HOUSEFUL

D 3.6: Social engagement strategy for the co-creation of HOUSEFUL solutions as new services (final version)

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Technical References

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[1] PU = Public

PP = Restricted to other programme participants (including the Commission Services)

RE = Restricted to a group specified by the consortium (including the Commission Services)

CO = Confidential, only for members of the consortium (including the Commission Services)

Versions

Version	Person	Partner	Date
1	Beatriz Medina, Adela Crespo, David Smith	WE&B	18/11/2022
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Abstract

This deliverable provides an approach on how to foster and implement an engagement strategy for the development of the HOUSEFUL solutions and services. The main objective of this deliverable is to define the actions and activities that were implemented in Task 3.2: *the process of co-creation through the implementation of workshops*. The action and activities are based on the evidence gathered after consulting with the identified and targeted stakeholders. Therefore, this document also provides information on who these stakeholders are, how they have been identified, their relationships and their role in the engagement process.

This deliverable is an update of the previous *Deliverable 3.4 Social engagement strategy for the co-creation of HOUSEFUL solutions as new services (version I)*, updating the evidence gathered after having run almost the entire project.

The evidence generated in this document originates from the consultation process that the HOUSEFUL WP3 partners have implemented together and the resulting implementation of a co-creation strategy in the project demo-sites. This has been achieved through completing a questionnaire and a series of in-depth interviews with the stakeholders from the early stages of the project. After the implementation of the co-creation strategy an update was carefully elaborated by all partners of the consortium. The analysis of these results is based on social analytical variables such as "effective engagement" and "co-management" through the Social Network Analysis approach, for the configuration of the social structure.

This report provides a final updated version of the stakeholder map including the contexts of the already defined demo-sites. We have also explored the barriers, enablers and best methods to generate an effective engagement both during the project and in the long-term after the project end.

The co-creation process as a service (Solution 2 of the project) , addressed in previous deliverables and being implemented during the project, has been refined on the basis of this learning process. Deliverable 3.3 will present all the details of the implantation of the co-creation in the project demo-sites, but in this deliverable includes the Service 2: the co-creation strategy outline as a stand-alone output from the project that has already been tested.

1. Introduction

The housing sector is a major contributor to the current global problems of resource depletion and climate change, representing one of the most important consuming sectors at EU level: 50% of all extracted materials, 40% of final energy consumption, 33% of water consumption and 33% of all produced waste (EC, 2017). A lack of trying to change the linear business models of today is causing many environmental problems and is one of the major barriers in the transition towards a circular economy.

The negative environmental impacts resulted from the dominant linear economic 'take, make, dispose' model of our time is traditionally adopted by the decision-making of main stakeholders in the housing sector (besides, buildings lifetime covers a minimum of 40-60 years). This means that the decisions and choices taken by stakeholders severely affect the current and future building's characteristics and its environmental performance from a water, waste, energy, materials and GHG emissions' point of view. Then, not properly planned decisions definitively affect the functionality of the whole utility, related housing practices and lifestyles of dwellers during several generations. A large number of referenced case studies and innovative projects are focused on the new design of products, smart production in industries and energy efficiency processes. However, this transition has not yet taken place at all levels in the housing sector (energy, water, waste and materials). Most of the time the circularity only focuses on one of these levels (e.g. BAMB project on materials, 4RINEU on energy efficiency and RES, etc).

For that reason, a new circular thinking approach is required to enable better decision-making on the selection of circular solutions at different levels for all different stages of a building's life cycle, promoting the participation and interaction among stakeholders in each stage for an optimal building's functionality and use of resources (water, waste, material and energy) in a co-creation process. The transition from linear to a circular business model in the housing sector will massively contribute to a low-carbon urban economy in future green cities and the reduction of waste and GHG emissions, contributing to COP21 objectives and the achievement of goals proposed by the 2030 Agenda for Sustainable Development (United Nations, 2015).

HOUSEFUL proposes an innovative paradigm shift towards a circular economy for the housing sector. The main goal is to develop and demonstrate an integrated systemic service (HOUSEFUL Service) composed of 11 circular solutions co-created by stakeholders in the current housing value chain. The HOUSEFUL Service will aim at the circular management and efficient use of water, waste, energy and material resources for all stages of a European building's life cycle.

In this sense, co-creation is an essential and transversal action for HOUSEFUL leading to effective engagement of the stakeholders. This should help to overcome cultural and social barriers associated with the paradigm shift to a circular management and use of water, waste, energy and material resources.

This report is part of Work Package (WP) 3- *Co-creation of HOUSEFUL services* and more specifically Task 3.1 that aims to analyse and map the stakeholder's belief

structures. Thus, relating to their underlying behaviour, attitudes, and societal concerns in order to address knowledge requirements for the demonstration and replication of the 11 HOUSEFUL solutions exploited as integrated services. This task leads to the achievement of engagement with local and regional stakeholders from the "Demo-site" Buildings and to frame the process of a co-creation process to achieve the HOUSEFUL solutions according to their needs and behavioural patterns. This will make co-creation of new HOUSEFUL solutions feasible and realistic from developed solutions and with value, which forms part of Task 3.2.

This deliverable is an update of the previous *Deliverable 3.4 Social engagement strategy for the co-creation of HOUSEFUL solutions as new services (version II)*, updating the stakeholder mapping process that was previously defined, but which has now been implemented in all four demo-site cases, and therefore tested.

This document provides a detailed review of the stakeholders' identification and analysis process for the different demo-site locations and contexts. This process resulted in the definition of a social engagement strategy aiming to ensure correct co-creation actions during the project. The previously defined roadmap for co-creation (Task 3.2 of the project) which has further been implemented within the project timeframe has culminated in the Co-Creation Blueprint (CCB) section 5.2.. A cross-cutting solution offered to stakeholders as a service that provides a clear process to implement co-creation solutions that results can results in new circular business opportunities to stakeholders in current housing value chain.

The intended readers of this document are the stakeholders addressed by this activity that are mentioned in the above figure.

This document has been structured on the basis of the methodology and its results. Firstly, section 3 of this document describes the context of this document at the level of the specific social contexts of each demo site (previous version of this deliverable addressed a literature review).

Section 4 presents the main results that have been organized on the basis of three sub-sections: 1) social structure (stakeholder maps), 2) update on the factors that shape effective engagement strategies, and 3) the 14 co-creation ideas derived from this process.

Section 5 of this document refines the generated roadmap that has been renamed the "Co-Creation Blueprint" (CCB) for implementing the co-creation process (task 3.2) that was developed in the previous version of this deliverable. Finally, in this section, conclusions and lessons learned are provided.

2. Methodology

The aim of Task 3.1 was to develop a roadmap for the co-creation process. Therefore, the planned methodology was built around this aim in implementing the co-creation process. The culmination has resulted in an easy to replicate Co-Creation Blueprint. Figure 1 details this procedure and the consultation actions in terms of the tasks, resources and documents in this report and their timing. Further details and specifications are included in section 5 (*The Co-Creation Blueprint*), together with roles and responsibilities. The figure highlights the steps required to achieve the implementation of the co-creation blueprint, starting with a contextualization and finalizing with an update of the information.
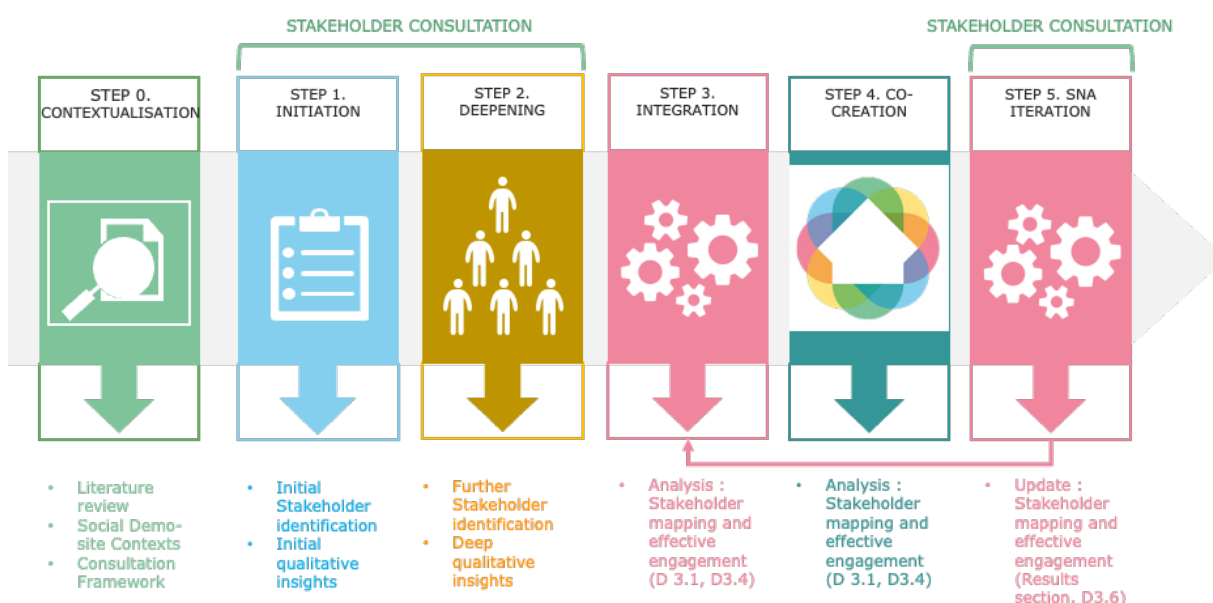
Figure 1 Methodology to address the stakeholder analysis and effective engagement through the co-creation process in HOUSEFUL.

A summary of each step is included below.

- **STEP 0. Contextualisation:** the literature review and the contextualisation allowed the identification of the analytical variables and the dimensions of the analysis and to set up a consultation framework for steps 1 to 3, as well as to create a social profile for each of the demo-sites and thus to provide a contextualisation for each of the demo sites. This step was further described in the Deliverable 3.4

- **STEP 1 Initiation**- This step related to undertaking a questionnaire to a selection of the key stakeholders (some of them aware of the existence of the project HOUSEFUL, and/or involved in related initiatives in the sector, and/or related to the demo buildings, and/or unrelated actors which have shown interest for the project). Other than these stakeholders, we addressed further key stakeholders which were unaware of the project HOUSEFUL but could add value to WP3. This step was further described in the deliverables 3.1 and 3.4. Furthermore, this step was iterated in Step 5, but in a shorter version of the

questionnaire, just addressing some key stakeholders that did not previously take part in this questionnaire.

- **STEP 2 – Deepening**. During this step we deepened through a qualitative social analysis, based on in-depth interviews and focus groups. Finally, results were integrated into step 3.

- **STEP 3 – Integration of results**. This was done based on two approaches:

  - STEP 3.1. (A quantitative method) Stakeholder mapping through Social Network Analysis (SNA). This step 3.1 was again iterated in Step 5.

  - STEP 3.2. (A qualitative method) Analysis of the stakeholders needs, concerns and expectations of the HOUSEFUL services in order to gather insights of stakeholder's behavioural decisions for building circularity through a stakeholder engagement process based on a co-creation process.

- **STEP 4 – Implementation of the co-creation strategy**. We have included this step as part of the methodology, as the implementation of the co-creation workshops and their organisation process entails an implicit learning of lessons that we consider as a step and from which we draw conclusions after the analysis of the reports of each of the co-creation workshops. The results of this process are detailed in Deliverable 3.3.

- **STEP 5 – Iteration of SNA.** This iteration aimed at refining the process of identifying connections between the stakeholders already represented and to identify new ones that may not have been mentioned previously. A validation process was first carried out with the HOUSEFUL partners, and then a shortened version of the questionnaire was sent out to the most connected stakeholders who had not previously filled it in.

The next sub-section dives deeper into the steps mentioned above, providing the describes the steps above mentioned.

2.1. Step 0 Contextualisation and Literature review

This first approach in the methodology was to identify and set the social context at each of the demo-site buildings as well as in general for the circular approaches in the renovations of the buildings. A review of the existing literature at each of the demo sites as well as a profound literature review regarding the factors conditioning stakeholder's attitudes and behaviour was undertaken to frame the methodological approach and to build a consultation framework.

A first identification of the stakeholders was conducted at the kick-off meeting of the project held in Barcelona in June 2018, during a consortium group-building discussion process that aimed to generate a first version of the stakeholder database.

This first analysis was used as a basis and a point of discussion to establish the next steps regarding the process of contacting the stakeholders and how to approach them.

In parallel, a literature review of the social context for each demo-site was undertaken as well as an in-depth literature review of ca. 200 scientific articles was accomplished. Annex 1 summarises the literature review process.

This process resulted in the consultation framework; a document that served as a guide for the WP3 team to work together when consulting stakeholders. The following step 1 and step 2 summarises the main elements of this consultation framework. Results of this step are discussed in section 3 of this document.

2.2. Step 1 Initiation (questionnaire)

The main objective of this step, undertaken in 2019, was to analyse and identify stakeholders (policy makers, public authorities, designers/architects, researchers/universities and CSOs) and the key connection points between them, in order to identify the key experts in the housing sector and circular economy – that included the main interested and influential actors over the course of the project. The specific objectives of this step were:

- To create a real and current perspective of the interest and concerns of those actors to be potentially involved in the co-creation activities within the HOUSEFUL project.

- To initiate the stakeholder map for those that are to be engaged in the co-development of the HOUSEFUL project.

- To start analysing how to strengthen the participation among the stakeholders and to establish a process to enable social networking amongst them.

- To foster dialogue to establish space for interaction to take place and to promote critical reflection on the project activities.

To address the objectives described above, the research questions presented below were formulated. These research questions were devised to be answered through various activities, including the launching a questionnaire to the stakeholders that are mainly aware of the HOUSEFUL project or that have a connection to the demo-site buildings. The following questions were used as a guide in the formulation of the objectives and will help the project in formulating the possible expected results:

- How does the HOUSEFUL "aware community" perceive the project?

- Who are the key stakeholders? And who is in contact with whom?

- What is their level of interest/influence over the project activities?

- What are their general perceptions of the benefits/risks of the proposed solutions?

- How can effective engagement with the selected stakeholders be achieved?

The questionnaire (not representative at a statistical level due to the fact that it is addressed only to the key stakeholders) mainly consisted of closed questions, so that the gathered results were more reliable and to minimize research bias, but also contained some open questions to let the respondents develop their own point of view.

There are two different locations in which we launched the questionnaire at the demo-site level of the two buildings in Catalonia (Spain) and the two buildings in Vienna (Austria). Thus, the questionnaire was translated from English into Spanish and German, thereby providing everyone with an opportunity to understand the questions and be able to answer them with clarity and understanding. To seek a wide representation of stakeholders and to provide a cross-scale view, questionnaires were launched to five specifically chosen scales which were strongly interconnected, these included:

1. The regional context in Catalonia: at this scale stakeholders are represented that do not have a close link to Demo 1 or Demo 2 but have a regional relevance in circular economy and/or the housing context of Catalonia.
2. The local context in Catalonia: at this scale stakeholders are tightly related to Demo 1 or Demo 2 were represented.
3. The regional context in Austria: this level represents stakeholders that are not closely linked to Demo 3 or Demo 4 but have a regional relevance for circular economy and/or the housing context of Austria.
4. The local context in Austria: at this level stakeholders that have a close connection to Demo 3 or Demo 4 were represented.
5. The general context: within Europe and no association to any specific HOUSEFUL demo-site building but with a deep understanding of circular economy and the housing sector.

The questionnaires provided questions that addressed the following themes: circular economy, understanding of the project, particularities of the housing sector, the general perception towards the reuse of resources, relevant stakeholders and connections, and the effective engagement for the co-creation activities. The questionnaire addressed in this step is available in Annex 2.

The questions were chosen to address the previously mentioned research questions. The questionnaire additionally included questions with a focus on aspects related to social research on attitudes and behaviour (the results of which are included in other deliverables). The following group of variables (as referenced in the literature, section 2.2) provided the context in which the questions could be grouped.

