solving a collective problem (Dunn 1981).

2.2 Decision among alternatives: multi-criteria spatial decision support systems (MC-SDSS)

The multi-criteria decision-making approach allows the description, evaluation, sorting, ranking, selection or rejection of a set of alternatives in a decision-making process (such as the PULL partly is in the REPAiR project). This approach considers discrete and continuous alternatives as well (Colson & de Bruyn 1989, in González-Rojas & Ochoa-Venegas 2017: 163).

In broad terms, the REPAiR methodology for decision making revolves around a combination of Multi-Criteria Analysis (MCA) and a Spatial Decision Support System (SDSS). MCA is a natural method for this type of analysis due to the complex realities of environmental problem solving and the diversity of options and opinions that exist in the context of waste management and governance. Simply put, MCA is used to define preferences between various options, and those preferences are tied to specific objectives with measurable success (Dodgson et al. 2009: 19). From the other direction, environmental and waste management problems tend to be intrinsically tied to spatial realities or descriptions; as such, combining spatial representation (through GIS visualisations) with the methodologies of MCA allows for the spatial elements in planning to be part of decision support systems (specifically MC-SDSS) in an intuitive and understandable way (Ferretti & Montibeller 2016: 41). Additionally, the combination of MCA into our decision-making strategies allows comparisons of both quantitative and qualitative criteria (Ferretti & Montibeller 2016: 41).

The core of MCA is the decision making carried out by a set of actors involved in the project. These actors are asked to collaborate with their combined knowledge, expertise and assumptions in a debate which has to obey to the mechanisms of bargaining and negotiation - with the final aim of selecting the most appropriate

policies. This method of negotiated decision-making leads to an environment in which a “process of learning [...] in which new, as well as previously disregarded, knowledge and information are diffused, a common terminology is developed, self-reflection on previous experience (including previous policies) is favoured, attention is paid to aspects previously neglected and issues are re-framed accordingly” (Liberatore 2003: 61). Of course, result of such process will not necessarily be the best option among the alternative proposed during the process, but all alternatives will be evaluated on the basis of a broader range of “information, points of view and experience”: the reason lies in the fact that certain arguments or combination of them - e.g. power, prestige and so on - can be used to favour a certain option rather than another (Liberatore 2003: 61).

The decision-making that will occur in the REPAiR project takes place in a number of steps, beginning with the meta-choices inherent in the design of the project and finalising in the selection of a “strategy” or set of them to be presented to pertinent power figures in the various study areas for consideration and possible implementation. These different decision steps will be outlined below in Section 4.1 and will consist of a variety of problem formulations, including ordering procedures and choice procedures (Colson & de Bruyn 1989: 1203). These will be utilised in the context of our both PULL workshops and meetings. Some possible best practices include using facilitated workshops for the elicitation of weights (priorities) and designing online surveys for their elicitation (Ferretti & Montibeller 2016: 48). These are represented in REPAiR’s use of a soft Delphi/Q-sort to be conducted before and during the PULLs (more information in Section 4.2).

2.3 Governance

Another topic relevant the REPAiR project is governance, in the sense that changes introduced by solutions can affect the current organisation of the institutions. Usually, “the term governance is associated with a change in the nature of the state” (Treib et al. 2007: 3): this means that governance indicates a process of governing which deviates from the traditional model where decisions are taken by elected representatives. Yet, this term is a broad and often confusing one because in the literature it is used in many different ways (Bressers & Kuks 2003).

One good definition available in the literature dictates that governance “in the encompassing sense [...] implies every mode of political steering involving public and private actors, including traditional modes of government and different types of steering from hierarchical imposition to sheer information measures” (Héritier 2002: 1). This definition is important to the extent that both public and private

actors are considered to be part of the governance environment: this mix between public and private actors is a characteristic that all case studies share (see REPAiR 2017g and 2017h). Governance regards a change in the “actor constellation, both during the implementation of policies and in the method of political steering” (Treib et al. 2007: 3), indicating a process of coordination within networks (Kooiman 2003; Jordan & Schout 2006).

Because of the possibility of involving changes in the governance, it appears clear that a method for assessing it is needed. De Oliveira et al. (2013) suggest an assessment method based on criteria and indicators that define good governance. In particular, one of the four dimensions reported is ‘decision-making process’ and it concerns closely the contribution of WP6 to REPAiR. This dimension can be assessed by three general indicators, namely participation / inclusiveness, responsibility / accountability, and decision-making effectiveness (de Oliveira et al. 2013: 146). This methodology will be deepened in the Section 4.1 - *Decision support theory*.

Regarding to environmental related issues, the term of ‘governance for sustainability’ (Lafferty 2003) is more and more at the background, and instead, environmental governance came to the forefront. The concept of environmental governance is closely related to ‘the processes of collective decision-making that are deployed to protect the environment and resolve conflicts over natural resources’ (Tacconi 2011; Paavola 2007; Driessen et al. 2012; Van der Molen et al. 2016: 436).

2.4 The policy cycle

In short, decision-making processes are complex and involve different elements. Thus, some authors tried to develop a framework to identify and clarify the main steps of a decision-making process. The literature refers to this as policy cycle. The simplest cycle consists of five steps: agenda-setting, policy formulation, decision-making, policy implementation, policy evaluation (Jann & Wegrich 2007). This definition includes the individuation of the actors that are involved in every stage: in the agenda-setting, all actors should be involved (policy universe); in the phase of policy formulation, not all the policy universe should take part, but a restricted group is asked to participate (policy subsystem); the decision is then taken by an even smaller group, defined as the government decision-makers; for the implementation and the evaluation of the policy, experts on implementation should be addressed, meanwhile for the evaluation of its results no restriction is suggested (Table 2.1).

Table 2.1: *The Policy Cycle and the actors involved in every stage (Own, reproduced from Howlett et al. 2009: 13).*

Stages in Policy Cycle	Key Actors Involved	REPAiR
1. Agenda-Setting	1. Policy Universe	Before REPAiR
2. Policy Formulation	2. Policy Subsystem	PULLs in REPAiR
3. Decision-Making	3. Government Decision-Makers	After REPAiR
4. Policy Implementation	4. Policy Subsystem	After REPAiR
5. Policy Evaluation	5. Policy Universe	After REPAiR

The PULL events within the REPAiR project have the scope of suggesting solutions bundled into strategies for future policies, which the final decision-makers will have to agree upon. Therefore, it can be stated that REPAiR activities are situated in the policy formulation phase: as a matter of fact, this stage “includes the definition of objectives - what should be achieved [...] - and the consideration of different action alternatives” (Jann & Wegrich 2007: 48).

Looking more carefully at the second column, Howlett et al. (2009) reports that the key actors of this phase are represented by the term of policy subsystem: this represents all those actors with sufficient knowledge of the problem, with a resource or an interest at stake, which make them eligible of having a say in the process. The typology of those actors is investigated in the next Section 2.5.

2.5 Stakeholders participation in decision-making process on environmental issues

As mentioned in the D6.1 - *Governance and Decision-Making Processes in Pilot Cases* (REPAiR 2017g), the approach chosen for REPAiR is the one of transparent decision-making process. Stakeholder participation is believed to be able “to enhance the quality of [...] decisions by considering more comprehensive information inputs” (Reed 2008: 2417). This is especially true for environmental issues - due to their characteristics described in Section 2.1 - which has become to be considered a democratic right (Reed 2008: 2418). However, not all participatory processes lead to a positive result, especially if those events are badly organised. For these reasons, Reed wrote in 2008 a paper review on the topic and listed seven elements to be considered when planning such processes. Among all, he argues that **participation should be considered as early as possible** and **should be kept for all the duration of the process** to get **continuous feedbacks**. Moreover, he suggests investigating the nature of stakeholders and to categorise them: this exercise helps to identify relevant stakeholders, differentiate them and investigate their relationship between each

other: to do this, several approaches can be found in the literature (see Reed et al. 2009, Dente 2014 and the Appendix D). Another relevant element refers to the necessity of having clear objectives in the process on which there should be an agreement on it, arguing that: "if the goals are developed through dialogue [...] among participants, they are more likely to take ownership of the process" (Reed 2008: 2424).

The categorisation of stakeholders lead to the following question: who are the stakeholders that should be involved (the ones that will become actors, see Section 5.4)? As a general statement, engaging more actors, especially from local level, would not be a guarantee for perfect information, but it could reduce the risk of overlooking of important knowledge and experience from local stakeholders (Graute 2016: 1932).

One debate in the literature which concerns this project as well is the one on local and scientific knowledges. Local knowledge is not simply seen as a mere added value to the process, but rather an important piece of information and a combination of the two "may empower local communities to monitor and manage environmental change easily and accurately" (Reed 2008: 2425). The scientific knowledge is delivered by experts, which are imperative in tackling environmental issues. To this group can be ascribable a series of actors, namely economists, lawyers, policy analysts and administrators, and of course the policy makers (Liberatore 2003). Each of them brings at the stake their specific arguments which contribute in the complexity and flexibility of the policy product: the economist will deal with market failures, lawyers will emphasise the importance of norms, institutional resources are of interest of the policy analysts and administrators and the choice of "politically 'safer' options" is of concern of policy makers (Liberatore 2003: 60).

To smooth over this dichotomy, authors refer to the importance of the facilitator (or filter, like in Dente 2014), which characterises a figure which is impartial, open and approachable (Reed 2008: 2425): their task is vital to keep the non-expert stakeholders in play, to help them along the process in understanding technical issues and to enhance their power against experts.

2.6 Actor Network Analysis

The sphere of actors' network is linked since its birth to the information system, which refers to every group of entities that are able to produce information. Hence, actor network refers to all these processes that link people and objects to the scope of transmit information: human and non-human elements are both part of it (Latour 1994; Walsham 1997). This thought has led to the birth of the Actor

Network Theory (ANT).

ANT makes use of some of the simplest properties of nets and then adds to it a stakeholder that does some work. Such properties are related to the proximity (or distance) between the stakeholders of the network and it allows the user to display these relations without considering the scale³ (Latour 1996).

Elbanna (2009) did an effort in trying to organise the work of several authors (among all Latour's works) and defines 4 main activities that the stakeholders carry out during the process of networking, recalling the work of Callon (1986: 65):

- Problematisation: it is the act of creating a problem to force actors passing through it.
- Interessement: group of actions by an entity to attempt to rise the interests of other actors.
- Enrolment: no predefined roles are given. In this phase, struggles and conflicts among actors for the roles definition (who has the lead role, who is ally, who opposer, ...)
- Mobilisation: to render mobile those entities that were not so beforehand (Elbanna 2009).

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According to Elbanna (2009), a network consists of a network builder, which should be the main actor involved in the project: he/she has a solution, which needs to be problematised (the act of problematise is indeed to make the other actors aware of the project/solution and force them to tackle it); he/she identifies other actors (allies) according to their goals. Those other actors are also involved in the problematisation, which may be seen differently; the interessement is to convince those actors to come to their side. The attempt of the interessement is that one of creating allies: other actors could indeed create their own goals, motivations, interests, which might differ.

The definition of the roles occurs all along the process through the 5 strategies and tactics which include the invention of new goals, the creation of new groups and others (see Elbanna 2009: 406-407). Dente (2014) proposes 4 strategies as well, with the difference that according to him, the roles are given and can be changed through the application of one or more strategies. However, these part of the theory does not concern REPAiR, at least not in this step yet.

³ "The network notion is ideally suited to follow the change of scales, since it does not require the analyst to partition her world with any a priori scale. The scale, that is, the type, number and topography of connections, is left to the actors themselves" (Latour 1996: 326).

Once created and designed the network, there are possibilities to describe it. Reed et al. (2009) refer to this step as the moment in which the network is investigated in the attempt to understand its inner mechanisms. Dente (2014) defines three indicators by which a network can be evaluated, namely Complexity, Density and Centrality. The Complexity represents the combination of different levels with the type of stakeholders, which returns the difficulties of the interactions among the elements of the network; the Density has the aim of quantify the number of interactions between actors; finally, Centrality indicates which are the stakeholders which share more interactions, hence the more central ones (Dente 2014: 60-64). This method is described in Chapter 4.1.

3. Project description

As previously mentioned, the definition of problems, objectives or challenges to tackle is a crucial part of a project. In the context of the REPAiR project, the two pilot cases (Amsterdam and Naples) have individuated these elements according to four different sources, namely interviews with actors, reading of official strategic documents, PULL workshops in the co-exploration phase with stakeholders and the interpretation of the research team itself.

Concerning Amsterdam, the method of the challenge and objective trees has been used to identify first the challenges (or problems) related to the project area and secondly a first impression of the actors' objectives: this process is explained with more detail in Chapter 7.