- **Organisational**. This aspect relates to the level of knowledge and experience of the respondent regarding circular economy. We intended to analyse the possibility of coordination and collaboration of the different stakeholders (associations, qualified professional management) considering who would be willing to participate in the project, as well as their ability to influence the consequences of the HOUSEFUL project.
- **Behavioural aspects related to experience**. This aspect related to identifying current practices, business models or other experiences with regards to the adoption of circular economy actions. This included questions about relevant experiences involving ecological behaviour and the approaches to promote behavioural change towards the use of circular economy practices in existing buildings. Results regarding this aspect were analysed in Deliverables 3.2

- **Personal attitudes**. This aspect related to the identification of attitudes that positively influenced the success of the project. For instance those attitudes fostering environmental awareness, and motivations that drive different stakeholders in the housing sector with regards to water, energy, waste and materials related circular solutions. Results about this aspect was however analysed in Deliverables 3.2
- **Cultural conditions**. This variable addressed the barriers and opportunities in the HOUSEFUL demo-site context (issues of trust in institutions, social rejection, lack of knowledge of the potential benefits, a lack of training of the prescribers of the project, social aspects, etc.). Results regarding this aspect was however analysed in Deliverables 3.2
- **Engagement**. This variable relates to identifying the key factors for the recruitment process in the selection and cooperation with the stakeholders that support the circular economy, as well as issues that motivates the participation in R&D projects.

In the process of distributing the questionnaire, different approaches were followed depending on the geographical context. For the regional context of Catalonia and Austria, and the local context of demo-building 1 and 4, the questionnaires were preceded by prior contact via email or telephone with each of the stakeholders. For the local context of Demo 2 and Demo 3 (the buildings were selected in the second project year), stakeholders were previously contacted to develop face-to-face interviews (step 2) as otherwise their involvement in co-creation activities would have been compromised due to the change in demo buildings.

The HOUSEFUL partners involved in this activity were required to review the stakeholder database to identify who they should contact. The type of stakeholders selected for the questionnaire were those that could be aware of the project, those related to a demo building or those that have already gained some knowledge in the housing sector and the circular economy models that can be applied within this sector.

2.3. Step 2 Deepening -Interviews

The purpose of this step was to deepen the social analysis of the results gathered from step 1, based on the qualitative social research methods (interviews and focus groups). The main objective after this step was to analyse the specific factors influencing behavioural choice making structures of people and the potential social risks and the barriers affecting successful demonstration of the proposed HOUSEFUL solutions as new services. With regards to the purpose of this document the results provided us with guidance for an effective engagement strategy at each building as well as to further deduce the interested ideas for co-creation.

The specific objectives of this step were as follows:

- To construct an in-depth analysis based on the results from Step 1.
- To identify the specific factors influencing behaviour and social attitudes towards the use and implementation of HOUSEFUL solutions, as well as the

contextual and cultural conditions and beliefs that can also influence decisions. This objective is further addressed in the Deliverable 3.2 and 3.5

- To start engaging with stakeholders to find out the motivational trends for them to be involved within the co-creation actions.
- To facilitate the recruitment of participants for the co-creation workshops.

To reach the above-mentioned objectives, the following research questions were addressed during these consultations:

- How are decisions taken with regards to the implementation of circularity models at each of the demo sites?
- What are the knowledge needs required to be ready to participate in HOUSEFUL social engagement activities?
- What are the main environmental considerations and priorities perceived by the different stakeholders' groups and how may this affect the housing sector and the implementation of circularity solutions?
- What risks or benefits are perceived through the implementation of CEBOs in the demo sites?
- What are the motivations of stakeholders to create a change in behaviour towards circularity models in the housing sector?

A bottom-up approach was proposed to gain an insight directly from those dealing with the issues of the housing sector and to allow participants of these consultations to express their opinions and thoughts in an open manner. Therefore, the empirical approach was based on interviews.

For the regional context of Catalonia and Austria, as well as the local context of Demo 1 and 4, selection of participants was done according to the results from the previous step, based on the interest shown through the response of the questionnaire and willingness to further engaged of the respondents. Further participants were identified according to the snowballing process[2] of the stakeholder network analysis taken from the questionnaire results.

The selection of participants for the local context of demo-site buildings 2 and 3 were based on consortium partner's knowledge of relevant stakeholders and succeeding snowball sampling process.

2.4. Step 3 – Integration of the results.

Results have been integrated and analysed based on two different approaches, in order to identify and analyse the social structure we used the SNA[3] (section 2.4.1.), and a qualitative analysis by using MAXQDA 2018 and 2020[4] to further identify factors shaping the stakeholders needs, concerns and expectations of HOUSEFUL services as well as to identify stakeholder's behavioural decisions for building circularity.

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[2] The snowball methodology consists in contacting the initial stakeholder and asking these first stakeholders for additional contacts that can have interest in the topic addressed. The snowball process usually finishes once the suggested stakeholders start to repeat or information obtained from these stakeholders is repetitive.

[3] SNA allows to analyse structural characteristics of social relationships

[4] MAXQDA is a software to analyse qualitative datata and apply mixed methods.

2.4.1.   Step 3.1. (quantitative) Stakeholder mapping through SNA

The stakeholder identification and mapping process followed the Social Network Analysis (SNA) procedure, which is based on the analysis of the structure of a social network. SNA is used to analyse structural characteristics of social relationships and provides measures to analyse communication networks within and between organisations. It helps to identify information pathways, spreaders (knowledge brokers) and gatekeepers (knowledge controllers); and supports the process of knowledge sharing within and between organisations[5]

> SNA views social relationships in terms of network theory[6] consisting of nodes and ties (also called edges, links, or connections)[7]. In the **HOUSEFUL** context the nodes are the organisations/institutions that have shown interest or influence in the circular economy and/or housing sector, and the ties are the relationships between them.

The way in which SNA has been approached for this project task is based on a snowball network study[8] initiated in a group process during the project kick-off meeting (step 0). HOUSEFUL partners where first consulted in this meeting to indicate key stakeholders according to their knowledge. The results from this first consultation allowed, in turn, for a further consultation to stakeholders beyond the project consortium (step 1, step 2 and the iteration in step 5).

Specific questions were addressed in the consultation process with regards to the social network structure of each of the demo sites. Therefore, as a result a database of stakeholders and circular economy initiatives in the housing sector was created with detailed information about the contacted organisations. The database of stakeholders has been internally stored in the WE&B (WP3 leader) storage system according to the WP8 Ethics and cannot be openly shared. However, to visualise the stakeholder maps, we have used the web-based software Kumu[9], to create relationship maps from each of the sites as well as the general context (not related to the demo, sites), based on the answers from the questionnaires and in the interviews.

Results from this step are discussed in sections 4.1 and 4.2 of this document.

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5 Kar-Hai Chu,Heather Wipfli,Thomas W. Valente, (2013) Using Visualizations to Explore Network Dynamics , Journal of Social Structure,Volume 14.

6 Network analysis is the study of social relations among a set of actors. It is a field of study -- a set of phenomena or data which we seek to understand. In the process of working in this field, network researchers have developed a set of distinctive theoretical perspectives as well.

7 Wasserman, S. and K. Faust, 1994. Social Network Analysis. Cambridge: Cambridge University Press.

8 A snowball network refers to the idea that the elements identified in an egocentric survey then become egos themselves and are able in turn to nominate additional elements.

9 https://kumu.io

2.4.2. Step 3.2. (qualitative) Insights of stakeholder's behavioural decisions for building circularity

A qualitative analysis has been conducted to identify the social beliefs, concerns, and perceived risks and benefits of the proposed solutions. This analysis also allowed the creation of a strategy for the development of solutions based in a co-creation approach. All interviews have been translated to English and transcribed. The transcriptions have been coded with the MaxQDA analytical qualitative software according to the variables described in section 2.1. Through the coding of the interviews based on the variables described in section 2.1. emergent topics could be identified, and their relevance assessed. The deductive analysis[10] has been done to address the issues of effective engagement, stakeholder analysis (social structure), co-creation and co-management to elaborate *The Co-Creation Blueprint* (section 5).

Resulting from this analysis of Demo 1 and 4, we collected the co-creation ideas for the workshops from a deductive process. In addition, ideas for co-creation were also identified through an internal brainstorming together with the HOUSEFUL consortium members based on a questionnaire. Results from Demo 2 and 3 have been included in a post-analysis to consider their inputs in the second workshop of T3.2. Outcomes will be addressed in Deliverable 3.2.

2.5. Step 4 – Implementing the co-creation strategy for HOUSEFUL

In the previous versions of this deliverable (Deliverable 3.1 and Deliverable 3.4), the co-creation process was established based on the analysis of the results gathered during the two previous steps. In this latest version of the report, the status of the implementation of the co-creation process is already in its final stages and it is worth including a methodological section here from which some previous results can be extracted. However, a detailed description of this process is provided in section 5, and all the results of the process are collected in Deliverable 3.3. Therefore, we only include a brief description of this co-creation process here.

The HOUSEFUL co-creation strategy is based on the backcasting methodology to generate co-creation ideas that were to be implemented in the project duration. The process consisted in the implementation of three types of a workshop in each of the 4 demo-site buildings of the project aiming at engaging with key stakeholders to identify, plan and validate generated co-creation ideas.

During the workshops, the discussions gathered in the workshop reports have raised expectations to the way relevant information regarding the relevance and interest of the stakeholders is to provide effective communication and participation. The chapter on "effective engagement" contains conclusions of this aspect.

2.6. Step 5 – SNA iteration

The process carried out in *Step 1- Initiation* has been partially iterated at two levels. The "organisational" variable described above has been assessed. This variable

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[10] A deductive analysis starts with the formulation of a hypothesis based on existing theory which the in tested through the analysis of gathered data.

related to the identification and analysis of the most relevant organisations and their connections. The two levels in which the stakeholder database has been updated are: again with project partners and with key external stakeholders.

The update of the stakeholder database at the project consortium level.

Each HOUSEFUL partner has reviewed the stakeholder database thoroughly and added the connections to those stakeholders identified. It should be recalled that the snowballing process was initiated in step 1 at the kick off meeting of the project with the HOUSEFUL partners.

The update of the stakeholder database with a second wave of a reduced questionnaire version in step1 addressed to the key stakeholders.

This version of the questionnaire has been extended to the new organisations identified after step1 and therefore, they had not responded to the questionnaire previously. In this case, the questionnaire only contained the questions related to the SNA (organisational variable). The extract of this questionnaire is available in Annex 4. In this version of questionnaire, the question regarding connections to relevant organisations was slightly altered. The options displayed for which respondents could identify the relevant connections where those with the highest relevance in the SNA from step 3.1. Following these two steps, the analysis described in step 3.1 has been updated.

3. The Context: the analytical scope and the four demo-site buildings.

3.1. The analytical scope

Based on an extensive literature review, principally from the social sciences based on more than 200 peer reviewed articles, we established, in early stages of the project, the research framework. The framework was used to identify the analytical dimensions conditioning behaviour and attitudes the of the circularity models in building refurbishments. The basis and reasoning behind this analytical framework and the related literature review are included in previous versions of this report (namely: Deliverable 3.4 and Deliverable 3.1).

The two analytical dimensions that contextualise the approach provided t are:

1) the analysis of the **social structure** of the HOUSEFUL demo-site buildings through **SNA** and, 2) the **qualitative analysis** of factors to address **effective engagement** in the refurbishment of buildings using the HOUSEFUL circular solutions.

Both dimensions are related to the circular economy environmental parameters addressed in the HOUSEFUL project: materials, waste, water, and energy. The figure below provides the analytical approach:
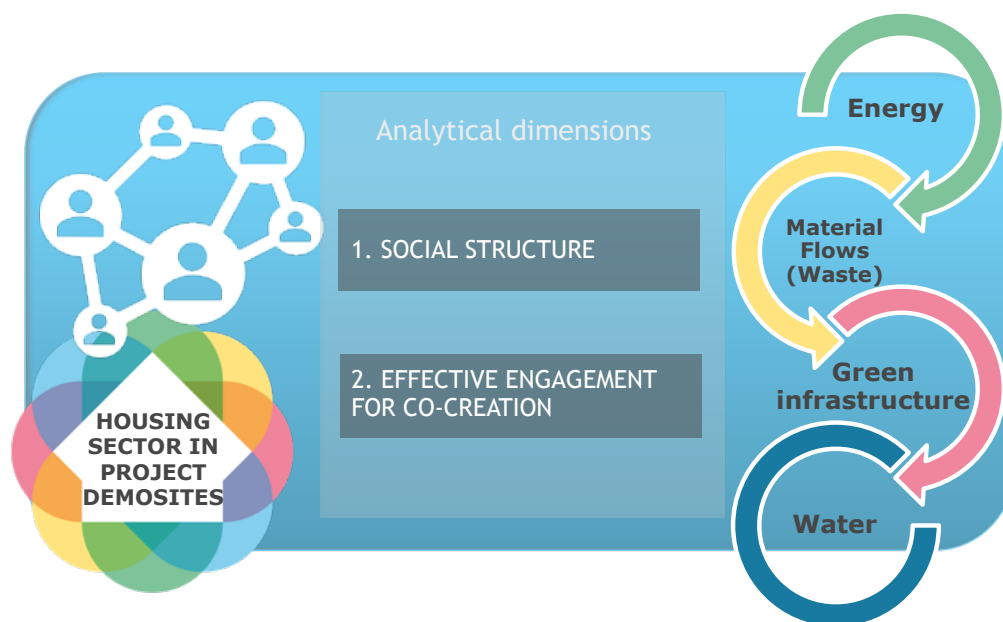
Figure 2. Analytical Framework for the Stakeholder Analysis of HOUSEFUL

3.2. The social contexts of each of the demo-sites

3.2.1. Overview demo-sites

The following section of the document provides an overview of the 4 demo-sites of the project from the social, political and comprehension context of the circular economy. The table below provides an overview of social key facts per each demo-site building.

SOCIAL CONTEXT HIGHLIGHTS				
	Demo 1 	**Demo 2** 	**Demo 3** 	**Demo 4**
Regional information	Catalonia		Fehring	Vienna
Demographics	Sabadell (216.204 inh.)	Sant Quirze del Vallès (20.156 inh.)	Municipality of Fehring (7.150 inh.)	21st district of Vienna, Floridsdorf (178.185 inh.)
General context	Sabadell is the co-capital and second largest city of the County of *Valles Occidental* in Catalonia, Spain	Sant Quirze del Vallès is a small town which lays between the two biggest cities of the Vallès region, Terrassa and Sabadell. Single family houses are dominant	Fehring is characterized by its low population. The municipality includes 17 villages. Single family houses are dominant.	Floridsdorf is the northern district of Vienna and is characterized by being a residential district.
Housing Management type	Social Housing (rental, emergency housing)	Social Housing (rental, youth profile)	Cooperative	Social Housing (property)[11]

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[11] This makes reference to social houses which are owned by their inhabitants, so they are not of renting.

SOCIAL CONTEXT HIGHLIGHTS				
	Demo 1	**Demo 2**	**Demo 3**	**Demo 4**
Key Aspects	- High rate of social problems (exclusion, low income, criminality, etc.) - Families with a high number of children - High turnover - High rate of migrants	- High rate of social problems (exclusion, low income, criminality, etc.) - Young families - High turnover - High reference of migrants	- Housing cooperative aiming to live in community - Sustainability as dominant theme - Promoted by funders (external and internal)	- Medium/low-income families - Families with high number of children - Low turnover - Medium migration rates
Previous CE studies	- Observatori Circular Economy Catalonia (in progress), Vallès Circular (2017- present), 4RinEU (2016-2020), PlugHarvest (2017-2021)		- Katch-e (2017-2020); Plattform Kreislaufwirtschaft ÖsterreichCircular Futures (in progress)	
Previous knowledge regarding HOUSEFUL	Low awareness in the region	Low awareness in the region	Low awareness in the region	Low awareness in the region

3.2.2. Social Context: Demo-sites 1 and 2 (Sant Quirze del Vallès and Sabadell)

Demo-sites 1 and 2 are located in Catalonia (Spain), in the towns of Sabadell and Sant Quirze del Vallès. They are located in the Vallès Occidental County in which 937,422 inhabitants live in a territory of 583,13km2 with a population density of 1,607.6 inh/km2 (Idescat, 2022)[12]. It is a relatively small territory, but it makes up to 12,1% of the Catalan population. In 2017, 1738 housing projects were started in the Vallès Occidental, of which 68 were for social housing, therefore it can be noted that there is a fairly large inequality in this area between private housing and social housing.