The first year has seen the focus on challenges on both case studies, even if the same activity in Naples has been divided in several meetings, in order to "enhance" stakeholders' knowledges. They were not yet used to think/talk in terms of CE-related topics.

From the interviews and the consultation of the strategic documents, the choice of the waste stream has been deduced: Amsterdam is going to deal with Wastescapes, construction waste from energy-retrofitting of residential houses, and food waste, meanwhile Naples with Wastescapes, CDW and organic waste (the choice of a specific kind of waste in these much larger flows is still ongoing).

Given the problems, the actors' objectives and the waste stream to tackle, the overall project goals can be formulated, and the Focus Area can be selected. In order for the various research teams to have a cohesive understanding of the different projects, and to assist in the summaries and descriptions of each project case throughout the written documents, description of the project specific for each case study should be provided in as concise and detailed a manner as possible. Ideally, this description should be maximum half a page long. To assist in this short-detailed description, the following series of questions have been provided to be answered:

- What are the specific goals of this project?
- What are the anticipated impacts of the project to the physical/ social/ governance environment?
- If you were to describe your project in one sentence, what would it be?

These questions should be answered based on the results from REPAiR (2017g), the *MS23 - List of key priorities of stakeholders in pilot cases* (REPAiR 2017i, internal document) and the stakeholders interviews/PULL meetings that have been conducted so far.

For this step, it is significant to involve the persons responsible for WP3, 4, 5 of the research team to find and agree upon the answers to these questions. It is important to have coherent answers within the research team before proceeding with the further involvement of stakeholders. As a matter of fact, this represents the basis for the discussion about solutions in every case study: this information will allow the completion of MFA and LCA.

4. Theory and Methods

4.1 Decision Support Theory

This section presents a list of methods which have the aim of supporting the activities along the lifespan of REPAiR.

GIS-MCDA: “At the most rudimentary level, GIS-MCDA can be thought of as a process that transforms and combines geographical data and value judgments (the decision-maker’s preferences) to obtain information for decision making (Malczewski 2006: 703).” As detailed above, REPAiR will be using the GDSE as a decision support tool at the numerous decision points throughout the project timeline.

Network Analysis: Several methods fall into this category. The one proposed by Dente (2014) already introduced in Section 2.6 appears the easiest (cf. Reed et al. 2009 with the Social Network Analysis, which adds information like trust and influence between the elements of the network). To calculate the Complexity, a matrix which combines the levels and the roles of the stakeholders is required. The simple multiplication of the rows times the columns gives the Complexity indicator. The Density describes the number of relations between stakeholders of the network: these are individuated by arrows which can be one-way or two-ways arrows. It is obtained by the following formula:

$$D = \sum k_i / (n^2 - n) \quad (1)$$

where k_i is the number of arrows (links) and n is the number of the network elements. Centrality indicates which are the actors with more relations, hence the more powerful. The formula for it is:

$$C = k_i / \sum k_i \quad (2)$$

where k_i represents the number of arrows for each actor. This should be done for each actor of the network. It is important to understand that strategies that are put in act by the stakeholders (in this case the actors because they ‘act’) point to manipulate this numbers. Moreover, a quick view on these results can highlight unbalances between stakeholders which can lead to the choice of a strategy. These strategies are to be found in Elbanna (2009) and Dente (2014), but are not part of the theory of this deliverable.

Weighted Summation: This method is used to evaluate a set of alternative solutions or policies against a set of competing or conflicting objectives; and since it is both easy to use and allows to compare between qualitative and quantitative factors, it is well suited for participatory processes and the REPAiR project methodology. It will be utilised in the prioritisation of stakeholder objectives (see Appendix B for more details).

Governance Assessment: See REPAiR (2017g) for research basis and REPAiR methodology.

Problem/Objective Trees: This methodology for determining and agreeing upon problems and their causes and effects is part of the participatory project design and planning phases used by USAID and numerous international organisations, typically as part of the logical framework project design process (Usaidprojectstarter.org 2017). Simply put, the problem tree is a logic tree of if/then statements that help to organise various identified problems into a hierarchy that can be converted simply into an objective tree and then used to guide the solution generation in pursuit of the shared goals (MDF 2005).

The Delphi method: this method for ranking among a variety of options relies on the principles of progressive preference detection (Colson & de Bruyn 1989: 1204) allowed by successive rounds of feedback, but requires a considerable amount of time and effort on the part of the organisers and the actors to conduct properly. It also runs the risk of limiting discussion based on the individual nature of the process, which runs the risk of missing critical discussion and in-person debate, as well as the facilitated decision-making possible with a moderator (Ferretti & Montibeller 2016: 44).

Q-sort: it is a research method used in psychology and in social sciences to study people's 'subjectivity' and was developed by the psychologist William Stephenson in 1936. The usage of this method refers to the capacity of finding correlations between subjects across a sample of variables: in this way, the many individuals perspectives are shrunk into few factors, which should represent shared ways of thinking among the participants (Stephenson 1953; Reed et al. 2009). To offset the individual nature of a traditional Delphi and gain the advantages of in-person debate, as well as utilise the established meetings of the PULLs, we are proposing a combination of the Delphi with the Q-sort, a consensus ranking methodology from the project management field (Wysocky 2014). We will refer to this combination methodology as a "Soft Delphi".

PULL: D2.1 - *Vision of the GDSE Applications* (REPAiR 2017a) defines PULL as one of the two columns of the GDSE, being Desktop research the other column. From

a decision-making perspective, a PULL can be viewed as short decision-making process in which stakeholders work jointly on developing solutions for the peri-urban area of their interest, using the GDSE to support this process. Starting from the analysis (status quo), beside REPAiR team' experts, decision-makers (and stakeholders) are called upon to investigate needs and preferences, define goals, and explore strategies, implementations and intervention scenarios in order to identify the most coherent, available (taking into consideration the relevant circumstances) and satisfactory choice (Della Spina et al. 2017).

Prioritisation: There are several approaches and methods for prioritisation in decision-making models in the literature. One of them proposed by Saaty & Rokou (2017) takes into consideration tangible and intangible criteria. They prioritise inventions (patent, but eco-innovative solutions can also be considered as invention) based expert knowledge, importance of inventions to obtain the overall priority of an invention for each relevant criterion and add these priorities over the criteria to obtain the priority rank of that invention (Saaty & Rokou 2017). Elements of this prioritisation can be useful in REPAiR decision-model as well.

Pairwise comparisons: the pairwise comparison is used - not only in analytic network processes but - in other decision situations. Saaty's (2005) absolute scale is used to compare any two elements and to measure the weights of the alternatives (Lami & Abastante 2014).

Snowball actors' identification: see REPAiR (2017g) for the description of the methodology from Reed et al. (2009).

SWOT: SWOT analysis is a proven technique for helping the strategy formulation. The tool classifies the key strengths and weaknesses associated with a system and comparing with the current and future weaknesses and threats. SWOT is widely used in strategic planning, where every individual factor affecting the system environment are analysed in detail (Kotler 1994). With SWOT analysis we can summarize the most significant and effective factor associated with the internal and external environment (Khan 2018).

4.2 Decision Support Methods

AS-MFA and LCA: Activity-based Spatial Material Flow Analysis (AS-MFA) and Life Cycle Assessment (LCA) are used to understand and represent the various flows that will be analysed and modified as part of the REPAiR project. More details are available in *D3.1 - Introduction to methodology for integrated spatial, material flow and social analyses* (REPAiR 2017c) and REPAiR (2017d).

PULL: The PULLs are seen as an ongoing process that helps guide participatory

problem solving and solution design. More detail is available in *D5.1 - PULLs Handbook* (REPAiR 2017f).

Problem and Objective Trees: As part of the PULL workshops that occur before Application Point #1 (AP#1, see Subsection 6.2.3), where the GDSE is not in use yet, the pilot projects have shown that the following steps have taken place:

- problem identification
- problem verification
- objective identification
- objective verification
- beginning indicator identification

These steps are used to verify the validity of the outputs from the initial stakeholder interviews, offer an opportunity for adding problems that have not been noted previously, and provide the starting framework for the status quo MFA and LCA.

Specific to this method, the formulation and phrasing of problems is critically important to the success of the methodology - as such, a few important reminders are in order for the individual(s) developing the inputs for the pertinent PULL workshops (MDF 2005: 2-3).

- Problems should be specific and detailed
- No non-existence of "lack of" problems
- No subjective interpretations or raw opinions

Once the set of problems is identified and agreed upon, causes and effects should be organised according to the basic structure of a problem tree (see figure 4.1 below left). Once the problems have been organised into their various causes and effects and the focal problem has been identified and isolated, the diagram can be converted into a objective tree, with the problems switched to positive actions that would lead to the desired result, and therefore the resultant effects. The identified "means" to do so would therefore be the basis for both a) the status quo MFA and LCA completed for AP#1 and #2, and b) the "solutions" to be generated and analysed as part of the later GDSE steps.

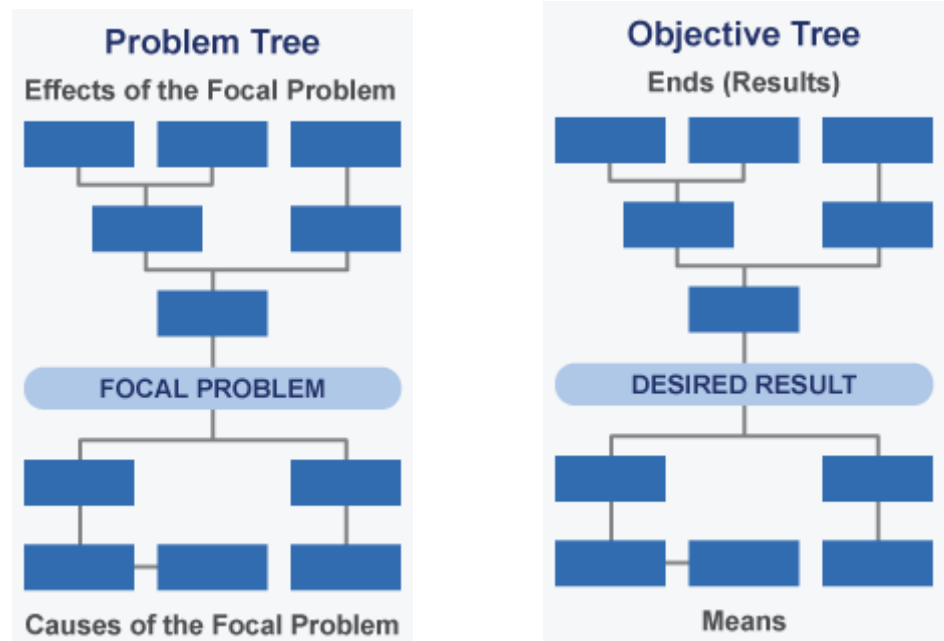


Figure 4.1: Example Problem and Objective Trees (Usaidprojectstarter.org 2017).

Soft Delphi: as noted above, this is our proposed combination method for generating a prioritised list of project objectives. The steps for this are outlined as follows, and a visualisation is in Appendix A. Specific realities for each pilot project are outlined in their respective sections.

Note: The first two steps of this process can either be conducted before the next PULL workshop, or be done at the beginning of that workshop, depending on the project realities.

Step 1: The stakeholders will receive the list of previously identified objectives (drawn from the interviews⁴ and previous PULL workshops, then clarified/simplified by the research team). If there are any critical items here that have not yet been included, then those should be included.

Step 2: Each stakeholder will then individually rank these objectives according to their importance, in their opinion, and return the answers to the research team. HCU provides a blank template to fill with your case objectives (These individual responses will then later be tied to the stakeholder data for the GDSE, but for now, they will be used for the next step).

Step 3: Each of those objectives is put on a notecard, and the cards are laid out on a table or stuck to a board, split into two groups - high and low priority, based on the output from the individual responses.

Step 4: Based on discussion, each group of objectives is then split into two (higher and lower priorities)

⁴ For Amsterdam and Naples cases, refer to REPAiR (2017g) and in particular to REPAiR (2017i), where the objectives of the key stakeholders are listed.

Step 5: If needed, this cycle continues until a linear order is reached (some objectives may have equal priority, but it is ideal to minimise this as much as possible)

Step 6: The stakeholders are invited to write down any objections to the order, as a final check on the consensus to allow for minority and dissenting opinions.

At this point, the teams will have a compilation of individual assessments (Ranking 1) and a group consensus ranking set (Ranking 2). These two comparable sets can then account for the potential bias of group decision-making and serve as an indicator for any underlying issues going forward with disparate priorities. The ranking information will also be included later in the GDSE as part of the strategy design step at AP#3.

In summary, the problem/objective trees and the soft Delphi act as supporting and self-checking steps that build the foundation for use of the GDSE and the further development of the project going forward. These meetings (and the detailed steps below in Chapter 6) will confirm that the problem(s) are identified properly, that the stakeholders are in agreement about the relations between and importance of both problems and objectives, and that the research teams are in possession of documented and logical justification for the later decision-making steps.

Strategy Selection Information: As part of AP#3, which is built around the design of strategies by combining various solutions, the ranking information tied to each solution will be displayed by the GDSE to aid in the decision process. For example, if a selected strategy contains solutions that address the three highest priority objectives, it will be useful to know that information. An example for how this objective prioritisation process will go, and how the data can be displayed, is in Appendix B.

4.3 Geodesign Support Systems

“Geodesign is defined by Campagna (2014) as “an integrated process informed by environmental sustainability appraisal, which includes project conceptualisation, analysis, projection and forecasting, diagnosis, alternative design, impact simulation and assessment, and which involves a number of technical, political and social actors in collaborative decision-making.”

The advances of geodesign compared to older landscape and environmental planning approaches are threefold:

- it allows an extensive use of digital data in design, evaluation and communication;
- it gives a prominent role to design, by developing spatial solutions to

- specific place-based (genius loci) problems;
- its transdisciplinary nature calls for collaboration.” (REPAiR 2017a)

Geodesign refers to the development an application of design-related processes intended to change *geographical* study areas (Steinitz 2012). In the context of REPAiR, geodesign support systems can be defined as a computer-based set of tools, which utilizes concept and methods of geodesign, and are developed for supporting a group of users in achieving higher effectiveness of decision-making during a PULL.

REPAiR’s main outcome, the GDSE, can be viewed as a geodesign support system, which will consist of a digital, web-based database and user-interface system designed for an interactive application of the REPAiR’s six-step geodesign framework during selected PULL workshops in the different case study areas (See Section 5 for more details on this). D2.2 - *Data Requirement Description and Data Delivery Plan for the Case Study Areas* (REPAiR 2017b) contains more details on the technical development of the GDSE, particularly how the six-step framework is implemented.

5. GDSE terminology

As Nino-Ruiz and colleagues (2017) argue, “to aid decision making, complex models are often created in an attempt to simulate the influence of factors provoking environmental change and hence to anticipate the effects of a range of decisions” (Nino-Ruiz et al. 2017: 128). In the REPAiR project, GDSE is such an aid. Aim of this chapter is to provide a ‘how to read’ guide for Chapter 6.

5.1 Geodesign Decision Support Environment (GDSE)

In *D2.1 - Vision of the GDSE Applications* (REPAiR 2017a), WP2 provides the definition of the GDSE programme in the context of the REPAiR project. In particular, “REPAiR adapts Steinitz (2012) geodesign framework, comprising six questions that are asked at, at least three points in a geodesign project to understand the study area, to specify the methods and to perform the study:

1. How should the study area be described?
2. How does the study area operate?
3. Is the current study area working well?
4. How might the study area be altered?
5. What differences might the changes cause?
6. How should the study area be changed?” (REPAiR 2017a: 6-7).

The change in REPAiR of this model application regards its usage in the field of waste management and recycling. The approach of this project consists in linking LCA with Steinitz approach, with the attempt of having:

- “a data-based modelling programme for evaluating alternative waste and resource management strategies by modelling social, economic and environmental impacts [...]”;
- a common cloud-based platform for the internal research process of the REPAiR team [...]”;
- the putting-into-practice of the methodological ground concepts (Steinitz, Campagna, LCA) for waste management and recycling;
- the major interface for communicating with the stakeholders brought together in the regional PULLs and including them into a co-design setting;
- an outcome of the REPAiR project by itself, as it will be available as an open source tool to everybody by the end of the project” (REPAiR 2017a: 7).

These elements above given, the GDSE will fulfil two main roles: firstly, “it will be the core element of communication and co-designing with the stakeholders involved in the six PULLs in order to transparently develop, assess and discuss requirements and alternative options for solutions towards the specific PULL-topics; [secondly,] it will serve as an important element to co-ordinate the internal research of the REPAiR team” (REPAiR 2017a: 8).

Useful considerations for the display of analysis output: using intuitive methods with and easy-to-explain logic, display results in a user-friendly way (e.g. graphics, visual colours, simple changes), and the use of methods that support dialogue and negotiation (Ferretti & Montibeller 2016: 46).

5.2 Solution

“In the terminology of the REPAiR project a solution is technical, organisational or juridical approach to solve one specific material and waste management challenge” (REPAiR 2017a: 6). For the problem/objective tree approach to project design and problem identification, a solution will likely be derived from the “roots” of the objective trees.

5.3 Strategy

“Combinations of solutions are called strategies” (REPAiR 2017a: 6). Strategy design and evaluation will be a circular, real-time iterative process as part of AP#4. Participants will be able to combine various solutions into a strategy package and evaluate the various impacts and correlations with objectives.

5.4 Actor or stakeholder?

Stakeholders can be identified based on different approaches. This identification is often an iterative process. One typology is to classify them along the vertical axis (from global, national, regional towards local level). Another - fundamental - division according to Grimble & Wellard (1997) “is likely to be between those who affect (determine) a decision or action, and those affected by this decision or action” (Grimble & Wellard 1997; Lienert et al. 2013).

The type of stakeholders varies according to the problem in question and its solution (Contreras et al. 2008) but it is important to apply clear definitions (Fassin 2008), or everyone can be considered as a potential stakeholder (Tullberg 2013; Caniato et al. 2014: 938-939). In the REPAiR project, we take into consideration those stakeholders who are affected by the main flows (e.g. organic waste, MSW, construction and renovation waste) and wastescape problems, their challenges

and potential solutions⁵. Our main 'vertical' focus is the local and regional level but taking into consideration the national and EU level as well (as spatial levels are described in REPAiR 2017c).

A fundamental point that needs to be clearly stated is to determine the difference between actor and stakeholder. REPAiR team has decided to follow the definition proposed by Dente (2014).

An *actor* denotes individuals which actually act. This means that whoever takes part actively in the decision process can be considered an actor. However, Dente (2014) points out that a person who does not take part to the process spontaneously has to be considered an actor: in other words, every decision or action done by a person which affects (or might affect) the result is considered an actor. Finally, the people who are in reality making the decision are also actors, but they could also not be engaged from the beginning, because they might be just interested in seeing the outcomes and not the dynamics of the entire process (difference between content and process related goal, cf. REPAiR 2017g): "the real decisional process in fact, could take place between other subjects and acknowledges the decision made by others" (Dente 2014: 30).

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On the other hand, *stakeholders*⁶ are those people which have an interest/stake in the project but for several reasons do not participate in the decision process: these are the cases, for instance, when a person thinks that his/her contribution in the process would be useless (lack of faith in the authority) or simply he or she is not aware of the process (Dente 2014: 31). This does not mean that stakeholders are not important, but rather the opposite: task of decision makers and actors together should foresee stakeholders' future behaviour towards the decision taken, since their actions can highly influence the project outcomes (Dente 2014: 29).

Finally, the actors defined as decision-makers are the ones who are actually taking the decision on an alternative proposed (see Lavis et al. 2003; Friedman & Miles 2006). Since REPAiR will not provide any decision, none of the actors involved in this project is called decision-maker, even though some of them could be the same that will take the decision in a later stage.

In the context of the REPAiR project, the first round of interviews conducted by the partners have pointed to the individuation of the 'key stakeholders', i.e. those

⁵ Cf. REPAiR 2017g for actors' identification in pilot-cases, REPAiR 2017h for follow-up cases.

⁶ Cf. Friedman & Miles (2006), pp. 3-15.

persons who, according to the research team, could have interest in the project. Once their intentions are understood, they are invited to participate in various phases of the process: only those ones are called 'key actors'.

The term 'relevant stakeholder' has been introduced to denote the sum of the persons that the 'key stakeholders' have mentioned during their interviews as entities with potential interest in the process in addition to the 'key stakeholders'. The totality of those people who participate in the process are named 'relevant actors'.

The last phase sees the participation of other kinds of actors which might have never taken part to the process, but they reveal themselves to be necessary to be involved: the term 'actors' population' indicates this group of people.

5.5 Phases

The phases in the GDSE retrace the main activities connected to the data to be inserted in the programme. In total, the process consists of 5 main phases, namely Co-Exploration, Co-Design #1, Evaluation, Co-Design #2 and Co-Decision. A 6th phase, Governance, happens outside the framework of the REPAiR project.

5.6 PULL events

The PULL is the method chosen by REPAiR to bring together stakeholders because citizens participation entails an important part among the principles of EU and Circular Economy as well, with the conviction that "physical participation [enables] modeling and promoting interaction among participants" (Ferretti & Montibeller 2016: 44-45).

For what concerns the GDSE, two different events related to PULL process have been individuated: PULL WorkShop (PULL-WS) and PULL Meeting (PULL-M). The first refers to the events when the GDSE, and the decision model included in it, is used by the actors; in all the other cases, events fall under the second naming. More specifically, the PULL decision-making process is structured in a series of interconnected PULL workshops.

The PULL workshops are interconnected because the outcomes of the first workshop are used as input for the ensuing second workshop, whose outcomes are in turn used as input for the next workshop. Each PULL workshop is designed to address specific objectives and therefore requires support tools (materials, hardware, and software) and GDSE components that deal with the tasks needed to meet these objectives. Tasks and participants are also specific to each PULL workshop.

5.7 Application Points (APs)

Application Points (APs) are moments in the decision process where the GDSE programme is used in a PULL Workshop (see Section 5.6). In the process designed in Chapter 6, a total of four application points has been identified (according to REPAiR 2017a) and for each of them WP6 has defined inputs, activities and outputs. Moreover, indications of what should be performed in between these points is also provided.

5.8 Decision model

This section reflects the genuine contribution of WP6. The model has been developed with the attempt to adapt the GDSE structure described in D2.1: this operation results in the DM GDSE Visualisation Chart (see Appendix C), which, despite the title, it is not simply a mere visualisation, but rather the decision model itself that considers the other work packages inputs. This choice was dictated by the fact that there was still not any clear understanding of the connections between work packages, being REPAiR a rather complex project.

It can be argued that a process like the one chosen in REPAiR which is hinged on participation, a decision process is fundamental (Bayley & French 2008). As these authors suggest, the first step is to design a decision model, which is meant as a tool able to reflect the decision problem: more specifically, the see “the building of a model as a process which forms a perspective on a set of issues, uncertainties, values and possible policies” (2008:200). In other words, the model provides the path for all decisions that are going to be made along the process.

The decision process has been divided into two main decision landscapes (Subsection 5.8.1) and, on the wave of Application Points, moments have been individuated for what concerns the decision to be taken, called Decision Thresholds (DTs): for each, the methodology has been provided.

5.8.1 Decision Landscapes

The first Landscape decision #1 has the following goals:

- Reaching a good number⁷ of solutions grouped in strategies

⁷ The ‘good number’ has been decided within the REPAiR team as to be equal to 2-7. Minimum two solutions should be present to give sense to the entire concept of the decision model presented in Chapter 6. The number 7 is the absolute maximum: as a matter of fact, a higher number could be difficult to handle in terms of amount of work that lays behind the performance of MFA and LCA. Perhaps, 5 strategies could be the optimal number.

- Determine a method to decide which actors should be involved

The second Landscape decision #2 aims to have:

- Discussion among strategies
- Ranking according to priorities (Soft Delphi)
- Method to decide which actors should be involved

5.8.2 Decision Thresholds (DTs)

DTs have been introduced to describe those moments in the process which correspond to a change, a turning point, a step ahead (see Chapter 2): they are distinct from AP in order to avoid confusions. In total, five DTs have been individuated with the correspondent methods.

Actually, the choice of a method is a decision *per se* among the plethora of methods and tools available in the literature. Chapter 4 of this document gives a brief overview of the most relevant methods. Which is the best one for a certain matter? Colson & de Bruyn (1989) suggest that to solve an issue, it is useful to formulate the problem properly and address it through questions (Colson & de Bruyn 1989: 1203).

Therefore, these thresholds have the form of questions to be answered to trigger a decision and the elements identified with the letter M represent the methods to reach a resolution.

6. GDSE: Decision Model Process

As explained in Chapter 3, there are some previous steps which precede the data insertion in the GDSE, namely definition of problems and challenges, project goals, the decision on the waste flow(s), the selection of the Focus Area and the identification of key stakeholders' objectives. For both pilot cases, the objectives of the stakeholders have been identified through the interviews and then translated into branches of the challenge trees, in what is called 'co-exploration' PULL workshop, i.e. all those preparatory meetings before the actual use of the GDSE (see Appendix E). In this chapter, WP6 will present the general decision model that should be applied in the follow-up cases, after having taken the experiences of the two pilots (described in Chapter 7 for Amsterdam and Naples).