With regards to the circular economy, in Catalonia, an observatory called "Circular Catalonia"[13] has been created to carry out circular economy initiatives. This observatory is promoted by the Catalan government. Catalonia has as well the so called "Vallès Circular"[14], an initiative signed by several regional entities from Catalonia to incorporate principles of circular economy in the economic, social and environmental development policies to promote public-private cooperation in the Vallès Occidental territory.

The problem of access to housing has become one of the main social problems in the territory, representing one of the most important demands of low-income social structures. Compared to the boom in the building sector in the whole Spain that lasted up until the financial crisis in 2008, nowadays families have difficulties in order to access to mortgages. The stricter requirements to access mortgages together with the precarization of the labour market, especially between young people, were some of the factors that favoured in Spain a change in the modality of access to housing. Currently, there has been an increase in the demand of rental housing, but there is a shortage of supply and social rental housing offer is low.

The Government Plan 2021-2025 of the Catalan Government identifies three main objectives with regard to the housing sector in Catalonia: 1. Ensure access and stay in housing for vulnerable people and families to favour their social inclusion; 2. Increase public housing supply and encourage affordable and social housing promotion; 3. Improve quality and conditions of housing.

Specifically, some of the lines of action include (see table 2 below):

Table 1. Catalonia Government lines of action with regard to social housing for the period 2021-2025.

- 15% of total housing stock allocated for social housing in 20 years

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- Increase housing policy budget up to 1 million

- Increase social rental housing stock at least in 5.000 per year

- Establish measures against rural depopulation by encouraging the promotion of affordable and social rental housing

- Support the refurbishment in Catalonia of 25.000 housing buildings per year, especially to projects that lead to an improvement in energy efficiency, the implementation of renewable energies and quality of life.

- Promote cooperative housing.

Demographics in demo-site 1: Sabadell and governance model

From a local perspective, Sabadell is currently a municipality composed of 216.204 inhabitants, with an area of 37,79km2 and a population density of 5721,2 inh/km2. In Sabadell, 48.6% of the population are men and 51,4% are women (Idescat, 2021)[15] and the age distribution of Sabadell is as follows:

Table 2. Sabadell Demographics (Demo-site 1)

Age class	Sabadell	Vallès Occidental Territory
0-14	15,51%	16,21%
15-64	65,71%	66,78%
65-84	15,55%	14,41%
85 and more	3,23%	2,61%

The most significant economic sector in Sabadell is the services sector (84,47% of all the economic sectors). According to the latest available data of December 2021 6,32% of the population was unemployed[16]. The municipality has experienced a constant population growth since 2000. Currently this growth is stabilizing.

According to the Sabadell Local Housing Plan 2019-2030, in 2018 the social housing stock (subsidised housing, rental housing, teacher's dwellings, etc.) included 2.542

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[15] Ibid

[16] https://www.idescat.cat/emex/?id=081878&lang=es

dwellings, a 3,2% of the total stock. The objective is to achieve by 2030 a 10% of social rental housing out of the total.

The HOUSEFUL project (demo-site 1) is being carried out near the public primary-school Joan Sallares i Pla, in a building called "The teacher's block", located at Calle Campoamor 98, which is currently under refurbishment to adopt the HOUSEFUL solutions and will have a social use. The district of Campoamor is located in District 6 of Sabadell, in the South of the city. This district in which 14,25% of the population of Sabadell lives, is characterised by high migration (22,72% of total population)[17] and, as stated in several interviews, by a lower socio-economic profile.

Currently, the 16 medium-apartments in the building have been awarded by the Sabadell City Council to families that were given the keys to the apartments in end September 2022. The Catalan Housing Agency (Agència de l'Habitatge de Catalunya, AHC) is the public institution that deals with the contracts with inhabitants (or the so-called "the users" in the jargon of the AHC). Therefore, AHC and Sabadell City Council are the main bodies that will deal with the building's residents and future residents.

In addition, the building has a public school (another public institution that is managed by the municipality). The school is aware of HOUSEFUL.

The building is located in the Campoamor neighbourhood, which has its own social dynamics with high socio-cultural diversity. To address this diversity, Sabadell City Council has mediation dialogue tables, ecological transition tables, and social housing tables. The three tables have shown interest in HOUSEFUL.

Both in the Vallès Occidental region, and in the region of Catalonia in general there is a strong commitment to position towards a circular economy approach. The regional government (Gencat) and other private initiatives are promoting this positioning, and as a consequence Sabadell has several circular economy pilots. Examples are the already mentioned Observatory of the Circular Economy in Catalonia and the Vallès Circular initiative.

Demographics in demo-site 2: Sant Quirze del Vallès and governance model

Sant Quirze del Vallès was established as a municipality in 1848 after being segregated from Terrassa (a nearby municipality with 223.011 inhabitants). Sant Quirze del Vallès has 20.156 inhabitants in an area of 14,07 km2 and a density of 1432,5 inh/km2 (Idescat, 2022)[18]. In Sant Quirze del Vallès 48.99% of the population are men, and 51,01% are women (Idescat, 2022)[19] and the age distribution in the municipality is as follows:

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[17] https://www.idescat.cat/emex/?id=082384

[18] Ibid

[19] Ibid

Table 3. Sant Quirze del Valles Demographics (Demo-site 2)

Age class	Sant Quirze del Vallès	Vallès Occidental Territory
0-14	17,27%	16,21%
15-64	67,66%	66,78%
65-84	12,84%	14,41%
85 and more	2,23%	2,61%

The main economic sector in Sant Quirze del Vallès is the services sector (71,33%). Industry is the second most important activity in the municipal economy. According to the municipality, the unemployment rates as to December 2021 was 3,54% of the total population. The municipality has experienced a constant population growth since 2000.

According to Sant Quirze del Vallès City Council, housing is a pressing issue in the municipality. Currently approximately 95% of houses are single family proprieties of recent construction (rehabilitation is not perceived as relevant) and there are only 65 social housing and 6 rentals in the entire municipality. This evidences a structural problem. Properties are expensive (compared to the average income) and social rental is expensive as well as it is situated in zone 1 of the Metropolitan Area of Barcelona. This is in strong contrast with the demand within the municipal register for social housing (especially from younger people who otherwise have to move to nearby municipalities), as mentioned by the Sant Quirze city council. The large number of single houses can also be an explanation to the large amount of neighbourhood associations. At present, the municipality is reviewing the situation of social housing in the region and is planning to increase the stock of social housing in the municipality.

The demo site is a social housing rental building – with a common backyard and 24 small apartments that are currently inhabited. Most of the tenants are young families. The building owner is Incasol[20], the Catalan Land Institute, which is a public company of the Catalan government. AHC is the building administrator and manage the building "users". However, the Sant Quirze del Vallès City Council is in charge of the new concessions. Within the Sant Quirze del Valles City Council, there is a low number of public housing available, however, this is something that the municipal government would like to change, due to the increasing demand of affordable housing. More and more young people are coming to live in municipalities like Sant Quirze del Vallès that are close to the city of Barcelona, as they would have better access to housing and good social services while being close to natural green areas.

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[20] Public law body dependent on the Ministry of Territory and Sustainability. Its tasks include the promotion of residential land, subsidized housing, the promotion of land for economic activities, the rehabilitation of historical heritage and urban renewals, http://incasol.gencat.cat/es/inici/index.html

This profile of young people usually value sustainability and is conscious of these aspects including circular economy. Therefore, having circular buildings with a social rental formula will help to provide a response to a demand for accessible and sustainable housing.

On the other hand, the building was already a pilot for another H2020 initiative (Plug n'Harvest project). Therefore, the residents already knew that their involvement is very much needed and valued. However, currently there is no consolidated building's management structure, which sometimes makes it difficult to have effective governance in the building's decision-making. Furthermore, being only tenants and not owners, their involvement in issues with regards to the building is limited and hindered their interest to participate in co-creation activities.

3.2.3. Social Context: Demo-sites 3 and 4

From a country perspective, out of its 8.95 million inhabitants, Austria has a workforce of 4.7 million people who are generally highly educated and skilled. The services sector dominates the economy, and also employs more than two thirds of the active population. Tourism has a strong impact on the country's economy.

In general, Austria is a pioneer of the circular economy and a strong partner of the EU in this regard. Austrian households generate between 4 and 5 million tons of waste per year, of which around 90% is recycled[21]. Initiatives implemented in this regard seem to have results. For instance, the Austrian Waste Consulting Association (VABÖ)[22] has worked for decades together with the municipal environment and waste consultants to raise awareness of the need for consumption that saves resources. However, the circular economy is not an issue that is only relevant in the field of waste management and should be addressed as well at society level. In this sense, one key initiative was launched in March 2018, the initiative Circular Futures[23], held by the Austrian Circular Economy Platform[24]. In this Circular Economy Platform, pioneers in the circular economy representatives from the EU not only from Austria but also from Netherlands, Finland, Scotland or Slovenia, discussed opportunities and challenges for the transition to a circular economy in Austria and the rest of Europe. This initiative promotes networking activities and informs about current political initiatives and developments.

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[21] https://openknowledge.worldbank.org/bitstream/handle/10986/30317/9781464813290.pdf

[22] https://www.vaboe.at/

[23] https://www.circularfutures.at

[24] "Multi-stakeholder platform, think tank, incubator and catalyst for projects and initiatives accelerating the transition to a circular economy in Austria and Europe" https://www.circularfutures.at/ueber-uns/english-language-summary/

Demographics Demo-site 3 – Sociodemographic in Fehring and Cambium governance model

The Demo-site 3 building is located in the municipality of Fehring in the Steiermark state.

The federal state of Steiermark has 13 districts and 1.252.922 inhabitants[25]. The unemployment rate in 2019 was the 5%.

The municipality of Fehring, in Steiermark state, has a total population of 7.150 inhabitants[26] of which 49,43% are men and 50,57% are women. The age distribution of Fehring is as follows:

Table 3. Fehring Demographics (Demo-site 3)

Age class	Fehring	Südoststeiermark
Under 20	17,7%	18,1%
20 -64	58,2%	60,9%
65 or more	24,0%	21,0%

Fehring has predominantly single-family houses, and it is difficult to construct other types of housing in the area.

The demo-site building is a former military building which is now occupied by a community of 75 people, the Cambium community that was founded in 2014. This community began to transform the main building into a suitable living and working area with residential units, co-working spaces, studios and a seminar facility. Since the basic value of the Cambium project is to build up an eco-village, to live with minimal impact on the environment, there are plans to establish sustainable agriculture and circular building technologies. The community is committed to public relations and outreach since a basic objective is the dissemination of acquired knowledge and ideals. In May 2019, Cambium bought the property with an "asset pool", a direct credit campaign, with over 250 investors.

Cambium operates as a private initiative cooperative. The residents themselves are organised in a sociocratic circle structure based on consent decision making processes. Its governance is particularly transversal, and it is located in an area where there is mainly single-family housing in low occupation density.

Since the first plans of the community to move in and buy the old military barrack, they have been in close contact with the neighbourhood and the municipalities. As the property was owned by the city of Fehring, the decision to sell it to the community

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[25]https://www.landesentwicklung.steiermark.at/cms/dokumente/12658755_141979478/5be8ae1b/6.pdf

[26]https://www.landesentwicklung.steiermark.at/cms/dokumente/12256490_141979478/c9b7c8d0/62378.pdf

project was made by the municipal council. For this reason, the involvement of the neighbours to counter certain fears or doubts was an essential point from the beginning.

Today, there are still regular events and tours organised by the Cambium community to keep in touch with the neighbourhood and build local initiatives.

On a regional level the city of Fehring is part of various initiatives, for example "Vulkanland" and "KLAR - Klimawandelanpassungresgion"(climate adaption model region), promoting sustainable and ecological projects. The Cambium community is linked to these initiatives in order to advance common goals.

Demographics demo-site 4 – Vienna and the Donaufelder Strasse 115 governance model

From a regional perspective, Vienna is a federal state, the capital of Austria and the largest city and municipality of the country. In the federal state, in January 2022 1.931.593 people lived in 23 districts[27]. Its municipal districts are not administrative districts as defined by the constitution; Vienna is a statutory city and as such is a single administrative district in its entirety.

The image below depicts the gross domestic product (GDP) of Vienna in 2020 (latest figures), where the values that are added to the goods and services in the different stages of the production process are collected.
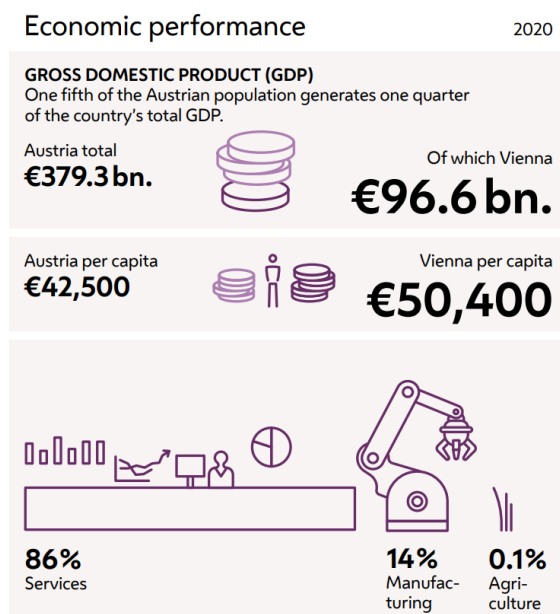
Figure 3. Vienna GDP 2022.

Source: https://www.wien.gv.at/statistik/pdf/viennainfigures-2022.pdf

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[27] https://www.wien.gv.at/english/administration/statistics/#overview

Unemployment rate in Vienna was at 13% in 2021, after reaching over 15% in 2020 due to Corona crisis.

Vienna is both a state and a municipality with a state senate and a federal council.

Among other things, the district heads and the selected district representatives are responsible for compulsory schooling, local aesthetics of the district, road construction, etc. Competences of the district representatives and households are assigned by the city. The district chief is formally ordained to the mayor.

The demo-site building is located in the 21st district of Vienna called Floridsdorf. The district has a total population of 178.185 inhabitants (Statisktik Austria, 2022) of which 48,8% are men and 51,2% are women. The age distribution of Floridsdorf is as follows:

Table 4. Florisdorf Demographics (Demo-site 4)

Age class	Floridsdorf	Vienna
0-17	19,7%	17,2%
18-64	64%	66,2%
65 or more	16,2%	16,6%

In Floridsdorf, housing and classification of the area is done by the mayor for whom municipal authority departments work – in Vienna the MA18 (city district) of the city council is the decision maker regarding city development and planning.

HOUSEFUL demo-site 4 is being implemented at Donaufelder Strasse 115, which is a residential building consisting of 54 apartments, one-day care centre and one supervised flat-sharing community for young people. From a technical point of view, according to Neues-Leben, this building is comparable to approximately 70% of residential buildings in Austria. In this building, residents are invited to comment on the project and Neues Leben is in charge to ensure this engagement.

This pilot building has already had its inhabitants for 3 years in a social renting regime. The building was already designed to have common spaces. When the inhabitants moved in, they were accompanied by a social dynamisation company to create the existing structures for communal management and use of common spaces.

The building is located in the 21st district and has a good public connection. The average age of the inhabitants is quite young resulting in one quarter of flats being used by a single person. Neues Leben is acting as property manager and therefore in charge of any changes and maintenance within the building.

In the case of HOUSEFUL and the co-creation activity, the building has not been the great reference point in the discussions with stakeholders as there have not been implemented technical solutions. Therefore, in this case, the governance model has focused more on using this pilot as a model of social housing for the city of Vienna.

The actors involved in the WP3 co-creation process have been both those most involved in the building itself and those in the value chain of the circular economy and housing in Vienna. The inhabitants of the building were not involved in the Co-creation process in the beginning due to the lack of technical solutions implemented.

As already stated, this building represents the building standard in Vienna and its participation in HOUSEFUL is interesting to the municipality and the building association.

4. Results

The results are organized according to each analytical dimension i.e. (i) the social structure (stakeholder map, target groups and relationships) and (ii) the factors conditioning effective engagement in the development of circular solutions in building renovations. Firstly, we present results of the methodology process. We, also, present an analysis of the stakeholders and the associated database. Furthermore, at the level of engagement strategies, the results are analysed on the factors that condition the effectiveness of these strategies, both in the process of generating circular solutions and in their long-term use (i.e. co-management).