The main differences lay in the fact that in this model the interviews are used to derive the challenges, the project goals, the decision on the waste flow(s) but not the actors' objectives, meanwhile the FA is defined at the beginning of the project. These objectives are explored during the first Application Point (see Section 6.2) with the help of the challenge and objective trees and later on prioritised through the soft-Delphi methodology (see Chapter 4).

This chapter has been structured along the GDSE timeline shown in the Appendix C - DM GDSE Visualisation Chart and it configures itself in the decisional process (i.e. decision model). For its realisation, REPAiR (2017a), REPAiR (2017c) and REPAiR (2017f) have been examined to grasp the entirety of the process. The sections from 6.1 to 6.5 are parts of the first decision landscape, which consists in the formulation of the eco-innovative solutions and the constitutions of strategies, whereas the second decision landscape corresponds to the discussion among the strategies and drafting of the suggestions for the final decision-makers (section 6.6).

This part has been written by imagining to take the DM GDSE Visualisation Chart and read it vertically: phase, sub-phase and AP. Not all DTs and Ms have a description since they are already entirely present in the visualisation and there is no need for further explanation. At the end of each phase description, a table shows telegraphic information about input origins from other WPs, the person(s) in charge of its realisation and the conjunction of the phase with the other elements of the GDSE, namely PULLs, APs, DTs and M.

In particular, the last two elements are to be understood as the main components

of the decision model for REPAiR. This has been decided to be one general for every case. This choice has been taken due to the complexity and the enormous diversification of the cases, which would have meant to create models with no possibility of comparison. For the sake of the research results, it has been preferred to opt for an umbrella structure that each case can take, use and modify eventually according to their needs.

6.1 Definition of problems and challenges, project goals, waste flow(s) and FA

These elements have to be determined before the GDSE utilisation. Problems and challenges are to be individuated in the interviews with the relevant stakeholders and through official strategic documents, if present. To obtain all the information, more than one PULL-M can be held (see Section 6.2). The research team can later on delineate the project goals, the waste flow(s) to work on and the location of the Focus Area. Such results are then presented in the PULL Meeting “Cognitive” and posed on closed examination by the actors involved.

6.2 Co-Exploration Phase

The co-exploring phase has the aim to grasp the information on the state of the art of the area (1.1), the stakeholders’ constellation (1.2) and the flows of the selected waste flows(s) (1.3), followed by an evaluation (1.4).

6.2.1 Base Data (1.1)

This phase concerns the data collection finalised to the description of the Focus Area. Main source of these data is derived from the Spatial Analysis performed within the WP3. The research team of each case study is required to conduct this analysis and the data captains are asked to send the results to WP2 and WP5 referents. To this phase, DT#1 and M#1 are related (Appendix C).

Table 6.1: Phase 1.1 categorisation (Authors 2017).

WP Input	WP3 - Spatial Analysis
Who	Research Team, Data Captains
Connections	DT#1, M#1

6.2.2 Stakeholders (1.2)

The aim is to identify on one side the stakeholders that conduct their activities within the Focus Area, i.e. those who have directly to do with the waste flow(s) selected, and those who might have an interest in the project, e.g. municipality and other bodies. In the first case, NACE code and Orbis Database are the

references to build this list. The second category is built at first instance by the research team; through the snowball methodology, new stakeholders can be inserted in this list (REPAiR 2017g for pilot cases; REPAiR 2017h for follow-up cases).

NB: those with the label of stakeholder are not the ones that are supposed to participate in the PULL process.

Table 6.2: Phase 1.2 categorisation (Authors 2017).

WP Input	WP3 - Nace + Orbis, WP6 - stakeholders' identification
Who	Research Team, Data Captains
Connections	PULL-M - Cognitive, DT#1, M#1

After having individuated these stakeholders, the relevant ones must be involved as participants in the **PULL-M - Cognitive**, where the stakeholders involved become actors and get familiar with the GDSE web application. One important element for the decision part (WP6 request) is the Table of stakeholders' categorisation (see Appendix D).

PULL-M - Cognitive. This PULL Meeting serves for the key actors to get familiar with the GDSE program and provides the occasion for them to get to know the research team and the other actors personally. Although it does not foresee any progress in the project, this PULL Meeting covers a social role within the project.

6.2.3 Flows (1.3)

Protagonist of this phase is the AS-MFA, which is a prerogative of the REPAiR project. This method is used not only to show the flows in the region (and the FA) regarding the waste flow(s) selected, but it contains the geographical information of those and the indication of the activities behind such flows as well (REPAiR 2017c). This phase corresponds to the first application of the GDSE in a PULL Workshop in the context of the project. This first workshop is used as a first attempt to speak about eco-innovative solutions.

PULL-WS - Status Quo MFA. As the first time in which the GDSE is used, this PULL Workshop is extremely important: in this event, the programme will be able to display the information collected so far by the research team, namely the spatial data, the stakeholders' analysis and the results of the AS-MFA. Starting from this information, the actors meeting around the tables are asked to develop first ideas for eco-innovative solutions and the '*first catalogue of solutions*' is drafted (see below).

AP#1. This application point refers to the inputs for, activities within and output from the first meeting in which the GDSE programme is used by the participants with the main goal of individuate 'secondary stakeholders' and a 'first catalogue of solutions'. These elements are described below.

Input 1: AS-MFA status quo of the specific waste flow(s). Representation (non-spatial and spatial) of the flows related to the material stream(s) chosen for the case study.

Input 2: Table of key stakeholders' categorisation. Before the start of this series, the table with the list of the key stakeholders and their categorisation should be drafted by the research team (see Appendix D).

Activity 1: Problems and objectives trees. To find out which are the problems and the objectives of the actors, the problems and objectives trees methodology is suggested. From the definition of the problems, solutions can be drawn using a template that describes solutions in a format compatible with the GDSE data structure. The objectives will be used further on in the process, in AP#3 and AP#4.

Activity 2: Definition of the first eco-innovative solutions. Key actors are asked to develop the first eco-innovative solutions based on the AS-MFA data.

Output 1: "First catalogue of solutions". Key actors are already able to draw up a first list of solutions to be added in the GDSE.

Output 2: Possible new stakeholders to be involved. It is also possible that the solutions discussed in this first meeting will require the intervention of further actors to fulfil their purposes. In this moment, therefore, it is asked to the key stakeholders to make a list of other potential stakeholders that, in their opinion, should be involved in the process (see WP6 Loop in Subsection 6.2.4).

DT#2 and M#2. For the sake of clarity, this paragraph gives a brief description of these two elements, since they do not specifically relate to decisions that must be made during the process, namely the selection of the relevant impacts for the LCA: in fact, the decision has been made for the project and there is no need for further decisions by the partners. From now on, the LCA "is fixed" (from the viewpoint of the GDSE and WP5/PULLs and Application Points). LCA experts have already decided on the impact categories to be shown in the GDSE. For these reasons, these elements are represented in brackets in the DM GDSE Visualisation Chart (Appendix D).

The method of the choice of impact categories/indicators was is briefly explained as follow. A preliminary defined list was generated by WP4 team (see REPAiR 2017d, Section 4.2). Afterwards a refinement of the indicators by a wider range of stakeholders has been undertaken. Here, stakeholders belonging to the REPAiR consortium were asked to rate the indicators from 1 to 4 taking into account their

importance from the REPAiR objectives. Stakeholders could also add missing impact categories/indicators.

In a second stage, the choice and the balanced representation of the stakeholders has been conducted: the “population” of the sampling was the organisations represented in the REPAiR project, including the user board as well. The goal was to create a balanced expert panel: this was formed by 3 persons from academic partners/scientific institutions, waste treatment companies, local/regional authorities in each case study area. These results will be shown in more detail in the forthcoming D4.3 (REPAiR 2017e).

Table 6.3: Phase 1.3 categorisation (Authors 2017).

WP Input	WP3 - AS-MFA
Who	Research Team, Data Captains, Key Actors
Connections	PULL-WS - Status Quo MFA, AP#1, DT#2, M#2

6.2.4 Evaluation (1.4)

The evaluation phase consists of two points: first of all, the research team takes as feedback the first solutions and the flows of the previous **PULL-WS - Status Quo MFA** and performs the LCA of the status quo; secondly, the second **PULL-WS - Status Quo LCA** (see below) is organised and carried out with the scope of developing and finalise the catalogue of solutions (*Final catalogue of solutions*). Between 1.3 and 1.4 phases, a loop should happen, called ‘WP6 loop’ (see below).

WP6 Loop. With this term we intended a reiteration process with the aim of shaping the ‘population’ of the stakeholders. This loop is used to assure that all relevant stakeholders have been engaged into the process: first key stakeholders, during the interviews, might have made the name of ‘secondary’ ones (called ‘relevant stakeholders’ in Section 5.4) which could be important to be involved in the project (see Section 4.1 with snowball method). It is of great importance to gather the relevant stakeholders before the PULL-WS - Status Quo LCA, so that solutions can be discussed with the most complete information as possible. If the key stakeholders coincide with the relevant stakeholders, the loop can be jumped.

PULL-WS - Status Quo LCA. In this second PULL WorkShop, all the stakeholders individuated through the WP6 loop are invited to discuss about the first catalogue of solutions with the new information about impacts from LCA. Secondly, new solutions can be developed according to M#3, which entails small group workshops and, if foreseen, inputs from students. Ideally, each group should include actors belonging to different fields, namely academic partners/scientific institutions, waste treatment companies, local/regional authorities. This method

has also been used for the selection of the impacts for LCA. A final discussion should occur to agree upon and eventually reduce the number of solutions if their number is too high (see DT#3 and M#3 in Subsection 6.3.1 for the methodology description). This PULL-WS covers both this phase and the 2 Solution generation phase (see Subsection 6.3.1).

NB: due to the considerable amount of work to do in this PULL-WS, the event can be split into two or more events.

AP#2. This application point refers to the inputs for, activities within and output from the second meeting in which the GDSE programme is used by the participants with the main goal of define the 'final catalogue of solutions'. These elements are described below.

Input 1: LCA of the status quo. The research team has to perform the LCA of the status quo discussed and designed with the key stakeholders during the first meeting.

Input 2: 'First catalogue of solutions' categorised in the GDSE. The research team categorises (icons, descriptions, etc.) the solutions contained in this very first list.

Input 3: Table of relevant stakeholders' categorisation. This step refers to the integration of the stakeholder categorisation done for the key stakeholders that now should be done with the new one(s), if any. In order to be able to fill the table, we suggest to interview directly the new stakeholder(s) in order to grasp their objectives (to be added to the already existent list) and their attitude toward the project (see Appendix D).

Activity 1: Show LCA impacts of status quo. Results of the LCA on the status quo have been drawn and presented to the stakeholders. Eventually, a resumé for the new stakeholders on the Application Point #1 is presented.

Activity 2: Check of the categorised "First catalogue of solutions". The catalogue is presented as it has been drafted by the research team according to the prioritised objectives of the stakeholders. This catalogue is submitted for revision by the stakeholders if they agree with the results of the research team and, eventually, re-add or re-organise the solutions. This step is particularly important if new actors have been involved in the process: they may have some changes in mind according their expertise bringing, for instance, new solutions at stake. **NB:** it can be that at this point, new stakeholders call for further new actors. In this case, this step must be reiterated until all the necessary stakeholders are considered to be involved.

Activity 3: Definition of new eco-innovative solutions. With the involvement of the 'relevant stakeholders', the new group of the 'relevant actors' is divided in small groups to design further eco-innovative solutions.

Activity 4: Finalise agreement. Once all actors participating the meeting agree upon the catalogue of solutions, the research team proceeds to its finalisation.

Output 1: 'Final catalogue of solutions' with rankings based on actor priorities. The final catalogue of solutions ranked according to the objectives of actors involved is produced and ready for discussion in the next AP#3.

Table 6.4: Phase 1.4 categorisation (Authors 2017).

WP Input	WP4 - Indicators of LCA, WP6 Loop
Who	Research Team, Data Captains, Relevant Actors
Connections	2 Solution Generation, PULL-WS - Status Quo LCA, AP#2

6.3 Co-Design Phase #1

6.3.1 Solution Generation (2)

This phase contains the work done in PULL workshops to further develop the catalogue of solutions into its final form that will be evaluated and modelled in the next Evaluation Phase (see Subsection 6.4). For those cases where the stakeholder group has been altered or expanded, it also offers the opportunity for clarifying and elaborating possible solutions.

DT#3 and M#3. At this point, once all the solutions have been created, all relevant actors are gathered together for the final discussion of the PULL-WS - Status Quo LCA: this should have the aim of finalise the agreement upon all solutions designed during the workshop(s)⁸ and eventually reduce their number. The methodology suggested here involves asking the participants to give an opinion in relation to the feasibility of the single solution: it can happen that some solutions can be developed only in the far future due to several reasons (lack of technologies, government structure, etc.). The categorisation suggested is the following: i) Easily feasible, ii) moderately feasible, iii) hardly feasible (need huge efforts), iv) feasible only in the future. The solutions that receive an average number of iii) and iv) votes should be discarded.

NB: there is not a right number of solutions, but if the ones individuated are visibly too many in terms of time requirement for the 3 Solution Evaluation (Subsection 6.4.1), that could be the case to undertake the reduction process explained above.

Table 6.5: Phase 2.1 categorisation (Authors 2017).

WP Input	WP5 - Eco-Innovative Solutions
Who	Research Team, Relevant Actors

⁸ See PULL-WS - Status Quo LCA in Subsection 6.2.4.

Connections See Table 6.4 in Section 6.2.4, DT#3, M#3

6.4 Evaluation Phase

6.4.1 Solution Evaluation (3)

This phase is to be intended as the internal research team work done on the outputs from the previous steps and as the preparation for the next PULL Workshops in Co-Design Phase #2 (see Section 6.5). This phase is where the analysis of the 'Final catalogue of solutions' takes place and the flows associated with those solutions are analysed through the MFA and LCA.

Table 6.6: Phase 3.1 categorisation (Authors 2017).

WP Input	WP3 - AS-MFA, WP4 - Indicators of LCA, WP5 Eco-Innovative Solution
Who	Research Team
Connections	-

6.5 Co-Design Phase #2

6.5.1 The two Phases

4.1 Solution Application. This phase runs simultaneously with the next phase, as the separation is a formal division which represents the circular and repeated process embedded in the PULL-WS - Strategies Design. "Application" in this context refers to the placement of a certain solution from the 'Final catalogue of solutions' in a specific geographical location using the GDSE and then viewing the resulting impacts on the indicators associated with that solution.

4.2 Strategies. This second part of the loop that makes up the Co-Design #2 Phase loop is the design and evaluation of strategies, which are a compilation or bundle of various solutions. As the process will necessarily involve some iteration, the cycling back between solution application and strategy design should hopefully result in narrowing down of options and isolation of the best possible strategies to carry into the next major decision phase.

PULL-WS - Strategies Design. Divided in small groups, the relevant actors are asked to bundle solutions into strategies. With the help of the GDSE, they are able to locate geographically each solution and the tool shows the MFA and LCA related to the changes introduced by the selected solution. The decision on location can be made internally in every group with a simple SWOT analysis (see Section 4.2). In addition, the Soft Delphi must be performed to reach agreement on prioritisation of objectives (see Section 4.2).

NB: as well as for PULL-WS - Status Quo LCA, there might be the necessity to split this event into two or more workshops.

AP#3. This application point refers to the inputs for, activities within and output from the third meeting in which the GDSE programme is used by the participants with the main goal of define the strategies by bundling solutions. These elements are described below.

Input 1: 'Final catalogue of solution' categorised and linked with flows and impacts. The research team categorises (icons, descriptions, etc.) the solutions contained in the final list and links each of them to flows and impacts.

Input 2: Actors objectives list ready for prioritisation. The list of the relevant actors' objectives is prepared for discussion.

Activity 1: Geolocation of the solutions. Through the GDSE the solutions are placed in the FA to find possible implementation locations.

Activity 2: Development of the strategies. Solutions are bundled together to create strategies.

Activity 3: Prioritisation of the actors' objectives. Relevant actors are asked to prioritise the list of objectives through the Soft Delphi method (see Section 4.2).

Output 1: List of strategies. The list of strategies is ready for the next and final step of the process.

Output 2: Actors objectives prioritised. Actors objectives are prioritised according to the methodology explained in the Appendix B. The result is inserted in the GDSE that displays which objectives correspond to which solutions/strategies.

Table 6.7: Phase 4.1 and 4.2 categorisation (Authors 2017).

WP Input	WP5 - Eco-Innovation Solutions, WP6 - Decision Model
Who	Research Team, Relevant actors
Connections	PULL-WS - Strategies Design, AP#3, DT#4, M#4

6.6 Co-Decision

6.6.1 Decision (5)

In this decision step, a different stakeholder group (made up of the critical decision-makers relative to the project and the goals) would evaluate the results of the previous Co-Design Phase #2. The goal of this phase is to provide a simple-to-use tool to facilitate the decision-making in a further step. Therefore, the actors' population will additional be responsible for selection or alteration of the final strategies to be organised and reported on the responsible parties outside the project. Before the start of the PULL-WS - Suggestions, a pairwise comparison for reduction of strategies should be considered if the number of strategies built

and selected in the previous PULL-WS - Strategies Design is too high (see Input 2 AP#4).

Table 6.8: Phase 5.1 categorisation (Authors 2017).

WP Input	WP5 - Eco-Innovation Solutions; WP6 - Decision Model
Who	Research Team, Actors Population
Connections	PULL-WS - Suggestions, AP#4, DT#5, M#5

PULL-WS - Suggestions. In this last PULL Workshop, the participants should represent the 'population' of the real decision-makers other than other actors that have been already involved during the process in order to introduce more information from the policy perspective. The result of this PULL-WS is the report for the decision-makers commission, which will take the decision outside the context of the REPAiR project.

AP#4. This application point refers to the inputs for, activities within and output from the fourth meeting in which the GDSE programme is used by the participants with the main goal of drafting a report for suggestions concerning the alternative strategies that can be implemented. These elements are described below.

Input 1: 'Final catalogue of solutions' categorised and prioritised. This step is the result of the Output 2 in AP#3.

Input 2: A reasonable number of strategies for final decision-making⁹. This comes from the points, made multiple times by multiple team members, that in order to usefully model solutions for consideration there needs to be a cycle (or a couple of cycles) of reducing the total number of possible solutions to a reasonable number. Otherwise it will be a large strain, or simply impossible, for the teams to turn around the analysis in a useful way before the next Application Point.

Activity 1: Discussion among strategies and final report. The actors' population discusses about the strategies defined in the previous PULL-WS - Strategies Design with the new information of the relevant actors' objectives prioritised. The proceed then to the draft of the suggestions.

Output 1: Report with suggestions. The research team is asked to draft a report which shows the results of this last meeting.

6.7 Governance

This last phase refers to the actual decision on the strategy to implement: the final decision-makers take advantage of what have been produced during the entire

⁹ See footnote #7 p.X of this document.

process and decide upon the best alternative. This phase happens outside the context of REPAiR project.

7. Pilot Cases

The methodology used by the pilot cases does not follow on a one-to-one basis the one proposed in this document in Chapter 6. This is because actions undertaken within the two pilots have been conducted before the decision model design. Moreover, the model explained has embedded the methods used in both cases (e.g. the problems and objectives trees) as part of the structure. The follow-up cases are instead supposed to follow the structure designed in this document, with exceptions.

7.1 Amsterdam: Description of the project

7.1.1 *The September PULL workshop*

The first AMA PULL workshop was held on 12 September 2017. The main objective of the workshop was to define and sharpen the key (collective) actors' objectives for circular economy development in the Amsterdam Metropolitan Area (AMA). Participants included representatives of local governments and policy makers, local business representatives, international partners of the REPAiR consortium and the TU Delft REPAiR team (see REPAiR 2017f) for overview of workshop participants).

Based on preliminary AMA workshops held previously in the first year, as well as the WP6 interviews conducted with key stakeholders (see REPAiR 2017g), the main challenges and actors' objectives were identified. These challenges were presented in the form of 'challenge trees' (see REPAiR 2017f), grouped and specified in more detail in categories *Cooperation*, *Policies and Regulation*, *Material Flows*, and *Wastescapes*. For each challenge tree participants were asked to answer to two main questions: 'What if we? (who and where)' and 'What should be assessed?' Participants were asked to provide feedback on each challenge tree by suggesting modifications and inserting sticky notes for each question of every tree. For each challenge, discussions for each tree took place around the 'common roots of all the challenges', 'general assessment of the challenges', 'specific challenges' and the two questions. The participants' answers to the questions and the discussions were summarized into key objectives and possible solutions paths. This resulted in a list of ten key challenges for CE development in AMA (see REPAiR 2017f).

7.1.2 Actors' objectives

Based on the consensus reached with the selective group of key stakeholders in the AMA PULL workshop, and the decision made within the 2nd REPAiR Consortium Meeting to focus on three waste categories, the REPAiR TU Delft team slightly reformulated and regrouped the identified challenges into collective actors' objectives. The following key objectives were collectively identified, following discussions with the stakeholders, and consecutive TU Delft team discussions.

1. Developing Guidelines for Information sharing about Material Flows among Stakeholders
2. Creating Trust and Collaboration among all Stakeholders in AMA
3. Introducing Tax Incentives to Change Waste Behaviour among Households & Companies
4. Introducing Circularity Criteria into Building Decree allowing Room for Experimentation
5. Incorporating Circularity into Spatial Planning Law Omgevingswet
6. Introducing Circularity Criteria into Building Tendering Procedures
7. Reducing amount of Waste and Negative Impacts generated in the Building Refurbishment Process
8. Collecting & Reusing Organic & Food Waste Flows from Households & Companies
9. Re-developing Wastescapes around Schiphol within Construction Restrictions
10. Re-using/re-programming Polluted Wastescapes in Amsterdam Harbour

Objectives 1-3 are applicable to all waste flow categories and are considered as overarching objectives. Objectives 4-7 specifically relate to Construction and Renovation Waste, Objective 8 is specific for Food Waste, and Objectives 9 and 10 are Wastescape objectives. These objectives serve as a basis for exploring and identifying eco-innovative solutions with a wider group of stakeholders during the 2nd AMA PULL-WS - Cognitive.

7.2 Naples: Description of the project

UNINA carried out a cross-cutting analysis of the study area by the aim of providing a scientific based description of peri-urban areas and 'Wastescapes' (Amenta & Attademo 2016). The analysis was oriented to collect quantitative and qualitative data, for representing, understanding and improving the relationship between peri-urban area identification and the current urban metabolism (especially related to waste cycles and criticalities).

The overall objectives of the project are tightly interlinked to this definition of topics specifics for the Focus Area, in order to ensure that the project fosters changes in improvement of the resources management, and thereby preventing waste generation. Through these improvements, Naples case is aimed at expressing the site potentials for the reconstruction of new public systems/infrastructures with high eco-systemic values, in order to reconfigure the outer spaces of peri-urban areas, assert new collective identities, and overcoming the social and ecological vulnerability of territorial systems.

The process of selection of wastescapes in the Focus Area through spatial analysis is as iterative as any other part of the PULL method (See REPAiR 2017f), and in need of stakeholders' feedbacks verification.

7.2.1 The PULL Meetings

REPAiR PULLs Handbook D5.1 (REPAiR 2017f) was the first of WP5, and it has been updated during the development of the first PULL meetings. It presented a timeline of the first two years of Pilot PULLs, where it was clear that the two cases had very different starting point, considering key knowledge on CE. That's why Amsterdam had the chance to start since the beginning of the process working directly on CE Initiatives (Month #0), while Naples chose to start creating interest around stakeholders to REPAiR consortium (Month #8).

The 4 PULL-Meetings have been held from April and November 2017, and they were collectively organized by UNINA team with the support of Campania Region. Participants included representatives of metropolitan and local governments and policy makers, local business representatives and UNINA and CRA REPAiR teams.

In line with LL proposed methodology (see REPAiR 2017f), PULLs started with a Co-exploring phase: after introducing REPAiR project goals to the stakeholders, Unina team presented the Focus Area of the Metropolitan area of Naples (MAN) and then pointed out two specific critical waste flows: organic waste (OW) and construction and demolition waste (CDW).

Then, representatives of the municipalities involved in the PULL meetings were invited to identify through visual media the presence of some critical spaces in their territories (wastescapes).

In order to deepen the knowledge around already existing policies and criticalities, UNINA organized two meetings respectively with focus on the selected waste flows. Starting from the current condition of these waste flows in the involved Municipalities, UNINA helped stakeholders identify potential and critical elements on sites to outline preliminary solutions. The chosen methodology was a decision tree to identify causes-effects and solutions. As a result, after the collection of the

information at different levels, stakeholders collectively agreed that it was crucial to consider waste flows management as resource for the regeneration of wastescapes in the Focus Area, and that the two issues of waste and wastescapes were strongly interconnected, confirming REPAiR premises.

7.2.2 Actors' objectives

Actors' objectives are based on the outcomes of the interviews, the discussions carried out during the four PULL meetings held so far and the review of the formal measures on the issue of waste implemented by the public sector.