4.1. Results about process of analysing the HOUSEFUL social structure

This section provides results showing how the process of analysing the social structure of the HOUSEFUL demo-site buildings and expanded to a more general context from circular economy in the housing sector. Results from the process of identifying, consulting, and engaging with stakeholder ate here provided as a result of implementing the methodology addressed in Section 2 of this document.

The HOUSEFUL stakeholders are defined as:

Those organisations that show interest and/or influence in the context of circular economy in the building sector and the related solutions developed through the lifetime of the project, both at a general scale and more specifically in the nearby communities of the project demo-site buildings.

Using the above definition of the HOUSEFUL stakeholders, the project partners have generated a stakeholder database of organisations and initiatives from across Europe that are involved in circular economy and the housing sector. Individuals were not the target of this research. Therefore, the contents of the database are of organisations and initiatives identified in relation to circular economy in the European housing sector.

The information for this database has been obtained through the consultation process described in section 2. Figure 4 provides a graphical representation of the process involved in obtaining the results, which is further described below.
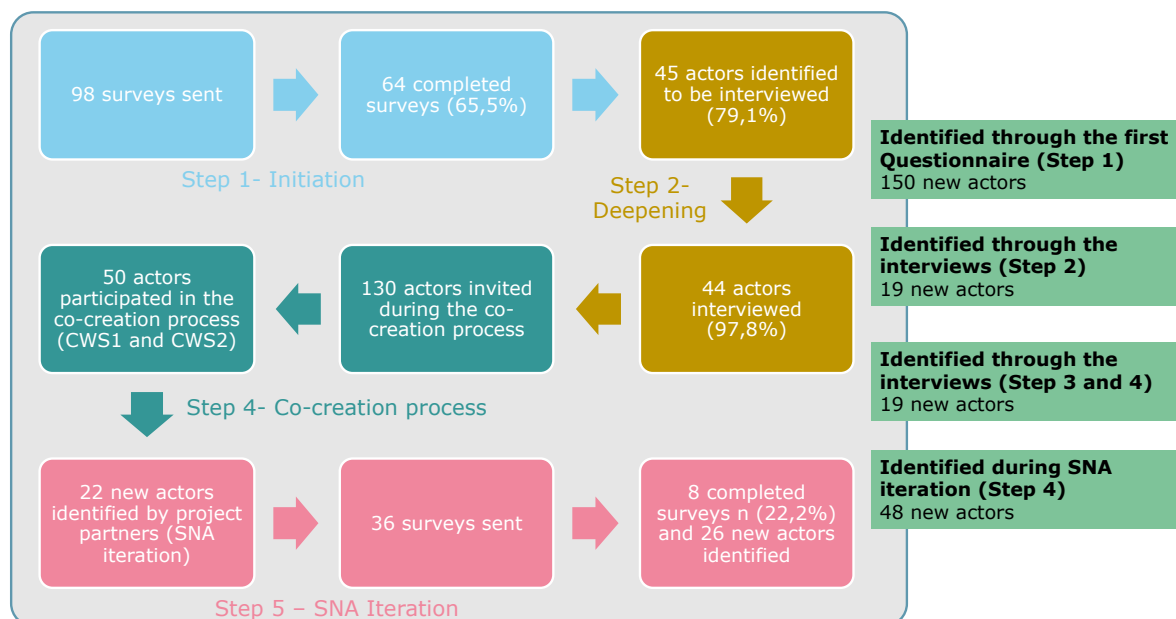
Figure 4. Process results of implementing the methodology.

A total of 370 organisations and initiatives have been identified through this process. The figure above displayed the results of the implementation of the methodology process:

- A total of 72 organisations answered the survey completely of the 134 surveys sent (step 1 and step 5). For some questionnaires which were completed partially we could use the information but for others, where the questionnaire was more than 50% incomplete, they were disregarded.

- These organisations and initiatives are connected to each other in total of 1781 interconnections.

- Of the survey respondents 68% were male and 31% were female. The majority (64%) of the age structure of the respondents were between 30 and 49 years old, whereas 34% were above 50 years old and 2% were between 18 and 29 years old.

- Regarding their geographical context, 44% are related to the Spanish context,34% are related to the Austrian context and 22% to the European context.

- A total of 45 stakeholders were identified to be interviewed (step 3 of the methodology) following the analysis of the surveys received. Of these, 44 stakeholders were interviewed, and 1 focus group was undertaken. At the time of writing this report further interviews and focus group are being undertaken to inhabitants of the demo-site buildings and project owners.

- Following this process, 43 new stakeholders and 10 new initiatives were identified.

- A total of 50 actors have participated (not counting on HOUSEFUL Partners) in the co-creation workshops (step 4 of the methodology), representing all relevant target groups per each demo-site building.

It is important to highlight that for the local context of demo-sites 2 and 3 that, interviews were carried out before the implementation of the questionnaire s. In this case 8 stakeholders have answered the questionnaire after being interviewed according to section 2.3.

As detailed in the methodology (section 2), during the project kick-off meeting, the stakeholder identification process was initiated. This allowed us to identify what we would eventually be 35% of the total stakeholder database (as it is currently).

Following this, the first consultation process (the questionnaire) to further stakeholders outside of the project consortium was undertaken amounting in 41% of the current set of stakeholders that have so far been identified. A further 12% of the total stakeholders in the database were identified during the interview process. The co-creation process and the SNA iteration then allowed for the identification of a further 12% of the stakeholders in the final database. Following this process we can confidently conclude that the snowballing process was complete as we acknowledge the saturation and repetition of stakeholders identified.

STAKEHOLDER IDENTIFICATION PROCESS
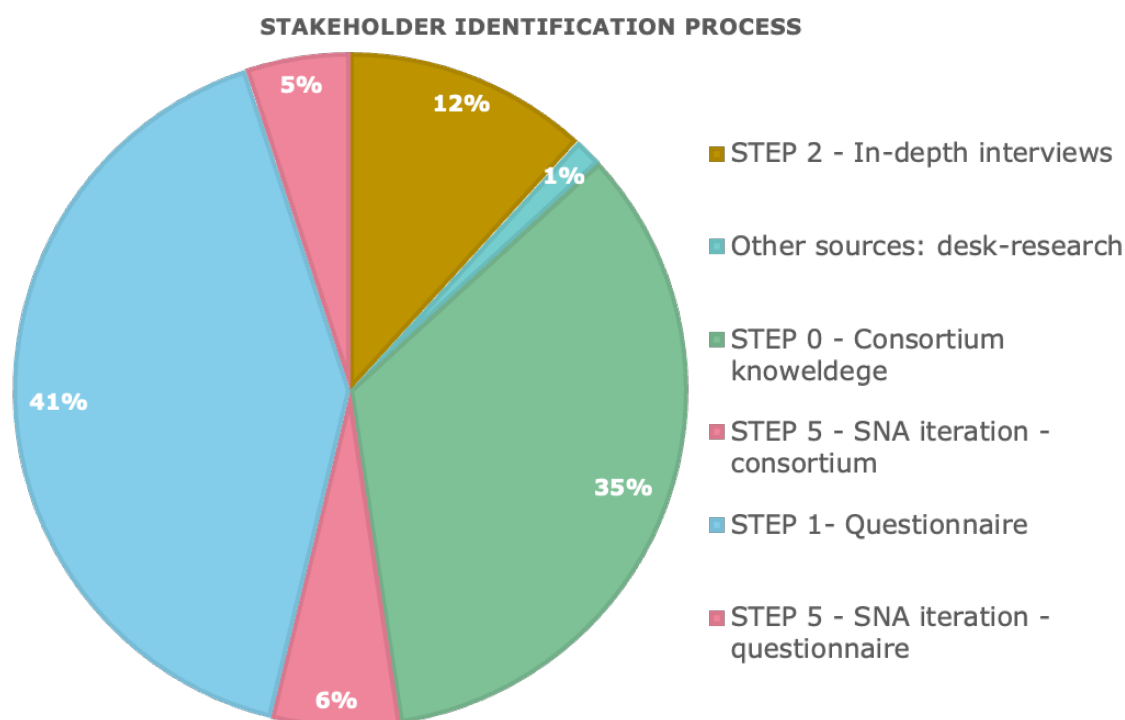
Figure 5 Percentage share of stakeholders identified in the snowballing process.

Data of the number of stakeholders participating in the HOUSEFUL actions leading to engagement

The figure below shows the quantity of stakeholders that have participated in each of the steps that involved different forms of engagement (questionnaires, interviews, focus groups and the workshops in the co-creation process):

Number of stakeholders participating in actions generating engagement in Houseful
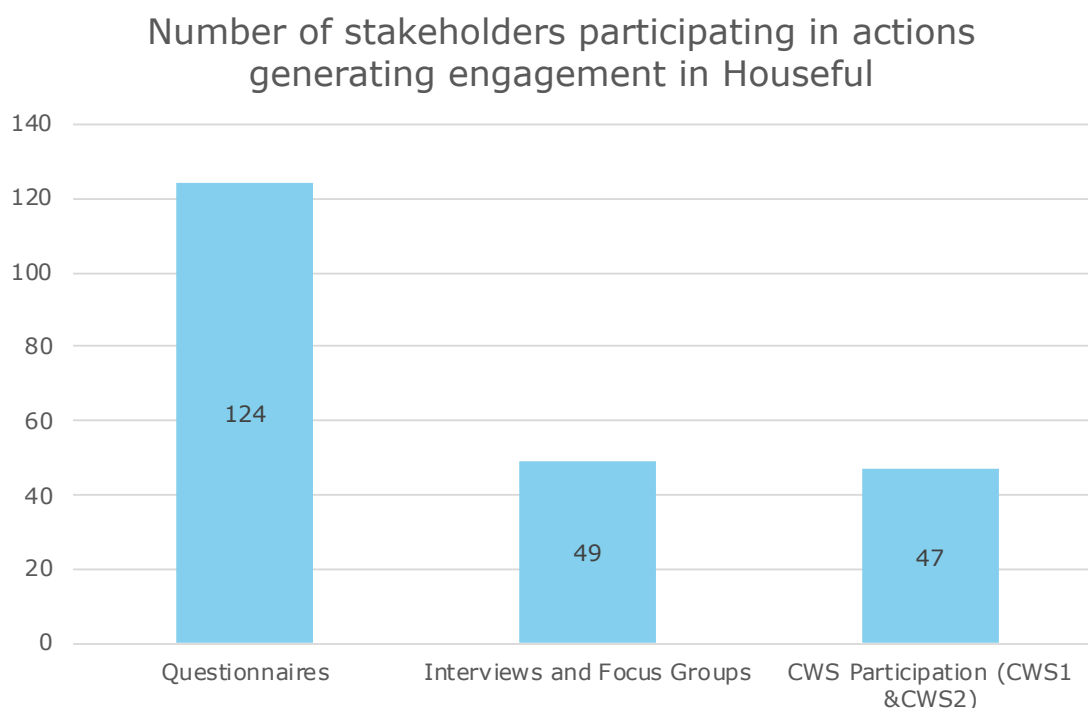
Figure 6. Number of stakeholders participating in actions generating engagement in HOUSEFUL

Target groups addressed

In the process of identifying stakeholders, at the beginning of the process, we addressed stakeholders considered to be experts or with a high influence in the decision-making process. We started the snowballing process with the consortium (mainly composed of experts in the housing sector or with expertise in circular economy). Naturally, the key linkages identified with other stakeholders are of similar organisations or those with high influence with whom they can interact. Figure 7 shows an overview of the proportion of stakeholders for each target group. It provides a perspective on the composition of the stakeholders that have been identified. The proportions of stakeholders addressed in Figure 7, from one group or another is not particularly relevant, as the aim to reach all target groups.

The majority of groups addressed are **public agencies** (including the municipalities of Sabadell, Sant Quirze del Valles and Fehring). In the case of demo-site 1 and 2 and 4, the **owners** of the buildings are public agencies and they are thus included under this category. The group of **designers and suppliers** was identified through the consortium knowledge and from the identification during the consulted stakeholders, for all demo-site buildings. We have also addressed the **research community** (universities and research centres in the field of the circular economy

and the housing sector) and the **general public** through CSOs and other citizen associations. These two last groups are representative in all four demo-site buildings,

In the specific case of demo-site 3 (Fehring, Steiermark) the **inhabitants,** which represent the Cambium cooperative (owners of the building), have been interviewed to gain an overarching context of the building. In the case of demo-site 1 (Sabadell, Catalunya) the inhabitants have not yet moved into the flats; however we addressed the community through the Campoamor neighbourhood association (as well as the school that is located in the adjacent building. We undertook the same process in demo-site 2 through consulting the inhabitants through the local association (Sant Quirze neighbourhood association). In the case of demo-site 4 we addressed the community by contacting the organisation that is dealing with the community management of the building. The reason that individual inhabitants have not been adjudged to have quantitative relevance in this study is because during the consultation process, individuals were not targeted in order to conform with confidentiality issues and ethics of EU projects. Moreover, as we have addressed organisations, if provided the opportunity to identify at least one inhabitant association from demo-sites 1, 2 and 3.

Figure 7. Share of stakeholder categories in the consultation process.

In a further category we have included the third sector, and the funding organisations groups (private investors, investment companies, funding organisations, etc.).

The table below provides further detail to Figure 7 through a description of the type of organisations that have been identified in the stakeholder database for each type of target group.

Table 4. description of the type of organisations that have been identified in the stakeholder database for each type of target group

Stakeholder target groups	Description of the identified organisations
Initiatives	In the stakeholder consultation phase, initiatives have been mentioned that do not correspond to organisations or entities, but rather to programs, projects, etc. that are more temporary in nature. Some of them are of a more regional nature, such as the Circular Economy Observatory of Catalonia or the Austrian Circular Economy platform, Circular Futures, etc. Initiatives are also mentioned, such as similar European projects (Buildings and Materials Banks (BAMB) Grant Agreement Number: 642384).
Research	The type of institutions mentioned, although there are more general ones, are often specialised research centres in Austria, Spain, and more specifically in Vienna and Catalonia. Specific centres have been mentioned in relation to energy, materials and construction.
Supplier	In the group of suppliers, the stakeholders identified are generally construction companies from both Austria and Spain, specialised guilds of the construction sector, and real estate companies associated with the areas close to HOUSEFUL's demo-site buildings.
Designers	In the group of designers, mainly architects, sustainable architecture offices, consultancies specialised in circular economy and professional architectural associations both in Catalonia and Austria have been mentioned. European consultancies with a broader scope were also mentioned.
Public Agencies	The public agencies identified are mostly at regional and national level related to the HOUSEFUL demo sites in the sectors of environment, climate, energy, water land management, housing, citizen care and social welfare.
Inhabitants	In this process of identifying stakeholders we did not identify "individuals", thus the type of organisations in this group are neighbourhood associations related to HOUSEFUL's demo-site buildings, hence the reason for the low number identified.
Policy makers (regional, national)	The policy makers identified are generally associated with Austrian and Spanish demo-site buildings.
Policy makers (Municipalities)	We have differentiated those policy makers from local level: city councils, and their respective departments. Those identified are the ones that have had an impact on the development of demo-sites, especially in the case of the demo-sites 1, 2 and 4, which are publicly managed.
Funding organisations	this category includes those organisations or initiatives that have the capacity to finance projects that can favour the inclusion of the circular economy in housing. They have been

	identified through other activities in Houseful (policy analysis and investor analysis).
ST6 Others	This group includes companies not associated with the group of suppliers or designers, clusters and associations, local media agencies, NGOs working in the field of environment of a more local character,

4.2. Mapping the Stakeholders: : How the stakeholders are connected

The stakeholder map presented in Figure 8 was created using the Kumu software, it assists in exploring the complex web and alignment of the key stakeholders within the HOUSEFUL project. The main connections of the network can be seen in an overview on the map, as well as specific in-formation for each organisation.

This map has been embedded and published on the HOUSEFUL website and can be accessed through the following page, created with joint efforts from WP7-*Communication*. The map will also be operative within HOUSEFUL solution nr.0, the Software as a Service, SAAS platform (*WP6 – Market analysis*)

Basic Tips to interpret the HOUSEFUL Stakeholder map

- The map consists of two figures essentially the nodes and their connections. These nodes represent the organizations/stakeholders which have been identified and connected to one another, as indicated by each stakeholder during the consultation process. Those that are not connected do not mean that they are unrelated, but that they have not been identified as a connection within this map.