Mainly from the PULL meetings on, some municipalities of the focus area have been acquiring an active role for their constant presence and their contribution given to the discussion and also some institutional bodies engaged in the waste management monitoring.

The main objectives, closely related to the three waste flows on which the research REPAiR focuses (Organic Waste, CD Waste, Wastescapes), are:

1. reversing citizens' distrust of institutions;
2. precluding organized crime being implicated with the management of waste;
3. responding to the European sanction about the lack of composting plants;
4. preventing the organic waste emergency from occurring, also through community composting;
5. disposing ecobales;
6. solving the issue of abandonment and illegal deposit of waste along the streets of the urban region of Naples;
7. overcoming the transition on the management of waste that causes immobilism;
8. overcoming the Nimby effect concerning the localization of a composting plant in an urban area;
9. overcoming the suspicion on the quality of the final product of the composting plants in the Campania Region;
10. overcoming the suspicion on the re-use of C&D waste;
11. informing and educating citizens and institutions on environmental issues and the functioning of the administrative machine with respect to environmental issues;
12. planning processes of urban change shared by the different actors;
13. planning measures that allow CE processes to be implemented and become everyday practices.

On the objective 3, the municipalities and the companies that presented a composting facility project and were financed are working together with the Region to make their plans feasible.

On the objective 6, several municipalities of the metropolitan area are working hard for the recovery of wastescapes. With respect to this objective there was an important agreement signed on May 24th, 2017, among the Ministry of Employment, the Campania Region, the municipality of Naples and the Metropolitan City of Naples, for the state funding (10 million euros) of the *Campania Più* Program, focused on the removal of special waste abandoned in the metropolitan city of Naples, with the involvement of local unemployed.

As for objective 7, the ATOs are still in standby as the general directors are not yet appointed. Thus, the transition stage from the old governance system of waste and the new one is currently at a stalemate.

8. Conclusions

This deliverable is the result of a joint efforts between the WP teams of REPAiR, especially WP2, 5 and 6. The decision model proposed should drive the entire process of solutions and strategies design until the end of the REPAiR project.

Aim of WP6 and in general of the REPAiR consortium is to help designing the whole process that leads to the final output consisting of the GDSE tool (Section 4.3) and suggestions for the final decision-makers, which will proceed with the final decision of the best strategy and its implementation to enhance circularity in their cities.

The design of the process has headed to a revision of the GDSE structure described in REPAiR (2017a): the theory of the decision-making combined with the programme has shown some incompatibility. For the sake of transparency and with the scope of improving the decisional process, modifications have revealed to be necessary. This is the reasons why the contents of this document and the one of REPAiR (2017a) present discrepancies.

This methodology has been designed for the pilot cases with the attempt to abstract it as much as possible: in this way, the model (represented in the last two rows of the DM GDSE VC in the Appendix C of this document) is thought to be used not only for the follow up cases, but, ideally, it is also meant to be used by other cities within the European Union. In the next months of the running of the project, this model will be used and tested to verify its adequacy and effectiveness. Lessons will be drawn from the pilot cases and, if required, this model can be modified according to the real circumstances.

The forthcoming D6.4 will consider those possible changes, if any, and will present further results from the pilots in addition to the description of the projects and the stakeholders' objectives list in the follow-up cases. D6.5 will draw a cross-analysis among the cases and the D6.6 will profit of all the results will be presented in D6.6.

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Appendix A: Soft Delphi Visualisation

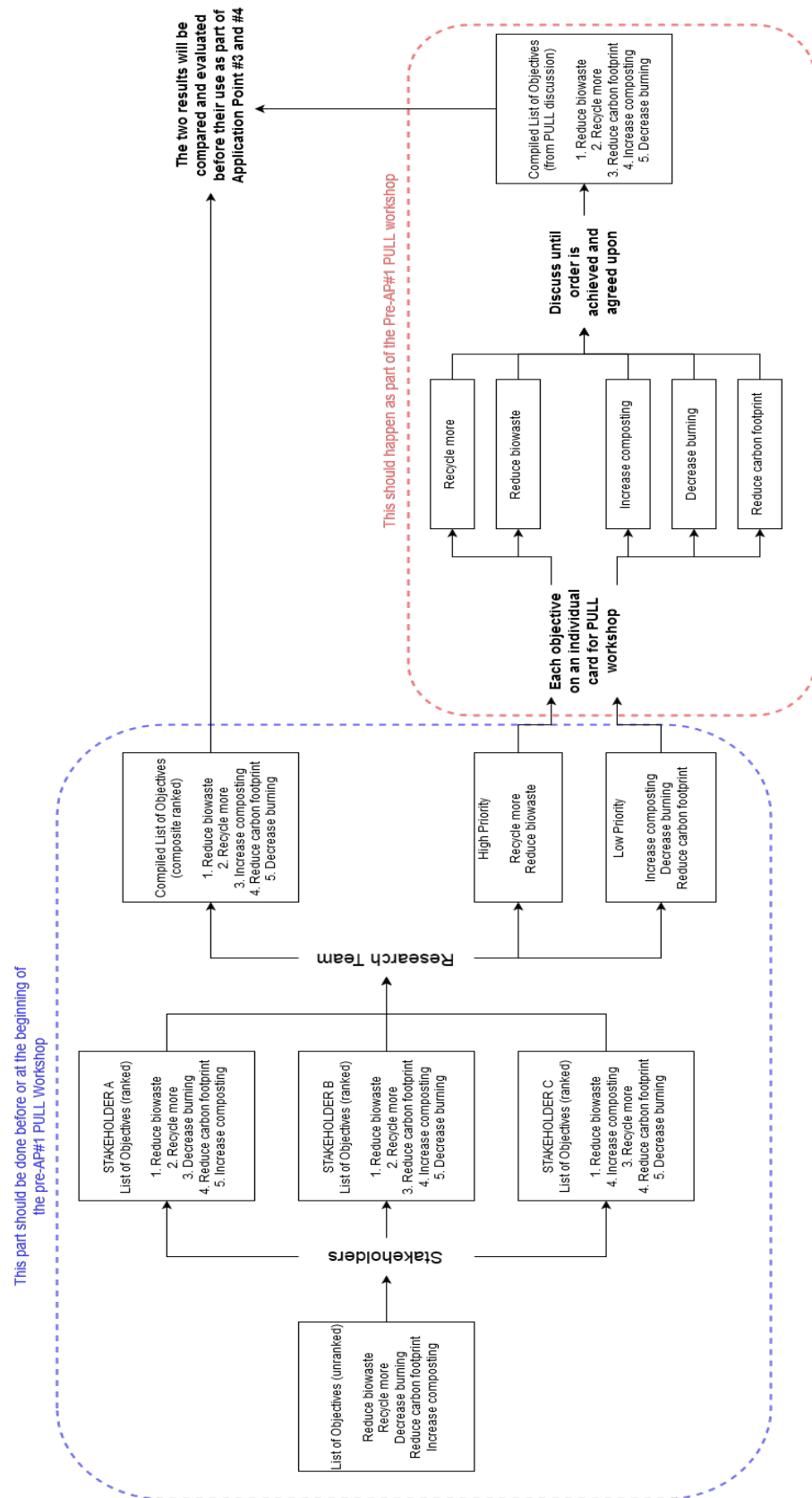


Figure A.1: Soft Delphi visualisation (Authors 2017).

Appendix B: Example of calculation for the prioritisation of stakeholders' objectives

In this example, we have imagined that at the end of the process (PULL corresponding to AP#4) five different strategies have been identified and prepared for the discussion for this last phase (Co-Decision), namely A, B, C, D, and E. According to the Grant Agreement, Task 6.2 asks for a method to link changes (actions derived from the strategies) to the objectives of the stakeholders. These objectives have been derived from the interviews by the research teams, and refined through the PULL workshops and problem identification techniques: therefore, the “soft Delphi” method was proposed as a way to refine the list of objectives and to achieve a ranking of these, with the idea that there exist some overall objectives which are shared among the stakeholders and, logically, characterised by a higher importance. From this perspective, we need to have the objectives prioritised.

In our imaginary case, we find the stakeholders agreed on the ranking of 7 objectives, from 1 to 7, where 1 represents the most important and 7 the less significant. Given these data, we imagine the following distribution:

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Table B.1: Strategies and related prioritised objectives (Authors 2017).

Strategies	A	B	C	D	E
Objectives	1	2, 4, 5, 7	1, 5, 6	3, 4	2

The method that we propose is a rather simple one that is able to apply a numerical value according to the relative importance of each objective through an easy calculation. Once having determined the total number of priorities ‘ y_n ’, you can divide 1 by this number. The result ‘ z ’ is obtained following the equation (3):

$$1/y_n = z \quad (3)$$

The number ‘1’ represents the highest possible: therefore, the solutions corresponding to the first priority will be multiplied by the factor ‘1’. The solutions linked to the second priority must be multiplied by a factor equal to ‘1- z ’. The one with the third priority by ‘1-2 z ’ and so on.

In our case, y_n is equal to 7, therefore, our z will have the value of $1/7$, i.e. ca. 0,14. The following table reports the numerical value for each objective:

Table B.2: Values of each objective (Authors 2017).

Objectives	1	2	3	4	5	6	7
Values	1	1-0,14 = 0,86	1-(2 x 0,14) = 0,72	1-(3x0,14) = 0,58	0,44	0,30	0,16

These values have to be applied to the Table 1. In the case to a strategy correspond more than one objective, the simple sum of all values must be applied. This because it is also important that a strategy is able to respond not only to the highest prioritised objective, but also to more than one objective at the same time, which can be considered 'killing two birds with one stone': in other words, this means that the strategy with the higher point might also not correspond to the first objective in the rank.

However, this method presents a potential issue: it presumes that the relationship between the objectives is linear, i.e. the difference in the value attributed to objective x and to objective x+1 is equal to the ones between objective x+1 and x+2 and so on. This might not fully reflect the actual preferences distribution: the first objective might have received way more assent (e.g. 70%) than the second (e.g. 40%) and the third (e.g. 30%).

Therefore, we suggest to simply multiply those values included in Table 2 by the percentage of voters for each objective. Table 3 reports these percentages for each objective and the corresponding normalised values.

Table B.3: Values of each objective according to the voters' preferences (Authors 2017).

Objectives	1	2	3	4	5	6	7
Values	1	1- 0,14=0, 86	1-(2x0,14) = 0,72	1-(3x0,14) = 0,58	0,44	0,30	0,16
Voters (%)	70	40	30	25	22	18	15
Correction	0,7	0,344	0,216	0,145	0,097	0,054	0,024

The final results, considering the preferences, are presented in the Table 5 below.

Table B.4: Values of the strategies according to the prioritised objectives and preferences (Authors 2017).

Strategies	A	B	C	D	E
Objectives	1	2, 4, 5, 7	1, 5, 6	3, 4	2
Values	0,7	0,344+0,145+0,097 +0,024= 0,61	0,7+0,097+0,054 = 0,851	0,361	0,344

The new rank of the strategies is the following: C, A, B, D, and E. The difference is explained by the fact that strategy C meets the most rated objective plus other two, namely the 5th and the 6th. Thanks to the higher preference of the first objective, strategy A is more preferable to B, even though it includes three objectives.

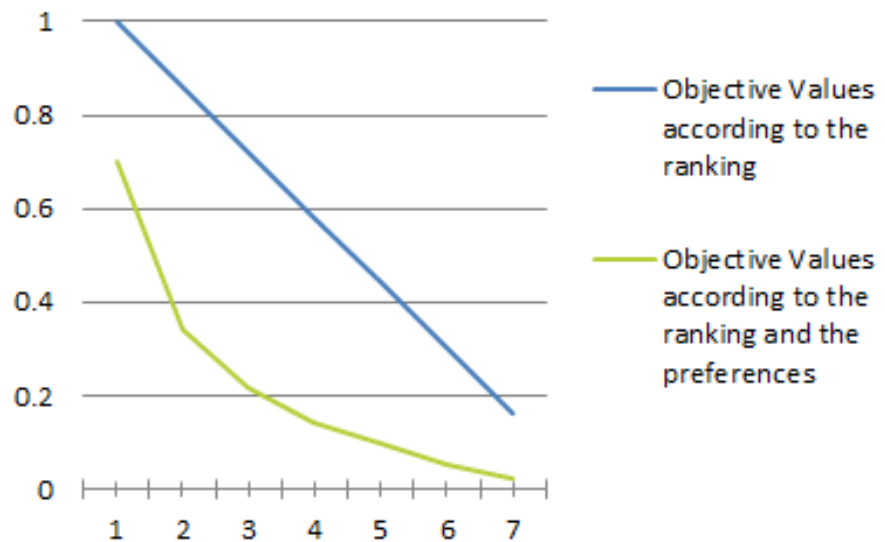


Figure B.1: Linear vs weighted objective ranking (Authors 2017).