- In addition, as it is an interactive map, by clicking on each of the nodes, you can explore more information of each stakeholder. Especially in the case of those organizations that have answered the consultation process (questionnaire and interview). Those organizations that do not have more information were identified during the questionnaires and interviews through the snowball process

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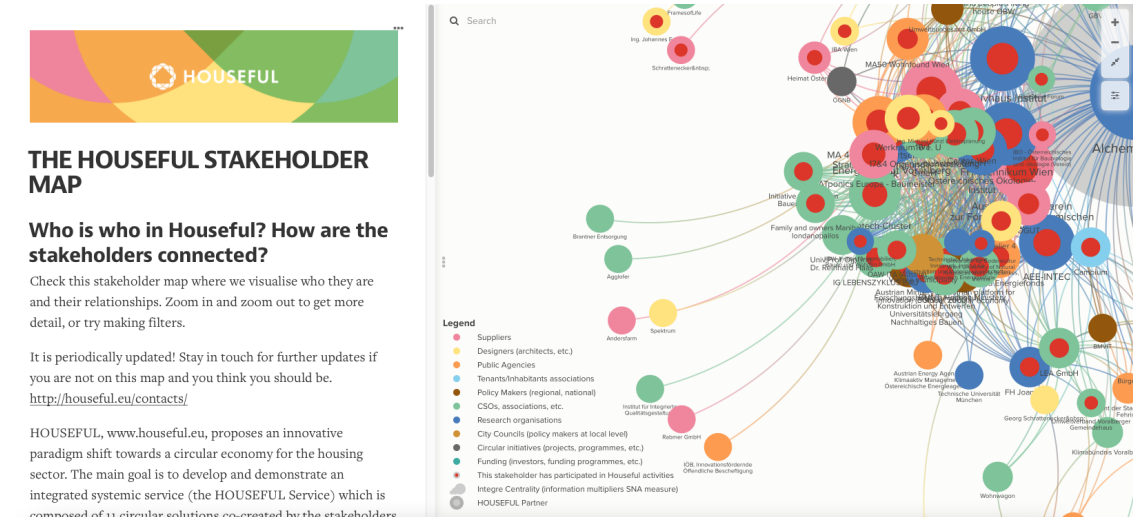
Figure 8. The HOUSEFUL social structure organised per target group (Kumu Screenshot, full available HERE)

With the database of stakeholders created and updated we have been able to create different views of the stakeholder maps as follows in the table below, where we also provide the link to them:

Table 5. Stakeholder maps links to the different views

Stakeholder map view
General scale and Target groups and SNA metric Indegree (see more information in section 4.2.2)
General scale and Target groups and SNA metric Betweenness (see more information in section 4.2.2)
General scale by communities detected per contexts
Regional view and target groups of Austrian Context
Regional view and target groups of Spanish Context
Local view and target groups Demo-site 1
Local view and target groups Demo-site 2
Local view and target groups Demo-site 3
Local view and target groups Demo-site 4
View about the identification process and stakeholders engaged

4.2.1. Community detection

Exploring the social structure of the stakeholder database we can observe some communities detected organized as the geographical contexts (see **¡Error! No se encuentra el origen de la referencia.**, where the Spanish area is in orange, Austrian area is in green and General European Housing Sector is in grey). Although _____ older map, not many connections between _____ observed. After the SNA iteration (step 5 of the _____ connections are observed, stakeholders have _____ ns in other contexts (Figure 9).
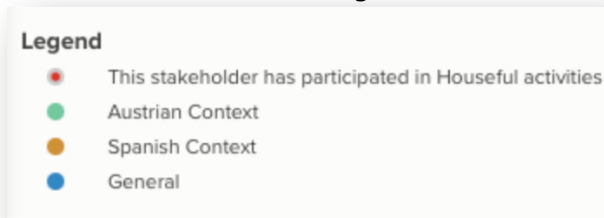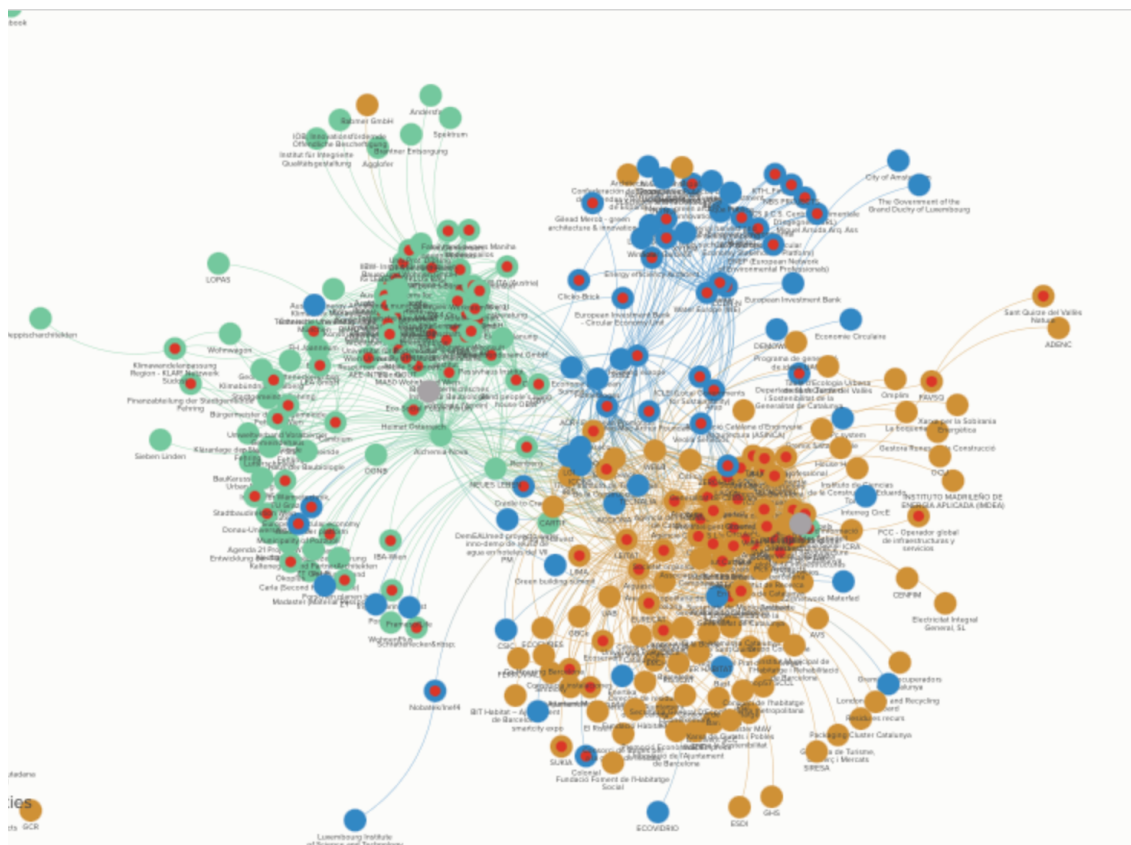
Figure 9. The current (2022) HOUSEFUL social structure per contexts (Austrian, Spanish and general).

The map shows that there are three groups of aggregations: brown (stakeholders from the Spanish area), blue (stakeholders from the more European area), and brown (stakeholders from the Spanish area). The Kumu community detection formula groups the nodes based on the density of connections detected. A higher density is observed in the nodes of Austrian stakeholders, which implies that according to the data collected in questionnaires, Austrian stakeholders are more interconnected with each other.

Stakeholders from the general context are well associated with the other two communities (Austrian and Spanish). The red concentric circle shows the organisations that have participated in HOUSEFUL engagement actions. It is precisely where there is a higher density of nodes (of connections) that there are participants in HOUSEFUL activities.

The current final version of the stakeholder map has increased in the number of connections in the **general** context of the organisations. The snowballing process provided the opportunity for many new organisations to be identified at a general European context with regards to influential organisations in the housing sector and/or in the circular economy approach. Social Network analysis: key organisations and their connections

The sub-sections below further explore the characteristics of the HOUSEFUL social network through analysing the specific SNA structural metrics. The SNA structural metrics are broken down into 1) Betweenness Centrality, and 2) Indegree.

As already highlighted in Section 2 of this report, the values for each of the SNA metrics gathered are based on graph theory and centrality measures. The results are displayed in a table with a ranking of the values gathered for each of the metrics. Each metric is shown as a ranking of the top 3 in the overall HOUSEFUL context, and then at each scale of Austria and Spain.

- **Information controllers (Betweenness Centrality)**

The Betweenness Centrality metric measures how many times an organisation lies on the shortest path between two other organisations. In a general context, the organisations with high *Betweenness* (indicated by a high score) have more control over the flow of information and act as key bridges within the network, on the contrary they could also be potential single points of failure. At this final stage of the mapping process, the organisations that have greatest control for information flow at each of the scales (General-European, Austrian, and Spanish scale) are indicated in the Table 6 below (we have excluded HOUSEFUL partners from this ranking):

Rank (TOTAL)	Label	Value of betweeness (times an organisation lies on the shortest path between two other organisations)
GENERAL SCALEL CONTEXT		
#1	ACR+ Promotion (CSO)	0.057
#3	Environmental agency, Catalan Government (Policy maker)	0.025
#4	Waste Catalan Agency (Public Agency)	0.023
AUSTRIAN SCALE CONTEXT		
#6	AEE-Intec (Research)	0.261
#16	MA 48 - Abfallwirtschaft, Straßenreinigung und Fuhrpark (Public Agency)	0.034
#20	Cleantech-Cluster (CSO)	0.028
SPANISH SCALE CONTEXT		
#4	The Catalan Waste Agency (Public Agency)	0.076
#5	Environmental agency, Catalan Government (Policy maker)	0.054
#6	Local Energy Agency in Barcelona (Public Agency)	0.036

Table 6 SNA metric – Betweenness

The results of calculating betweenness at the European scale is interactively shown through this LINK. In this scale, in addition to the HOUSEFUL partners that have a central role, it is shown that general organisations such as ACR+ have an important role as connectors in the network of stakeholders. At the regional scales, there are important public waste and environment agencies, specifically in the Catalan area. The latter makes sense since some of these agencies have a strong international

perspective. Precisely, in the Catalan demo-site buildings 1 and 2 being social housing buildings, those public agencies become more relevant. In Austria, the most relevant organisations are in the field of research and service suppliers (which are precisely hybrids of research and innovation).

With this map and its results we can see who more control over the flow of information with regards to circular economy or sustainability in the Housing sector can have, showing that public agencies in social housing projects are a key to keep control of the information, i.e. to get them engaged over the process. Also those key large networks such as ACR+ in the general scale.

4.2.2. Leaders for knowledge exchange (Indegree)

The Indegree metric measures the number of incoming connections for an organisation (i.e. the number of organisations that mentioned them as a relevant stakeholder). The organisations with a high Indegree (indicated by a high score) can be considered stakeholder leaders where others see them as a source of advice, expertise, or information. At this stage of the mapping process, the organisations that are identified as the greatest influencers per each of the context are the following.

Table 7 SNA metric – Indegree – Who are the influencers?

Rank (TOTAL)	Label	Value of indegree (nr. of incoming connections)
GENERAL SCALE		
#1	Catalan Waste Agency (Public Agency)	52
#2	Catalan Water Partnership (CSOs)	52
#3	Catalan Water Agency (Public Agency)	51
AUSTRIAN SCALE		
#1	Austria Solar – Verein zur Förderung der thermischen Solarenergie (Supplier)	49
#2	Energieinstitut Vorarlberg (Research)	48
#3	FH Technikum Wien (Research)	51
CATALONIAN SCALE		
#1	Waste Catalan Agency (Public Agency)	52
#2	Sostre Cívic (CSOs)	49
#3	Water Catalan Agency (Public Agency)	51

The results of calculating the indegree measure (who are the leaders) in the general context are shown in this LINK. In this general scale, Catalan public agencies and policy makers have taken predominance as those that have the greatest control of information on circular economy and housing.

Being an unforeseen result, we should mention that this is representing the Houseful perspective, where we have had high participation and interest from Catalan public agencies over the process (two Houseful demo-sites are managed by the Catalan government). Although the snowballing process to identify stakeholders is complete,

those organisations from a more general scale that did not form part of the questionnaire process did not provide information on their connections, showing less relevance

In the Austrian context, organisations from the field of innovation and research in the field of energy are the most relevant for this measure. In Catalonia, the organisation Sostre Cívic (a public initiative to promote cooperatives in social housing) also appears in this metric, which has shown great interest in being a follower building (activity framed in WP6- market analysis).

4.3. Effective engagement with stakeholders

The concept of **effective engagement** was developed in the Deliverable 3.4, section 3.1. In this section we align the theoretical approached found in the concept review of "effective engagement" with the results observed in the process of engaging with the HOUSEFUL stakeholders through questionnaires (step 1 and 5), interviews (step 2) and the co-creation process. The results of the following sub-sections provide us with a deeper understanding of the barriers and enablers observed to engage with stakeholders during the HOUSEFUL co-creation and consultation processes.

This section is updated from the previous version presented in Deliverable 3.4 with the observations derived from the co-creation process (step 4) in the discussions obtained in the workshops and modifications related to the observations from external reviewers. The results of the entire co-creation process are to be collected in Deliverable 3.3 once all the workshops have taken place.

The table below summarises the identified enablers and barriers including quotations (in italics) from the consultation process of the 45 interviewed stakeholders (in step 2 of the methodology - deepening).

Table 8. Stakeholder identified enablers for effective engagement.

Enablers		
Regarding the characteristics of the HOUSEFUL Solutions	A requirement for low maintenance needs	*Maintenance is a very important issue. This should be easy and cheap, if we add difficulty and it is more expensive than a conventional system (in a way that in the final balance we have no savings), it is not worth it.*
	Stepwise implementation	*[…] in each building or in each community, you can implement for example solar panels or better recycling of water, but not all at once […]*
	Costs/Benefits are understood by users	*Such solutions are accepted, when it comes down to any added value for the individual people, be it lower costs …or longer useful life …, it would make such solutions… attractive*
	User's habits are known, and the co-creation process is built upon.	*That this [CEBOs are] exactly thought for people and their habits. I mean to know their habits to see how they can change, because otherwise they will not be able remain up to date. In the end we all have our very rooted daily routines.*

	Creating a feeling of need for CE solutions and for ownership of the project.	*…, if you have managed to get attached to the project and have a sense of belonging regarding these measures, these things will be sustainable over time. And how is this achieved? Well, involving people but also as the same people who manage the maintenance of these systems that put in place […]*
About the engagement process	Balanced representation of stakeholders and new actors are engaged through the process	*Then, I believe there should be a broad and balanced representation of the different actors of the sector involved in the constructive process up to the final user. It would be important to have all the actors of the sector represented equitably.*
	Use of a common language	(deductive evidence)
	Community feeling to facilitate engagement	*… if you have managed to get attached to the project and have a sense of belonging regarding these measures, these things will be sustainable over time. And how is this achieved? …, involving people but also the same people who manage the maintenance of these systems that are placed […]*
	Users empowerment and involvement from the onset of the project	*All these actors must be involved and participate in the process from the beginning because this type of solution is not immediate, they need time and maturity to find the right solution*
	Use of information material in a form of publicity	*I think it is very important to have a lot of publicity. That experts in the field come and look at it and are involved early in the process*
	Political and decision makers need to be engaged	*To create change we need to inform, invite the political decision makers.*

Table 9. Stakeholder identified barriers to effective engagement.

Barriers for effective engagement		
About Housing sector (social housing and cooperatives)	Sustainability is not a priority for users' profile of social housing in general, therefore the needs or benefits of circular solutions cannot easily become a priority.	*There are neighbours who do not pay the energy bill, some do, they consume... yes there are many who come from not using anything in order to pay a small energy bill, to not have a high bill. With these kinds of users, you do not reduce anything, it is more increasing the comfort of families. Here, at the level of refurbishment, it is about using materials that are more efficient, more sustainable*
	In social housing, user's rotation is high in some cases, this would undermine effective engagement (even though rotation is decreasing)	*There is also a whole part of work with the neighbours that we have to look at how we do it. There will be a lot of rotation of people that should be looked at how to manage it. We have to explain to them what they can throw where and how ... a job must be done and, as XXX has told you, their priorities are different.*

	Negative perception about secure investments of financing sector upon cooperatives	*Well, a cooperative can help. One that gets involved in a cooperative to buy a house, usually is a person more conscious for these subjects. Although, the cooperative aspect is not well seen in the market, unfortunately. [Here there is a cooperative experience, isn't it?] Yes, but when they are going to buy the houses, it is well seen that the seller isn't a cooperative. Because when it is through a cooperative it seems that it is going to be cheaper for you at the beginning but then when there's a problem, you are the promotor, so people are getting scared with this subject.*
About circular economy and HOUSEFUL solutions	CE is perceived as an academic topic far from implementation and with uncertainties	*In Vienna I would say, that there is no reason, the need is missing. In theory it is known, that we have to react to climate change, but circular economy as a solution is not in the foreground. There is a lack of awareness. Circular economy is an academic topic, it is not discussed in mainstream media or discussions.*
	Lack of coordination between the project pace and bureaucratic activities	*I believe that the main barrier to many innovations of an environmental nature are basically legislative. In all the issues of reuse we always end up dealing with the issue of legislation, no one knows exactly to what extent what they are doing if reuse is applicable, if there is a problem, or not, when we can apply this water when we cannot?*
	Pace of the project in comparison to other factors that affects it, such as the permitting process	(deductive evidence)
	Difficulty in addressing the different local context/interests	(deductive evidence)
	Perception that the project does not arise from user's necessity (bottom-up) but is top-down.	*These projects do not arise from a necessity that a user detects and for which he asks for a solution, it arises from a consortium of entities. It is a top-down approach and when we are dealing with a top-down approach there is a lot of work to be done at the bottom, because the need isn't felt. When the user feels that doesn't have a need… that is an extra barrier when it comes to implement new solutions and it is harder to do it.*
About the engagement process	Lack of knowledge and awareness along the value chain of the solutions	*At the moment people do not know about their actual behaviour, how resource consuming it is and they do not know about alternatives. That is why educational work is so important.*
	Lack of agreement between involved actors	(deductive evidence)
	Lack of trust between engaged actors (users and policy makers or public administration in the housing sector)	*Users can't take decisions because they don't know how to do it.*

Taking the inputs from the stakeholders on the barriers and enablers (tables above) together with the reflections from the from the consultation and the co-creation process we provide the lessons learnt with regards how effective engagement can takes place through a co-creation process. They are organised based on the aspects identified in the literature review in section 3.1.1 of Deliverable 3.4: representativeness, early engagement, continuity and long term, ways of interaction, participatory models, effective communication and the goal of engagement.

4.3.1. Lessons Learnt: Representativeness

Selecting and engaging the key influential stakeholders is vital in the co-creation process. Widely agreed was that both stakeholders from the housing sector and circular economy (innovation) should be key influential stakeholders. But to have representativeness, the target group from the tenants is the key. Context-wise we can also observe some differences. In Vienna for instance, the engaged actors stated that more technical approaches and social engagement is not perceived as a major issue. In contrary to that, in Catalonia, where both demo-site are social housing, integrating the social aspects are seen much more challenging (specially for the public agencies).

Interviewees have also expressed their concerns with regards to circularity in **social housing** (especially in the context of demo-site 1 and 2, Catalonia and demo-site 4, Vienna). In this sense consulted stakeholders referred to the difficulty to engage with some tenants at this very early stage for various reasons. One reason that was pointed out was, that some of the demo-sites addressed users from socially vulnerable profiles not having time/interest available to participate in innovation actions. These tenants as users of HOUSEFUL solutions are perceived by the building managers to have conflictive profiles leading to the misuse of housing infrastructure. This has led to a deep lack of trust towards the dwellers from the building administration in terms of maintenance as well as the use of circular economy technologies. Other reasons that can lack representativeness are that, in some cases, the tenants have not moved to live in the houses, so they still did not see the benefit in engaging in this process. Therefore, we (the HOUSEFUL project partners) are only engaging with them in the later stages of the project. Regarding the motivational elements, another reason for tenants to get engaged is when their daily essential priorities are not covered (health and food).

Furthermore, in relation to this, the importance of maintaining a high degree of flexibility for those entering and those leaving the process has been stressed, in order to have a balanced representation of stakeholders and new actors through the entire process.

A representative role that we have observed that has provided specific benefit, especially in the case of the demo-site buildings in Catalonia (social housing), is the social affairs department of the municipality in question. The participation of this

entity helps to understand the reality of the territory, how it can be integrated with local policies in place. In these two cases in Sabadell and Sant Quirze del Vallés, there have been representatives of these bodies and it has been very effective in giving unity and meaning to the process of engaging with local actors.

4.3.2. Lessons Learnt: Early engagement

During the consultations, all participants agreed that **engaging from the beginning of the process** allows time to consolidate the right solutions and to seek a commitment from the involved parties. However, some actors from the public sector have shown some reluctance in being involved early on. They expressed that, with early engagement the process is not concrete and thus should be defined and in alignment with the social housing governance process before they become involved. Indeed, we have also found over the co-creation process that involving tenants from social housing and with rental schemes, could lead to false expectations regarding how the project could benefit them. This doesn't mean that early awareness and communication cannot take place, but effective engagement with these tenants can better take place once they move to their houses and it is certain that they will be living there during a certain period. This is especially true for those who are renting or for those situations where inhabitants rotate more frequently as part of the social housing process.

On the contrary, we have found that in the cooperative model from Cambium, early engagement has emerged naturally among the tenants, leading to a continuous and natural process of participation among the main stakeholders.

4.3.3. Lessons Learnt: Continuity and sustainability

A consortium such as HOUSEFUL can also create a trusting environment with engaged stakeholders. Therefore, a *strong collaboration of consortium partners* is desired to implement solutions. This should be coupled with the involvement of the entire spectrum of stakeholders (from designers to installers and end users) to make solutions effective through a co-creation process.

In this sense, the continuity of the process must be guaranteed on several levels, on the one hand that the HOUSEFUL project itself integrates the co-creation ideas into its own development process, and on the other that long-term implementation mechanisms are sought ensuring sustainability of the ideas. In this sense, a Co-creation Task Force has been created during the process with the aim to the development and integration of all co-creation ideas within the project.

Thinking in terms of the **long-term housing management**, the literature review (see Deliverable 3.4 (section 3)) evidenced the benefits of **co-management** of circular solutions as well as the community stability in Housing. We have included a

shortened list regarding the several tools and methods have been discussed and mentioned during the consultation process:

- Speaking of sustainability implies changing systems of reasoning that are already deeply rooted within our consumer society. Therefore, in this type of process it would be useful to draw lessons learned from the formal education system that will allow access to this information starting with the youth.

- Creating a governance mechanism of regular meetings with users (such as working commissions) with the objective to build upon the HOUSEFUL results.

- To have experts on social engagement involved with a budget to ensure **continuity**. Facilitation experts should be involved to seek cooperation with them to ensure long-term effectiveness of circular solutions

- Seeking funding opportunities to guarantee continuity: this could be through public agencies, private funding, etc. (for e.g. IBÖ in Austria)

Responding to some of the approaches suggested below, the Step 4 of the methodology addressed the co-creation strategy of HOUSEFUL where this long-term aspect has been addressed. Three of the co-creation ideas (1.4, 2.3 and 4.3, from section 4.3) elaborated further this engagement aspect within their respective demo-site buildings. It is precisely the social support in the long-term implementation of the HOUSEFUL solutions that is indispensable in guaranteeing their implementation. To this end, different tools have been developed to guarantee sustainability, which vary

according to each building. These are:

Table 10. The combination of the engagement methods and tools mentioned

Type of method for engagement	Mentioned tools for engagement
Events	• Symposiums (for general public or technical audience) • Open conferences to share experiences • Workshops (i.e. value chain, of joint possibilities) • Field visits (to successful cases) • Trainings of all actors along the value chain (i.e. users for maintenance) • Bi-lateral meetings (interviews, focus groups)
Ways of engagement *(co-management)*	• Working commissions (in the spirit of cooperatives) • Working table • Cooperatives as source for wider co-creation processes
Tools	• Simulations of what is being implemented • Users guidebook • Brochures to promote innovative solutions or buildings (to create a sense of ownership). • Information campaigns from the city that are both B2B and B2C. • Participation in Circular hubs and support centres • Podcasts, videos, etc.
Others	• Word- of -mouth • Exchange platforms (adapted to each country to facilitate engagement of SMEs). • Information campaigns • Education (experts conceive the need to educate non-experts (specially users but also promoters or others) but education and training is in fact demanded).

During the course of the project, various modes of engagement have undoubtedly been explored, although one particularly relevant has been the advent of online methods due to the COVID19 pandemic and the physical distancing imposed during the years 2020 and 2021. During this period, only online actions between stakeholders were adopted (for interviews, co-creation workshops, bilateral meetings, etc.). This mode of engagement was widely accepted. Virtual interaction has ensured interaction and continued engagement during this period, where multidirectional communication has always been sought through online participatory mechanisms:

surveys, online whiteboards, and other modes of innovative online engagement actions.

In each demo-site building, the co-creation process and the ideas derived from it have been addressing and adapted the tools for interaction with stakeholders (more specifically Co-creation ideas 1.2, 2.1, 3.2 and 4.2). In general, in one form or another in HOUSEFUL, diverse activities have been generated by each of the tools mentioned in Table 10. The combination of the engagement methods and tools. Some that can be mentioned are the following:

- Development of communication material to visualise the benefits of the HOUSEFUL solutions (related to the co-creation ideas 1.2, 2.1 and 3.2).

- Development of local communication action plans based on the local needs and resources of each demo-site building (this has been co-developed with WP7).

- Specific working groups within WP3: the co-creation task force, alignment with existing working groups (demo- site 3 in Cambium, and demo-site 2 in Sant Quirze)

4.3.4. Lessons Learnt: Participatory models

The **role of cooperatives** in the housing sector has been discussed as they are one of the co-management tools most used that could have significant impact for the wider implementation of the HOUSEFUL solutions. The interviewed cooperatives have had difficulty to get funding for their initiatives requiring a lot of effort from their side. Cooperatives have established CE approaches in buildings and for that the community feeling, empowerment and engagement from the onset of all actors was crucial (beginning with interviews, simulations of methods used). Actors participated in the design right up to the end of the project. The drawbacks are seen as limited financing for cooperatives which have created significant budget constraints.

A fundamental difference, that can be found between the different case studies, is whether mechanisms for prior participation among stakeholders already exists. This does not yet exist in the demo-site buildings: 1,2 or 4. However, the cooperative organisation on which the governance of demo-site 3 is based in Cambium guarantees a participatory model that has already been created and that works. Another example found is the case of dialogue tables that already exist in the management of the municipalities, as is the case of Sant Quirze, for which HOUSEFUL participated in this dialogue table of the housing and circular economy sector in February 2020.

4.3.5. Lessons Learnt: Effective communication

Some aspects have been mentioned during the consultations for which effective communication (through coordinated actions with WP7) is essential. First, it is essential to communicate in such a way that the benefits of the HOUSEFUL solutions are understood, as well as the problems that are being solved. As mentioned in section

4.3.4, three of the co-creation ideas addressed these specific purposes (i.e. co-creation ideas 1.2, 2.1 and 3.2).

The use of terminology that is mutually comprehensible and generates understanding was also emphasised. The communication materials created addressing local actors has always adopted this aspect. Contents addressing non-expertise audiences was carefully reviewed by the HOUSEFUL partners. At the same time, the need for wider and more general advertising was stressed, in order to reach the majority of the population and bring them closer to the concepts of CE.

Finally, it is important to know how to correctly transfer the inputs generated in the co-creation process to the technical development of the project and to give feedback to the stakeholders. All this must integrate a communicative process in a bottom-up approach. The HOUSEFUL co-creation strategy includes horizontal actions throughout its implementation to ensure this integration and the bottom-up approach through the Co-creation task force (see Deliverable 3.3 and also the services outlined in Section 5.2 of this report).

4.3.6. Lessons Learnt: the goal and benefits for engagement

Although it has already been discussed implicitly in some of the previous sections, the previous literature review evidenced the need to set a goal for the co-creation process that favours social engagement, and with that, to make clear the benefits that the project will bring to the participating community.

This is a matter that arose during the consultations in the step 1 and 2 of the methodology, but also during the co-creation process (step 4). In the consultations it is evident that, in order to have the commitment of the stakeholders, they must be represented in the very objective of the project, with their own ideas and understanding of how exactly the project will help to improve their lives or professions. Participants mentioned the need to clearly explain the benefits of implementing circular solutions. In this regard, proactive behaviour and engagement can be increased if the usage of the solutions generates **positive local economic impacts** for the inhabitants.

The HOUSEFUL co-creation process has had the clear objective of generating ideas to improve the implementation of HOUSEFUL solutions in the demonstration buildings of the project. The whole process has been designed with the same objective in mind. Care has been taken to ensure that feedback was offered to the participants of each action, in fact the co-creative process closes with the validation workshops (CWS3) and explanatory visits to the buildings. In addition, after each event, a CWS report provided information on how the ideas generated would be integrated into the project and specifically shared with the participants of the CWS.

Visualising the benefits of the HOUSEFUL solutions has been specified in three co-creation ideas (1.2, 2.1 and 3.2) and further detailed above. Their derived actions range from communication actions to the development of functionalities in the SaaS platform (HOUSEFUL solution nr.0). With regards to the SaaS platform, some

functionalities already include the visualisation of benefits (as integrated indicators in WP2 and WP5) at the building level. Additionally, the SaaS platform will also address a functionality at individual user level, addressed for tenants who want to see their performance, with associated data protection rights as it involves daily private behaviour from individuals.

4.4. Effective engagement per target group

During the stakeholder consultations, in the interview process (step 3 of the methodology), and the behaviour observed during the co-creation process (step 4 of the methodology) the potential role of the target groups in the engagement of the development of HOUSEFUL solutions was explored. The table below details the roles of the organisations and their ability to influence the process that have been responded to by each of the stakeholder groups interviewed. The results are combined for all of the demo-sites.

Table 11. Roles per target group derived from results of the consultation process
and the co-creation actions

Stakeholder group	Identified roles from the engagement actions
Suppliers	• Transfer the ideas to real life settings and to innovate with solutions with low energy consumption, efficient water cycle, etc. • Take part in related associations and initiatives about circular economy in the housing sector • Provide consulting services for building owners, building developers, and decision-makers • Take part in the local participatory actions to understand local needs and also to provide required knowledge through training. • Adopt new legislation for the circular solutions
Designers	• Act as facilitators in the engagement processes in order to adopt a holistic or general vision of the project. They are usually well positioned in terms of relationships in the social structure • Be active in the social housing process and to not disconnect in the process after the design phase of the value chain. • Take an active role if there is a cooperative model
Public Agencies	• Be an "*agent of change*": they can adopt suggested recommendations in their procedures and procurements adopting circular economy approaches • Support the social inclusiveness of the circular solutions, circularity should be affordable to all. • Integrate the different sectors to work towards circular economy • Promote the adoption of EC policies
Inhabitants/Tenants	• Play a key role in the decision-making process and in the co-management process • Participate in training actions to obtain a full understanding of the use and correct maintenance for the solutions • Provide feedback to the other key stakeholders to improve the processes.

	• Take responsibility in the generation of community cohesion with regards to the governance of circular systems
Policy Makers	**(Municipalities and city planners)** • Be an "*agent of change*": they can adopt suggested recommendation in their procedures and procurements adopting circular economy approaches. They are the key element to mobilise actions in their regions. • Support the social inclusiveness of the circular solutions, circularity should be affordable for all.
Others (CSOs, clusters association, research community)	• Foster the cradle-to-cradle approach • Provide trust in the engagement process • Support the implementation of HOUSEFUL solutions • Create awareness regarding the HOUSEFUL solutions • Contribute to the networking of the solutions: clusters, create new projects, etc.
Funding sector/investors	• Maximise the impact of circularity in the long term. • Widen the implementation of co-created solutions • Foster the replicability of the HOUSEFUL solutions
Building owners and managers	• Include engagement actions as part of the building management tasks • Ensure that there is a circularity agent designated for its building • Ensure that there is community cohesion in the building and with the neighbourhood

When looking at the particularities in each of the stakeholder's categories, the figure below shows the different desired modes of engagement that were evidenced during the consultation and also according to their behaviour during the co-creation process. This is a general reflection responding to the observed general trends as well as part of the consultation completed in step 1 of the methodology.