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Suggestions for visualisation

What follows is a suggestion to use the potentiality of the GDSE to visualise the results.

		Objectives						
		1	2	3	4	5	6	7
Strategies	A	x						
	B		x		x	x		x
	C	x				x	x	
	D			x	x			
	E		x					

Figure B.2: Objectives and Strategies combination (Authors 2017).

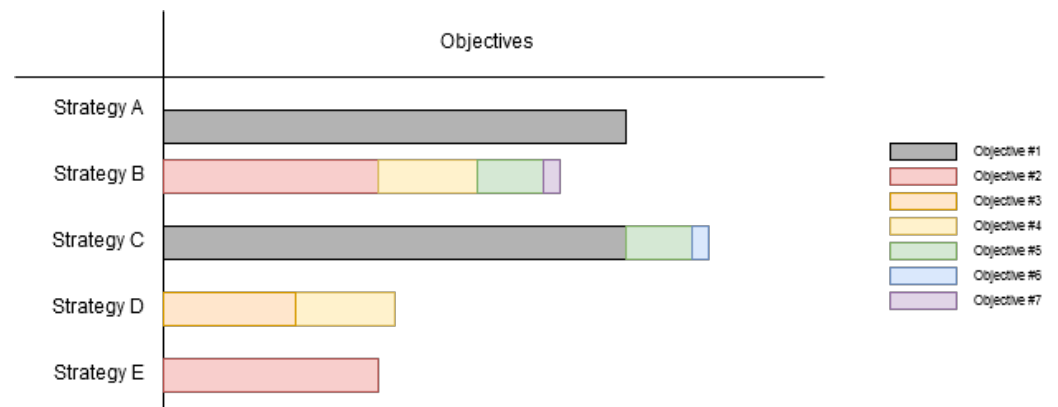


Figure B.3: Objectives and Strategies combination (Authors 2017).

Appendix C: The decision model in the DM GDSE Visualisation Chart

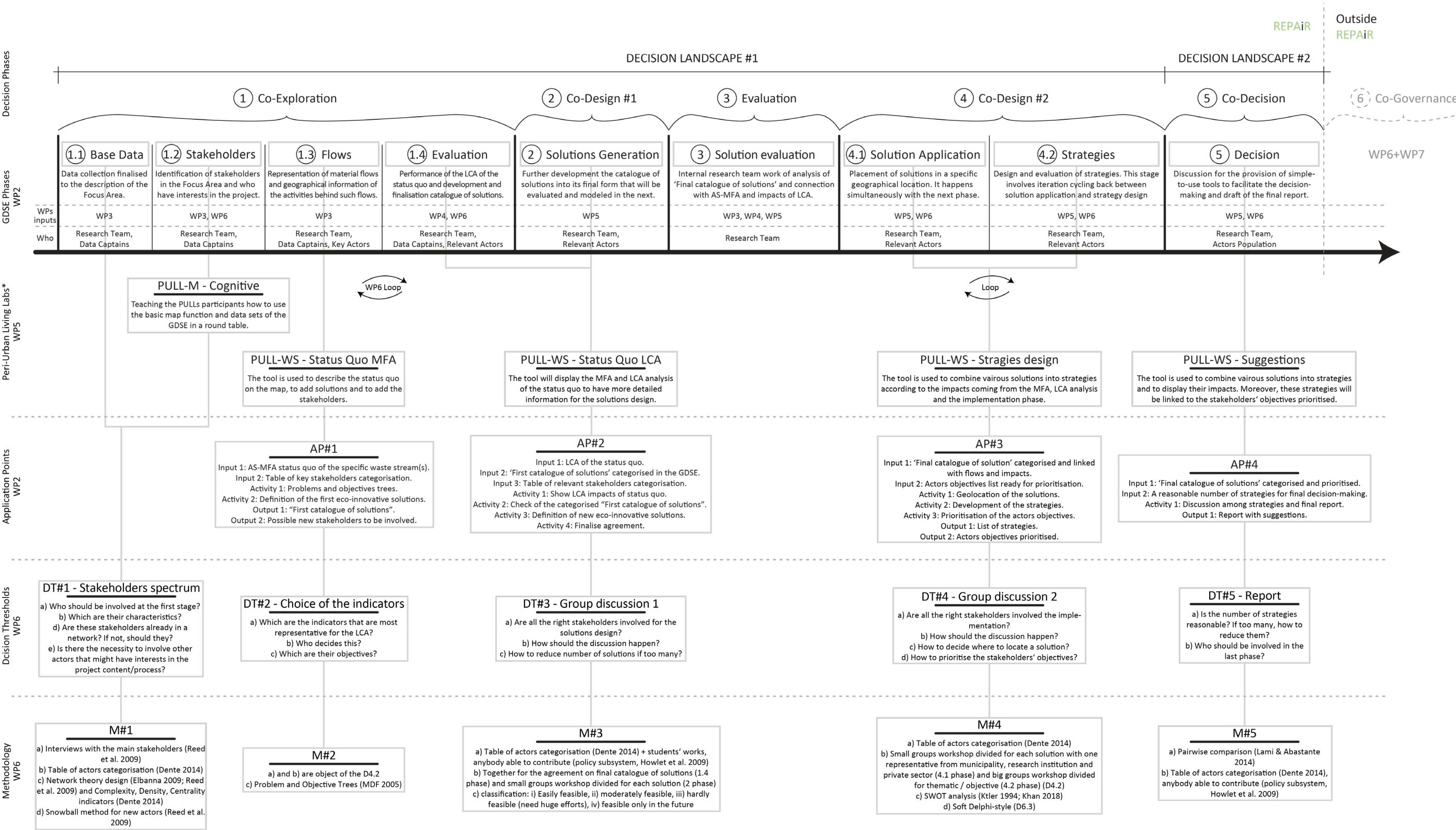


Figure C.1: DM GDSE Visualisation Chart (Authors 2017).

Appendix D: Categorisation of stakeholders

The categorisation table provided attached to this document (and shown below) is the basis of values and inputs to make all the cases of governance frameworks comparable. Please fill out the chart attached with the information needed. We also know that some of you have interviewed new actors: please add these in this new document. It follows the guidelines.

The purpose of the categorisation is to try to insure the various cases are comparable in a qualitative and quantitative manner. We suggest to categorise the stakeholders once the interview has been done: some "traits" can be assessed only after having spoken with the interviewees. We ask here an effort in the sake of abstraction: doing so, it will be easier for all to compare the cases and evaluate quantitatively a qualitative analysis.

Level of Governance: We are utilising (up to) 6 categories of governance level - supranational, national, regional, sub-regional, municipal, and sub-municipal actors (modified from Marks 1993).

Sectors: Private, public, and a combination of the two.

Resources: *Political, Economic, Legal, Scientific/Cognitive*¹⁰. This category explains in which way a stakeholder can affect the process and the result of the decision: this is described as the ability of transferring "any good that as a value for the receiver" using the concept of political exchange (Dente 2014: 35). Political resource refers to the ability of the stakeholder to mobilise consensus (or discord). Economic resource is the ability to mobilise money, e.g. private companies or funding institutions. Legal concerns the advantages that the law grants to some actors: this resource refers both to the ability of actors to use the law to counter or favour certain behaviours using the existing code but also to modify it partly. Finally, Scientific/Cognitive represents the ability of bringing data or models relevant to the decision, in other words, knowledge (from Dente 2014).

Content/Process related: The stakeholders need to be organised into those who are directly interested in the outcome of the project (content related), and those who have an interest but not any particular direct investment (process related) (from Dente 2014).

¹⁰ Dente identifies deliberately just four resource typologies to avoid redundancy. He also states that one more possible typology could be related to use of violence: the example reported in his book refers exactly to the waste management, linked to the activity of organised crime.

Role: the role describes how an actor approaches the current project. The roles have been investigated also from other scholars with small differences (cf. Elbanna 2009, for instance) - *Promoter* is the central actor in the project formulation phase, it raises the problem, involves other actors and formulates the solution (content related goals); *Ally* shares with the Promoter the interest in the solution of project problems (content and/or process related goals); *Mediator* does not have direct interest (called indirect or non-actor) in the project or process, but he/she acts in behalf of another actor and represents this actor's interest or claim (can be process related); *Opposer* disagrees with the problem definition and/or the choice of the solution (content and/or process related goals) (from Dente 2014).

The blank table of stakeholders' categorisation is shown in the following picture.

	A	B	C	D	E	F	G
1	NUM	NAME	LEVEL OF GOVERNANCE	SECTOR	RESOURCES	CONTENT/ PROCESS RELATED	ROLE
2							
3	1						
4	2						
5	3						
6	4						
7	5						
8	6						

Figure D.1: Excel sheet for the stakeholders' categorisation (own from Dente 2014).

Columns B-E describe the stakeholders. Column E contains the resources of the actor (Political, Economic, Legal, Scientific/Cognitive): this column can be considered as one of the most important because, based on the type of resources, the decision-maker is supposed to choose the stakeholders to be involved in the project (i.e. the future actors). Column F represents the interest of the stakeholder to be involved in the project (content, process or both). The role in column G represents the attitude of the stakeholder to the project (Promoter, Ally, Opposer, Filter¹¹).

¹¹ These categories are derived from Dente (2014: 54-59). He presents seven roles that an actor can have: Promoter, Director, Opposer, Ally, Mediator, Gatekeeper, Filter. For the sake of simplicity, we believe that the four mentioned are more than sufficient to cover all cases and to avoid misunderstanding. Moreover, these roles represent the actors with content related goals, which are more interesting and active than the other categories.

Appendix E: AMA PULL-WS report

Appendix F: MAN PULL-WS reports

PULL Meeting Cognitive #1

STRUCTURE OF MAN PULL Meeting #1 _Campania Region_Naples

- Introduction of relators involved in the PULL Meeting
- Presentation of REPAiR Project and Focus Area
- Bystanders's presentation and debate
- Conclusions

MAN PULL Meeting #1_Campania Region _Naples

After a short introduction on REPAiR project goals and the ways in which UNINA Team intends to achieve them, it has been introduced the focus area of the Metropolitan area of Naples (MAN) of the REPAiR project. In particular, the meeting among University, Institutions and the mayors of the involved municipalities showed the need of an immediate intervention on Wastescapes, within a circular economy, by linking them to issues related to inappropriate waste management. In order to settle the emerging issues, REPAiR is based on a Living Lab approach to facilitate the decisional process, aimed to improve the quality of life in the Metropolitan Area of Naples. In this sense, in order to recover Wastescapes, the representatives of the municipalities involved in the PULL meeting stressed the presence of some critical spaces in their territories. In particular:

- Municipality of Afragola: recovery of peri-urban illegal areas closed to the high-speed station (TAV);
- Municipality of Casalnuovo: an abandoned factory, named Ex Moneta, at the moment it is submitted to recovery and expected to become the first public park in Casalnuovo in addition to some disused sites on the territory;
- Municipality of Casoria: the presence of abandoned areas owned by the municipalities to connect with the high-speed station TAV and neighbouring municipalities.
- Metropolitan Area of Naples: the cooperation among Region, Municipalities and University is essential to recover abandoned areas as has already been done in the past for Parco della Marinella, in Naples.
- Municipality of Frattaminore: besides large municipalities, it's important to involve smaller municipalities within regeneration process as they are the main part in the North area of Metropolitan City.

At the conclusion of the first PULL, after the identification of critical areas located in the different involved municipalities, an operational meeting has been suggested in order to identify specific eco-innovative solutions for these sites.