Table 12. The combination of engagement methods and tools per target groups

Target group	Desired engagement method							
	Co-creation workshops	Other face to face meetings	Online meetings	Interviews	Passive role (receive news)	Long term (co-management)	Tools	Training
Designers/Architects	✓	✓	✓	✓	✓	✓	✓	✓
Policy Makers (regional and national level)	✓	✓		✓		✓	✓	✓
Municipalities	✓			✓		✓	✓	✓
Public Agencies	✓			✓		✓		
Research	✓	✓	✓			✓	✓	✓
Suppliers	✓	✓	✓	✓	✓	✓	✓	
Tenants from social housing	✓				✓	✓	✓	✓
Inhabitants from cooperatives	✓	✓	✓	✓	✓	✓	✓	✓
Others: Civil society organisations	✓	✓	✓	✓	✓	✓		

The deliverable D3.4 in section 4.4 provides more figures about the desired modes of engagement for the consulted stakeholders. Below we provide a description based on observations from the co-creation process

The **policy makers** and the **public agencies** did not demonstrate specific interest or commitment to be involved in the project co-creation workshops or F2F meetings. However, they expressed interest to be involved through online actions, as well as to be informed over the project development and results. Therefore, as part of the HOUSEFUL actions, they have been engaged through specific technical consultations and actions.

However, with regards to the **municipalities** at the demo-sites, they showed interest in being involved at any time and manner, including the different city departments (such as the housing, social and sustainability departments).Indeed, they all have been involved in the co-creation process throughout the project.

The **CSOs and similar organisations** (third sector) expressed a significant interest in participating in F2F actions and the co-creation workshops, normally those related with sustainable consumption, inhabitants' associations and circular economy

initiatives. They indeed have participated in the co-creation workshops organised, especially local actions with regards to circular economy.

The **technology suppliers** expressed high interest in participating in online activities. Most of the technology suppliers in HOUSEFUL where in the consortium and they did participate in the different proposed engagement actions.

With regards to the **inhabitants**, we have thus far engaged at all demo-site buildings. For the tenants from social housing we have organised different engagement mechanisms according to their worktime, language barriers, etc. Tenants have participated in the HOUSEFUL actions, especially for them organised online.. We have also addressed them via municipalities and inhabitant's associations. They expressed very high interest to participate, but limited time as they can only become involved outside of working hours.

In general, the other stakeholder categories (**researchers, suppliers and designers**) have always been involved, knowing that most of them are taking part in the HOUSEFUL consortium. Those not very much related with the demo-site building did not show specific interest and willingness to participate unless it was an online action. This could be because there are many collaborative activities underway in the CE sector and a priori they do not want to overcommit themselves to these initiatives.

Generally, most of the participants would still remain available for further bilateral meetings (focus groups, interviews, etc

This predisposal to participate in the project activities is surprising if we consider that 82% of interviewed stakeholders conceive the circular economy approach and its application in the housing sector as the most interesting aspect of the project and only 28% the participatory character[28]. When looking at the above graphs, general conclusion is they want to get involved somehow, but then in the questionnaire the less interesting part of the project for them is precisely the co-creation project. An explanation for that is a lack of understanding of what engagement implies and involves increasing the reluctance to it, as it usually is a long-term process.

The representation of a **matrix of interest vs influence of stakeholders** can give an idea of their predisposal in engagement strategies and their potential relevance to it. The interest and influence of stakeholders (n=150) can clearly be distinguished between groups. According to the results the researchers are those with the least interest and influence. Three stakeholder groups with a high influence are the public agencies, policy makers and the tenants having the later level of influence over the engagement of the process. Municipalities also have a high interest and influence depicting their value for the co-creation process. An intermediate level of interest and influence is given by other policy makers, suppliers, designers, and the group of other stakeholders. Initiatives have not been mentioned as only one initiative is

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[28] Both criteria are non-excludable this is why the sum of values can be larger than 100%.

representing the group and additional information needs to be acquired to give a concrete picture.
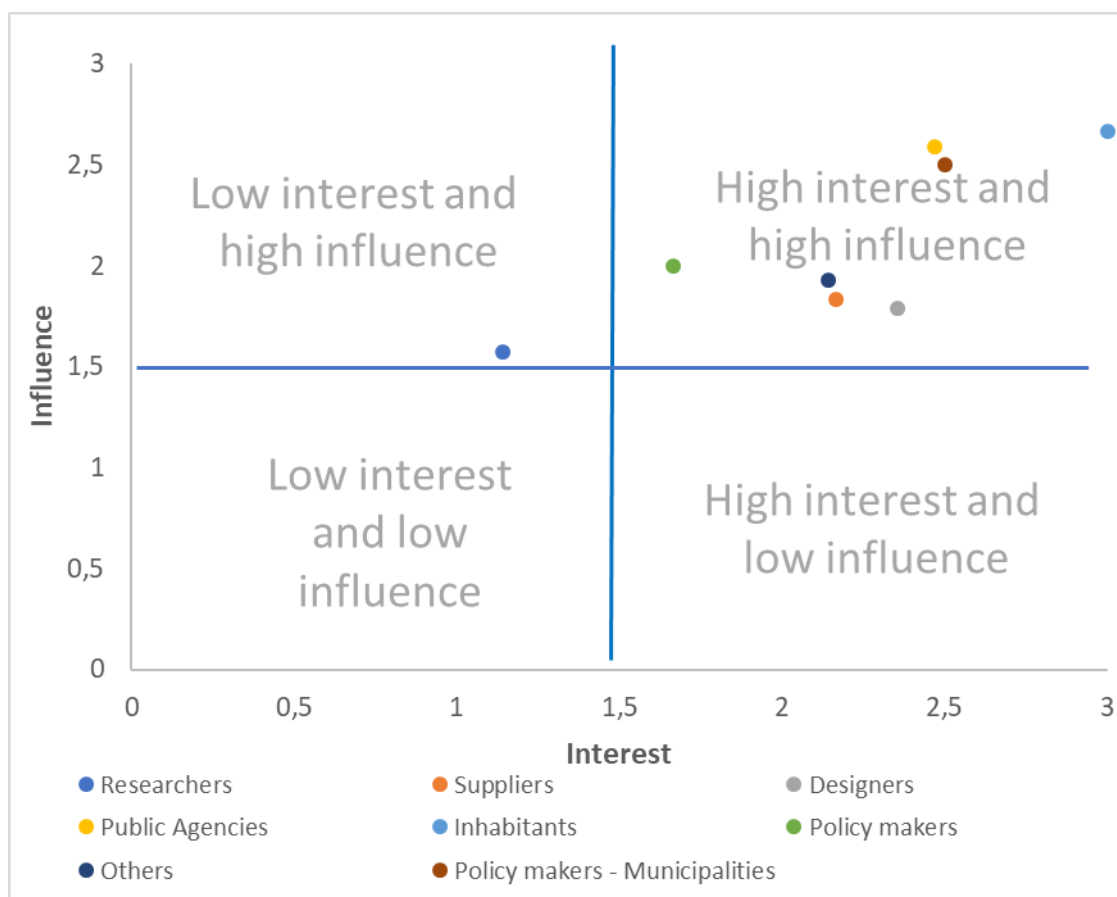

Figure 10. Interest and influence. The figure shows the interest and influence that stakeholder groups can have in the HOUSEFUL project with values from 1 to 3 being 3 high and 1 low.

4.5. The generated ideas for co-creation

In this section we present information on the 14 co-creation ideas that have been finally selected and are being implemented in the process. The selection process of the co-creation ideas is described in step 4 of the methodology.

These ideas are the result of a bottom-up approach based on a process of bi-directional communication with stakeholders, that respond to their concerns, needs and interests. They were integrated in HOUSEFUL workflow and are results evolving over the Co-creation process.

The co-creation ideas can be grouped in thematic groups to facilitate their integration in the project workflow, organization, communication and dissemination of tasks within the project and the partner's activities with regard to the implementation of

the co-creation ideas: 1. Training; 2. Material; 3. Visualization of benefits; 4. Reduction of costs; 5. Effective communication (including Key messages and Aesthetics); and 6. Governance.
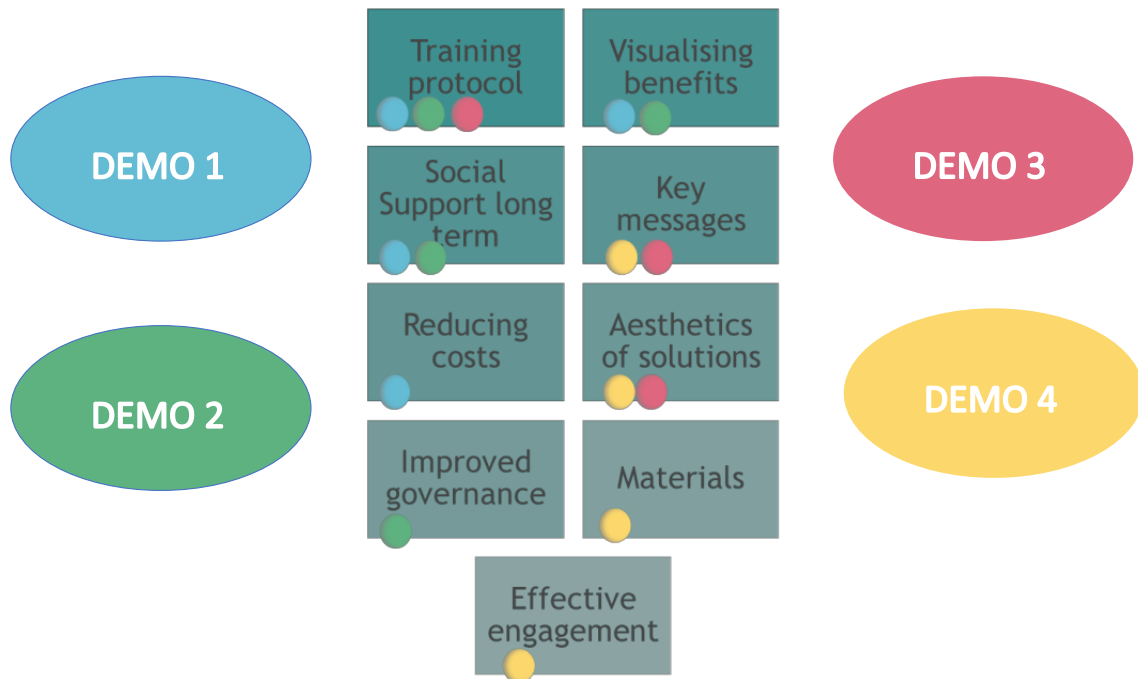

Figure 11. Co-creation ideas per demo-site.

A detailed explanation of the results of all workshops is presented in Deliverable 3.3 Social conditions for the co-creation of all HOUSEFUL services and co-created materials.

Annex 7 further described each of the co-creation ideas. In the next section the roadmap to the co-creation workshops is depicted.

In total 12 co-creation workshops will be implemented under a backcasting process (see section 5). These twelve workshops are divided into three groups of four workshops: three workshops for each demo-site. Further to this, activities between each workshop have to been added (see section 5).

In these co-creation workshops the aforementioned co-creation ideas for each demo-site will be presented to stakeholders to start the co-creation activities.

A first workshop has been implemented on the 9th of March 2020 for demo-site 1. This first workshop had a regional focus on Catalonia giving particular attention to the demo-site building 1 and involving diverse stakeholders. Special attention has been paid to include those with high interest and those with high influence in outcomes such as building owners, local municipalities and public agencies amongst others.

The objective of the first co-creation workshop was two-fold: the first objective was to identify the desired futures of the housing sector and for social housing within the framework of circular economy in Catalonia. The second objective was to validate the co-creation ideas that emerged during the previous consultation process together with the key actors in the sector. As outputs from this workshop a validated list of co-creation ideas was aimed for, groups were established to build on these co-creation ideas and desired futures for a circular housing were depicted. Regarding the types of participants, a broad representation of all stakeholder groups was aimed for in order to generate knowledge exchange and include a wide perspective in the desired futures of the circular housing sector in Catalonia. A detailed explanation of the results of all workshops will be presented in Deliverable 3.3 Social conditions for the co-creation of all HOUSEFUL services and co-created materials

In the next section the roadmap to the co-creation workshops is depicted.

5. The Co-Creation Roadmap

Based on the results achieved, the objective of this section is to design how the engagement processes with stakeholders in the housing sector will be carried out through a co-creation process in order to facilitate the implementation of circular solutions in a refurbished building. Summarising it presents the project Solution 2 "Social engagement for co-creation

Therefore, this section describes the roadmap that this task should take around the workshops that will be done in the building to be refurbished.

5.1. Backcasting approach of the co-creation process

The engagement activities will follow a backcasting process with the selected stakeholders, due to the problem-solving character of this methodology. Backcasting is a process consisting of defining imagined futures that are desirable and working backwards to identify policies, programs, activities, etc. that will help connecting the ideal futures to the present. This planning approach is increasingly used in futures studies in fields related to urban sustainability as an alternative to traditional planning approaches and a formal element of future strategic initiatives (Bibri 2018)[29].

Backcasting is fundamentally normative as it is concerned with not only describing what the future looks like, but in providing an evaluation of how the future building should be. Normative scenarios show how a solution to a particular problem should look, from the participants' own personal point of view (B.rjeson et al. 2006)[30]. Bibri (2018) argues that the backcasting approach is well-suited for finding long-term sustainability solutions due to its normative, goal-oriented, and problem-solving character. Backcasting allows visionary images of futures at different temporal scales, and this can stimulate an accelerated movement towards achieving such normative goals.

Backcasting workshops are intended to get the participants to evaluate the future and justify their reasons during ongoing facilitated deliberation. In HOUSEFUL case, backcasting has been used to frame the engagement process. Backcasting then, framed the process in the implementation 3 types of co-creation workshops with the stakeholders of the demo-sites buildings, as stated in the **¡Error! No se encuentra el origen de la referencia.**. In the co-creation workshop 1 (CWS1), the desired futures will be identified. In the CWS2 the co-creation ideas will be selected and an action plan to implement them developed. In the

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[29] Bibri, Simon Elias. 2018. Backcasting in futures studies: a synthesized scholarly and planning approach to strategic smart sustainable city development. European Journal of Futures Research 6 (1): 27. Accessed July 27. doi:10.1186/s40309-018-0142-z.

[30] B.rjeson, Lena, Mattias H.jer, Karl-Henrik Dreborg, Tomas Ekvall, and G.ran Finnveden. 2006. "Scenario types and techniques: towards a user's guide." Futures 38 (7):723-739.

CWS3 the stakeholders will validate the implementation of the co-creation ideas comparing the situation with the desired futures. Work is done with them moving from left (the defined desire future) to right (present situation) to help shape the backcasting process.

Figure 12- The three co- workshops series overview based on the backcasting approach

Altogether, the output of this activity is a transversal action to create ownership, relevance and collective intelligence for the development of the HOUSEFUL solutions. The aim of the co-creation actions is to get social validated ideas that facilitate the implementation of HOUSEFUL solutions in the refurbished building.

5.2. The Co-creation Blueprint (CCB): Social engagement for co-creation

The Co-Creation Blueprint (CCB) is the Solution 2 of HOUSEFUL project. This solution is framed as an open innovation action. Open Innovation means that valuable ideas can come from inside or outside a research project and can go to market from inside or outside the research action as well[31]. One of the key components of open innovation is the co-creation of value, that it is achieved when an R&D action open the boundaries to the outside world and put in place a co-design process with its users and relevant stakeholders. The goal of this process is to co-create value, as an outcome of the process. In the CCB, as a co-design process, the user and stakeholders become co-designers and is integrated at the beginning of the housing value chain.

This process is aptly named a blueprint as it allows for an accurate reproduction of the same process in different settings, just an engineering building blueprint does the same. This methodological process of the CCB allow those that are looking to refurbish a building to copy, adapt and implement the process in any building refurbishment project.