PULL Meeting Cognitive #2

STRUCTURE OF MAN PULL Meeting #2 _Municipality of Casoria

- Regards and Introduction on the PULL focus: Organic Waste
- Exposition of the way to conduct Living Lab in addition to employed instruments (Decision Tree, an evaluation system based on Causes-Effects and Eco-solutions)
- Presentation of the Municipalities during Workshop to define territorial critic aspects related to waste flows
- Workshop results and conclusions

MAN PULL Meeting #2_Municipality of Casoria

The research intends to define approaches on governance and management practices involving actors at different levels: Universities, Public Administrations, enterprises and citizens. The second PULL, in Casoria, was important for identifying issues related to the three waste flows selected by the REPAiR research: organic waste (OW), construction and demolition waste (C&D) and Wastescapes. The issues raised are an important starting point to define specific eco-innovative solutions for the municipalities to be developed in the next PULL meetings. In particular, besides critical elements currently submitted to the attention of public administration, the issues raised were the following:

1. Municipality of Afragola: the first problem is related to the inappropriate waste separation, the illegal dumping of waste on the roads and a part of them destined for landfill and/or burnings. Improvements to contain the problem have been adopted and they consist of information campaigns for citizens, surveillance actions and tendering to introduce the electronic bag as control system. Regarding the recovery of Wastescapes, the high-speed station is an important opportunity for the Municipality of Afragola as well as for the neighbouring municipalities. In addition to this project, there is another one related to ROMA Camp and to the landfill Marrazzo, in which characterized interventions and risk analysis are still ongoing. Among other actions there is the creation of composting plants, the recovery of a seized recycling point that will become, according to Campania Region, a temporary storage site and the concession to an association of Maiulo's Farm, a confiscated property to the Camorra. Funding have been provisioned in order to activate two recycling points.
2. Municipality of Casoria: the main challenge is the improvement of waste separation though surveillance actions, according to private customers. Concerning Wastescapes, Casoria involves three abandoned large areas, first of all Rodiatoce, in front of the station. It is an industrial disused site which play an important role in the urban context in connection with the near high-speed train station (TAV) of Afragola connected with urban centre by a bus line.

3. Municipality of Casalnuovo: growing urbanisation has caused a significant pollution and generation of waste spilled in the river bed of Santo Spirito, a part of the Regi Lagni rivers. For this reason, industrial requalification projects have been supported for Ex Moneta and Liquidgas areas. Another project is related to the abandoned railway which could become a boulevard to link the urban centre. After awareness raising the separate collection has improved, from 6% to 60%. Two collection points have recently been opened near a ludic-didactic park and a dog garden.
4. Municipality of Caivano: The main problem is related to illegal waste dumping into rural areas along the roads and it's impossible to remove them due to the considerable amount not available. The other critical elements concern the presence of authorized or not ROMA camps, the main cause of illegal burning on sites. The only positive note, in terms of waste, is the proper functioning of the recycle point. The Wastescape submitted to REPAiR research is an ex ROMA camp currently a gathering area in the event of a natural disaster but it is used improperly as a landfill.
5. Metropolitan city of Naples: It suggests to consider the impact of waste flows on peri-urban areas and it invites all involved municipalities to consider C&D waste flow illegally spilled on site. The Metropolitan City of Naples provides interesting perspectives from environmental and economic point of view, in particular: in Casoria, the landfill expenses weigh on public budget with a percentage around 10-12% and, for this reason, it would be desirable a C&D recycling waste, the Municipality of Caivano is provided with recycling plants while the Municipality of Afragola required improvements for the disposal process through tendering; in the Municipality of Casoria a disposal of materials is desirable on site in order to use them as inerts.

During the PULL, important and interesting Wastescape have been identified and through them a co-creation process can be applied in order to draw eco-innovative solutions.

PULL Meeting Cognitive #3

STRUCTURE OF MAN PULL Meeting #3 _Municipality of Caivano

- Regards and Introduction
- Exposition of REPAiR Project principles and Living Lab Methodology
- Presentation on critical aspects of waste flow in the Municipalities involved in the PULL Meeting
- Conclusions

MAN PULL Meeting #3 _Municipality of Caivano

This PULL meeting was organized in the Municipality of Caivano with a specific focus on the organic waste flow. The Campania Region, in addition to actions on

eco-bales disposal, is providing the implementation of a plant for the treatment of the organic waste to be delegated to the competences of ATO (introduced by RL 26/05/2016 n. 14). The art. 45 of this law identifies interventions for the construction of community composters. In this sense the participation and involvement of citizens is important to obtain a good separate collection and then a high quality of the compost. Currently organic waste flow, due to the lack of plants, was transported in Veneto Region by paying a large amount of money by Municipality and therefore by citizens. Starting from the current condition of organic waste in the involved Municipalities and into line with REPAiR project, it was possible to organize a PULL meeting in order to identify potential and critical elements on sites to outline eco-innovative solutions. During the PULL meeting, the evaluation and organizational system was a decision tree to identify causes-effects and solutions. In particular:

CAUSES

- Bad quality compost produced by plants;
- Waste perceived as a problem and not as a resource;
- A bad management of separated waste collection due to the lack of information;
- The lack of a governance.

EFFECTS

- The mistrust of farmers to use the compost produced by plants;
- The absence of responsibility, integrated management and ambitious visions for CE;
- The impacting presence of waste in the territories;
- Lack of confidence about separate waste collection;
- Lack of collaboration with public administrations to achieve good practices to achieve a CE;
- Lower separate collection of organic waste over the years within the focus area;
- The marked environmental degradation of the territory.

ECO-innovative SOLUTIONS aim:

- To improve the use of high quality compost within green public procurement;
- To improve awareness and information of citizens also on circular economy processes, in addition with gadgets made of recycling materials;
- To provide household tools for a good separate collection;
- To provide households comparative data to demonstrate environmental benefits of separate collection;
- Regular information on plants and funding for them.

As a result, after the collection of the information at different levels, it emerged that is crucial to consider waste as resource for the management of Wastescapes in Campania Region, and that the two issues of waste and Wastescapes are strongly interconnected.

Concerning the actions, today in Campania the approach is still sectoral, but it could be interesting to understand in which way a solution could include a behaviour, process or technique.

The main drivers identified, once related to education and culture and once on the governance of the process, could lead to two different solutions to explore.

PULL Meeting Cognitive #4

STRUCTURE OF MAN PULL Meeting #4 _ Association of building contractors of Naples (ACEN)

- Regards and Introduction on the PULL focus: Construction and Demolition Waste
- Presentation of data related to Construction and Demolition waste flows, in order to get new ideas and proposals, starting from the knowledge base of the Focus Area
- Reflections from C&D Waste Management companies
- Workshop results and conclusions

MAN PULL Meeting #4_ Association of building contractors of Naples (ACEN)

The research has the aim of identifying new approaches on governance and management practices, involving actors at different levels: Universities, Public Administrations, enterprises and citizens. The fourth PULL, in Naples, was important for identifying issues related to the Construction and Demolition waste flow selected by REPAiR research, in relation to the analysis of the territorial impacts and to define specific eco-innovative solutions for the municipalities to be developed in the next PULL meetings. C&D waste flow is part of the category of special waste and could be represented by dangerous and non-dangerous typology of materials; the latter have the possibility to be re-used in different way, leading to new form of regeneration of our territories. From a quantitative point of view, it represents the most substantial waste flow, being the 40% of the total special waste flows in Italy (in Campania 43%), but in the same time it is also more difficult to identify, especially because not all the typologies have to be declared. A particular category of C&D flow is that of "by-product" that is not classified as waste and could be reused in a different productive process. An example is represented by "excavated earth and rocks", that, if satisfying certain requirements, could be governed by a "plan of use" (Piano di Utilizzo) and could become part of an environmental recovery plan. These flows, turning into second raw materials (Materia Prima Seconda - MPS), if subjected to a proper management, could become an opportunity for the territory.

Besides critical elements currently submitted to the attention of public administration, the issues raised were the following:

1. the analysis of data is done through an “annual waste communication” (Modello Unico di Dichiarazione ambientale - MUD) and data are elaborated in order to create statistics and waste reports, supporting regional planning. With the directive 2008/98/CE, Europe establishes the necessity to recover 70% of the total C&D waste by 2020. Data are collected through declaration of the waste management plants, that have to specify the typology of waste they receive, according to CER codes (Catalogo Europeo dei Rifiuti) (EWC – European Waste Catalogue) and the senders. Thanks to this declaration and in general to the Italian traceability system, it is possible to estimate the total amount of waste flows. Anyway, it is not possible to identify the illegal waste management, which in some territories is very relevant. As far as the life cycle of a building is concerned, it is important to prevent the waste generation from the early stages of the construction, following the prescriptions of Circular Economy. In Campania of 7 million tons of special waste, 3 million tons are represented by C&D waste, and almost all goes to crush and recovery, in order to obtain aggregate recycled for infrastructure works, or it is mainly disposed outside the Campania Region. Many Italian regions are promoting the selective demolition through the stipulation of program agreements. The latter, being more expensive, requires the establishment of incentives for companies, giving the possibility to obtain a cleaner material that could be more easily reusable. This procedure could lead to some problems, especially due to the distrust in using materials coming from waste and to the non-existence of the item “recycled aggregates” in the price lists. Furthermore, there is no taxation on mining activities, that could guarantee competitive prices to the recycled material compared to the virgin one and there are no end of waste criteria for C&D waste. Anyway, there are also opportunities of development with the Green Public Procurement and minimum environmental criteria (CAM – Criteri Ambientali Minimi) to be mandatorily included in public procurements.
2. It is important to conceive waste as a resource. The regional waste observatory does an action of education, prevention and solicitation. Because of a resolution of the county council, the transmission of data about waste production to the observatory is prevented, limiting in this way the possibility to communicate with local authorities. Another important task of the waste observatory is that of control and repression against illegal waste management, in collaboration with the police. Finally, another important problem to solve is that of waste balls.
3. It is important to use technological innovation in the waste management sector, in order to improve the recovery and recycling phases and to create new opportunities. Entrepreneurs need to receive concrete directions on the waste management; it is necessary to use evaluation tools, such as Life Cycle Assessment (LCA) to evaluate environmental impacts and Building Information Modeling (BIM). The latter enables to know the precise materials of the building that it is going to be demolished, in order to implement the selective demolition and the minimal environmental

criteria. An important aspect is related to “land and rock to be excavated”, with the aim of facilitating the regulatory procedures and of giving information to entrepreneurs. The link between entrepreneurship and research is essential to promote change.

4. Administrators find many difficulties in dealing with territorial management, especially because of illegal waste spills from other municipalities of the Metropolitan Area. For this reason, it was established to create two units of the ecology service that have the task to monitor an area of 18 m². More in depth, it was established a Memorandum of Understanding with the neighbouring municipalities for the territorial mutual observation, also in relation to the fires of last summer. This monitoring activity could be also extended to the illegal waste spills, which very often is formed by C&D waste. Anyway, this activity should be incremented, basing its effectiveness on a teamwork and on the information sharing. Circular Economy could be better implemented through informative campaigns, in order to raise awareness among the citizens but also among plants and companies. Furthermore, ecological island in Afragola municipality accepts C&D waste from individual citizens only once a year, in order trace the flows and to create the right material recovery chain. Finally, it is important to act on the material separation, before it is sent to plant.
5. The company deals not only with the recovery of non-hazardous special waste but also with demolition and reclamation. Another main problem is the territorial monitoring, especially because it usually happens that private citizens who do their own construction and demolition work, try to dispose of the resulting material directly to the plant, without involving any ecological island and without any authorisation or waste identification form (FIR – Formulario di Identificazione dei Rifiuti). For this reason, the company can't accept it, even if this flow is very substantial and this involves the presence of abandoned waste on the territory. The company also deals with asbestos reclamation, that is very expensive and time consuming, leading to the illegal disposal. Furthermore, another problem is that the secondary raw material (Materia Prima Seconda - MPS) stored in the company does not have a good market and does not meet the requirements of the tender dossier. Anyway, the society is able to send this material to some types of companies that can reuse it.
6. There is an attempt to implement Circular Economy together with Centro Commerciale Campania with a project called “Lotto in Campania” in collaboration with the Department of Architecture. Another important project is “Biofuel in Campania”, that has the aim to produce, from the waste materials generated by the activities of the shopping centre, bio methane, electricity and hot water.
7. UNINA REPAiR Team reflections:
 - one of the main topics of REPAiR research is related to the discarded areas (westscapes) and this is perfectly in line with the present discussion;

- selective demolition, although introduced at a regulatory level in 2013, has never been adopted. It could be possible to try to understand what are the obstacles in the procedure, apart from the problem linked to the economic costs. Social costs are also very important, in order to respond to C&D waste flows and the flows related to wastescapes. Eco-innovative solutions must bring together different dimensions. If the process of demolition and disposal is designed from the beginning, it can also influence the results. Another possible solution could be the creation of an environmental education service for the re-appropriation of wastescapes and a natural surveillance service;
- the economic cost for the entrepreneur becomes a social cost that could be sustained by an institutional entity that can invest to reduce the social cost. A first hypothesis is that of demolition and recycling of the illegal building patrimony;
- the form of recycling of some aggregates can be linked to specific territorial projects, such as the reconfiguration of illegal territories or the safety of territories (for example where there is risk of flooding), determining the construction of a new landscape. Furthermore, it could be possible to use door-to-door containers for disposal of C&D waste;
- recovery plans for abusive buildings are not adaptive. The landscape can be modified by demolishing and reclaiming, determining new settlements and giving new vitality to the space. This also requires identifying an economic viability with a special incentive, as a reward for example linked to a better quality of construction.