The CCB is a cross-cutting solution, offered to stakeholders as a social engagement service, consisting in offering capacity development activities for co-creation of circular economy

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[31] DUPONT Laurent, MASTELIC Joëlle, NYFFELER Nathalie et al., « Living lab as a support to trust for co-creation of value: application to the consumer energy market », Journal of Innovation Economics & Management, 2019/1 (n° 28), p. 53-78. DOI : 10.3917/jie.028.0053. URL : https://www.cairn.info/revue-journal-of-innovation-economics-2019-1-page-53.htm

opportunities to the quadruple helix stakeholders (public institutions, private organizations, academia and citizens) in the current housing value chain, including investors.

Social innovation activities offered by this service include a continuous social analysis action of drivers, enablers and barriers driving stakeholder decisions and behaviours when it comes to circular economy solutions. The years of research and implementation of the engagement activities offered to the 4 buildings where HOUSEFUL solutions are demonstrated is the basis for the CCB standardised process as a practical roadmap of its application.

The principal benefit of this process is that a building that is to be refurbished, is done in a manner that all relevant voices are heard and the product is built back better and according to the users' and surrounding community desires and behaviours. The benefits are not just for the users, but for the promoters, neighbourhood, owners, suppliers, policy makers, etc. that can work together to have the barriers removed which allows for, amongst other aspects, better financial performance.

New and unexpected ideas are generated resulting in a demand-driven innovation process, where common and collective understanding is generated. This process further fosters ownership of the final refurbished building that would lead to greater acceptance of the circular solutions, care for the building and implementation of maintenance plans.

Finally, as organisations, specifically in the housing sector, begin their journey towards a circular economy, the KPI impact measurements will assist all the entities involved in the refurbishment to report social indicators to their concerned stakeholders and shareholders. This powerful process of monitoring and evaluation of the generated impact will further promote the investment potential of these companies.

The CCB is based on a five (5) step process where the emphasis is placed on the "co-creation" of value through the engagement with the relevant actors in a building refurbishment. The process can include but not limited to investors, designers, suppliers, public authorities and agencies, inhabitants (the users), academia, and civil society.

The process is to be initiated in the design phase of a refurbishment project involving circular solutions and finishes when the circular solutions are implemented and in their usage phase. Although it is linear in nature where each previous step is an activity that is required before the next step, the process can be continued and extrapolated to the long term, through iteration. The CCB is provided in graphical form in the figure below.
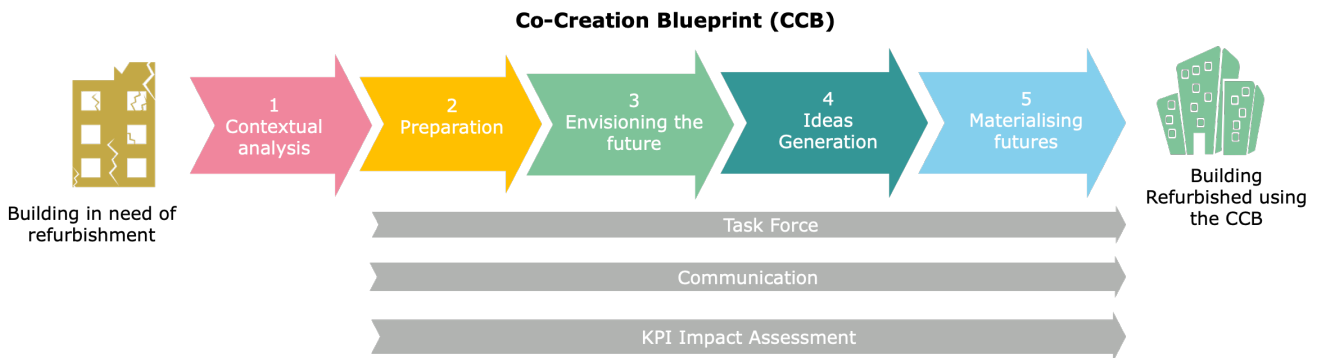
Figure 13: The Co-Creation Blueprint

There are three continuous processes of "task force": "communication" and "KPI impact assessment". Those three are initiated in Step 2 but continue throughout the process. Step 1 Contextual Analysis, "breaks the ground" in the co-creation process providing a baseline to the rest of the steps. Step 2: Preparation provides the foundations from where the rest of the process can be built. Step 3 provides the process behind a future vision that is provided together with the stakeholder. Step 4 dives deeper in these visions by providing a process to uncover the generation of ideas and develop an associated action plan per each idea. The final step, step 5, provides a process where the stakeholders can start to materialise the desired futures provided in Step1 through a validation about how this all aligns to the initial vision. The outcome is a refurbished building with co-creation value.

5.2.1. Step 1 Contextual analysis
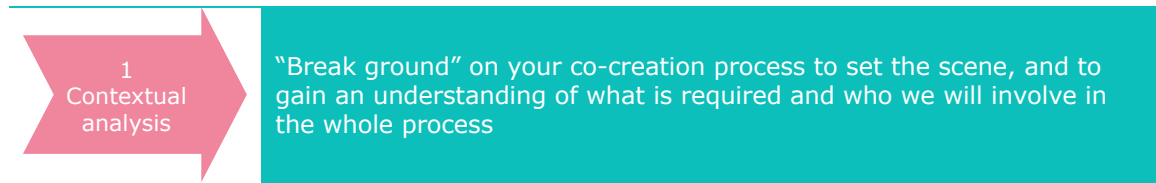
Outputs from Step 1

- Contextual analysis in which the building sits, i.e., social, economic, environmental and governance analysis
- A map and an analysis of the stakeholders to get engaged in the co-creation process
- A first engagement with key selected stakeholders to address a qualitative analysis aiming to gain understanding on the attitudes, and behaviours to adopt circular solutions
- Preliminary list of co-creation ideas

This step is organised in three activities: initial analysis, stakeholder analysis, and first engagement actions.

- **Initial analysis**

Following the steps 0 to 4 of the methodology in this deliverable, the organisations driving the building refurbishment would first need to understand the context in which the building sits. This is done through a literature review, including grey literature (local authority databases, media articles, governmental and third-party reports etc.). The analysis should address aspects that include but not limited to the social context (i.e. political orientation of the community, low-medium-high income area, cultural perspectives, unemployment rates etc.); the environmental aspects (water scarcity issues in the area, climatic conditions, soil conditions, pollution levels etc.); governance (for e.g. changes in potential building regulations and requirements). Through this process, information is obtained that provide the background and baseline to initiate the process. A result of preliminary ideas for co-creation is provided in this step.

- **Stakeholder analysis through Social Network Analysis**

Following step 1 and 3, the identification of who is relevant to get engaged is addressed in this step, as well as a continuous analysis to ensure that relevant organisations and actors are engaged. This activity provides information on who to identify, approach, involve and indeed how to map and to continue to identify these stakeholders across the full value chain of the building refurbishment process. The mapping and analysis of stakeholders is done through SNA.

The diagram below taken from D6.5 provides an idea of the complexity of the number of types of stakeholders that can be included within the entire value chain.
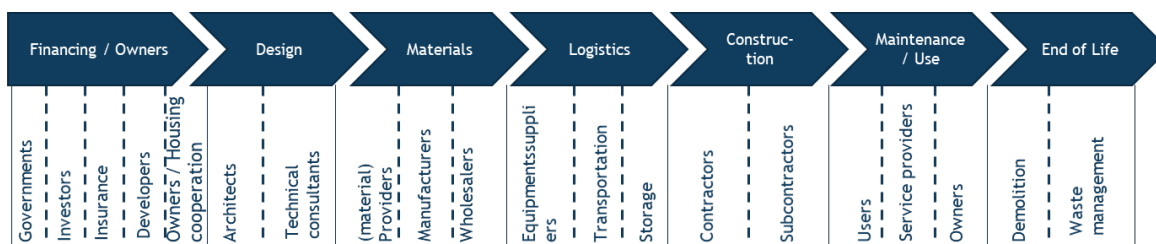

Figure 14. Stakeholder types in the housing value chain (taken from Deliverable 6.5)

- **First engagements**

As part of the contextual analysis, the first engagements with the identified stakeholders provide the basis for the rest of the CCB steps in forms of bilateral interviews and meetings as stated in the step2 of the methodology of this report (section 2.2). The objective of these first engagement approach is to gain understanding directly from the stakeholders about their interest, willingness, needs, ideas and challenges in the refurbishment process. The generated understanding can even deepen in a secondary objective, more aligned with a deepen social analysis. Through a qualitative content analysis, the factors influencing

behaviour and social attitudes towards the use and implementation of circular solutions can be further explored.

5.2.2. Step 2 Preparation: Task Force, Communication, KPIs

2 Preparation — Driving step across the CCB that involves managing actions as the task force set up, communication plan, and monitoring.

Outputs from Step 2

- Co-creation Task force established
- Communication and Dissemination Local Action Plan
- Protocol to engage with inhabitants (as individuals)
- KPIs system established

This step involves three main activities: establishing a co-creation task force, developing a communication plan, and monitoring

- **Establishing the co-creation task force**

The Co-creation task force is the body that manages and supervises that the CCB is properly implemented. It involves the main stakeholders of the process: circularity agent, building property manager, suppliers, designers, and a representative of the user side.

As key responsibilities, members of the task force will be responsible of the well development of co-creation ideas and their continuous reporting to other stakeholders through the established communication process. For each identified co-creation idea there will be one responsible body from the Co-creation Task force.

In this step the Co-creation Task force is settled and a managing process is established.

Furthermore, the co-creation task force would review the preliminary list of co-creation ideas in terms of feasibility and priority (as used in HOUSEFUL this can be done through a Delphi group process as stated in section 4.5).

- **Communication process**

The co-creation process involves an associated process of communication with the stakeholders involved and external communication to give visibility to the project. This communication should be clarified from the outset through a Local and Communication action plan, which should be managed by the Co-creation task force.

The main objective is to build awareness, communicate the progress and outcomes of the engagement actions and to encourage and motivate the engagement of different stakeholders connected to the CCB.

In this activity it should be developed the following actions:

- The selection of the communication lead from one of the members of the Co-creation Task Force.
- Development of a Local and Communication action plan. This plan will include an identification of, key messages, communication channels, timeline, and monitoring.
- Development of a "Protocol of Social Support to the Inhabitants" which will describe the means to maintain a continuous bilateral communication with the inhabitants of the building. The aim of this protocol is to help the inhabitants with the implementation of the co-creation ideas, to communicate to them the relevant information related to the project, solve questions they could have, gather information to analyse the KPIs, etc. The Protocol will be implemented before, during and after the refurbishment of the building and it will be managed by the communication lead.
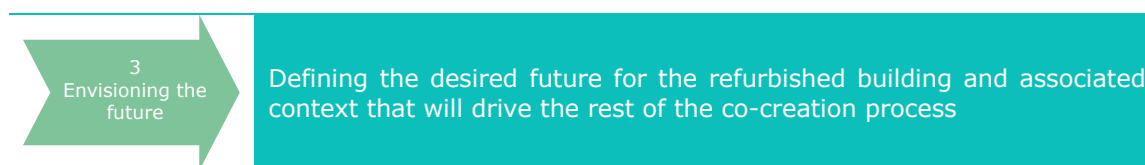
- **Monitoring of the Co-creation process**

This process truly attempts to reach the concept of "effective engagement" developed in section 4.3 of this document. Hence, the Key Performance Indicators (KPIs) associated with the identified components of "effective engagement" should be developed

- Representativeness of the social context
- Timely engagement with all relevant actors
- Continuity of actions in the long-term
- Level of interaction between participants
- Effective communication (awareness, feedback, etc.)
- Consistency with established goal of the CCB
- Appropriateness of the process to the identified local needs

A questionnaire model is created to be addressed periodically during the implementation of the CCB to allow gathering data over the CCB performance.

5.2.3. Step 3 Envisioning Futures

3
Envisioning the future

Defining the desired future for the refurbished building and associated context that will drive the rest of the co-creation process

Outputs from Step 3

- CWS1 workshop report, that includes the "envisioning future" and the final list of co-creation ideas
- Factsheets per co-creation ideas
- First inputs for the KPIs

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- Update of stakeholder mapping process

Step 3 involves the performance of the co-creation workshop 1 (CWS1) with the stakeholders where they will co-define the desired future for the refurbished building and surrounding area that will drive the rest of the co-creation processes. After the workshop takes place it involves a series of preparatory actions by the Co-creation Task force.

- **Co-designing the ideal future (CWS1)**

The CWS1 starts with the results obtained from the context analysis in Step 1 and the preliminary list of ideas identified in step 1 and prioritised by the Co-creation Task force. This list of co-creation ideas is used as an input for the CWS as well as other supporting material such a communication information regarding the project.

The dynamic of the CWS1 help the participants to better understand the possible implications of incorporating the solutions into their day-to-day lives and to identify the needs and barriers regarding the incorporation of these solutions.

An informative session kicks off the CWS1 to explain the project. Following this the participants are divided into groups of 5/6 members. The group distribution ensures that at least one type of stakeholder participates at each of the tables (groups). A deliberative dialogue is followed and driven by open questions.

With exercise of the River of Life metaphor[32] , a deliberative exercise aims to design, the future scenarios or the vision of the building to be refurbished with emphasis on the enablers and the barriers that can be translated into actions (to implement), actors or assumptions (context). The result is the "ideal refurbished building"

Based on the achievement of that "ideal" scenario, the list of co-creation ideas is validated and prioritized by accepting them or by proposing new ones.

This workshop will help as well in the mapping and evaluation of stakeholders and to start gathering information to analyse the KPIs designed in Step 2 by using a short questionnaire.

- **Further defining the co-creation ideas**

Between the CWS1 and CWS2 the CCB process continues with the conceptualization and further definition of the co-creation ideas identified in CWS1. This process also involves the planning of the CWS2 while keeping the stakeholders engaged throughout the process.

Once the ideas of co-creation have been identified, the next step is to bring them into the project and to frame them into tasks indicating their viability and their implementation.

During this step, each co-creation idea is assigned to the different Task Force members. To this end, the Task Force identifies the conditions for the development of the co-creation

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[32] River of Life is a group facilitation technique using visual narratives to help people tell stories of the past, present and future.
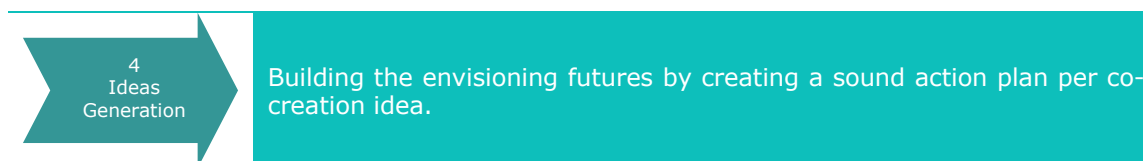
ideas. For each of the co-creation ideas, a Factsheet (see template in Annex 5) is created. This forms part of the communication outcome and provide all involved key stakeholders an understanding of the processes that are taking place and the decision that have been made.

Indeed, before the CWS2, the first draft of the Ideas Factsheet is shared with the relevant stakeholders. These factsheets serve as a baseline for discussion in the CWS2.

From the discussion generated in CWS1, the Task Force continues identifying other relevant organisations and their connections and keeps updated the process of mapping stakeholders that should be involved in the refurbishment process.

5.2.4. Step 4 Ideas Generation

4 Ideas Generation	Building the envisioning futures by creating a sound action plan per co-creation idea.

Outputs from Step 4

- CWS2 report that includes a list of assumptions made per each co-creation idea and the related action plan
- Update of the Co-creation idea Factsheets
- First inputs for the KPIs
- Update of stakeholder mapping process
- Identification of the training needs from the stakeholders.
- Implementation and monitoring of the communication of the tasks in the co-creation ideas action plan

During this Step 4, the co-creation ideas are to be integrated in the process of the refurbishment project, for that an action plan per co-creation ideas is to be design and started to be implemented. This step involves the organisation of the CWS2 "Ideas Generation" and after seek the integration of the co-creation ideas in the project.

- **Generating ideas (CWS2)**

This second workshop last about 3h, depending on the number of co-creation ideas to be discussed. The objective is to build on the co-creation ideas already identified and validated in CWS1, by identifying with stakeholders the required actions for their development. Roles, responsibilities and actions identified are based on assumptions and requirements of the context of the building.

Main questions that this workshop set for participants are the following:.

- How can the co-creation ideas help to achieve those futures identified in CWS1?
- How would the workshop participants like them to be produced?

The workshop would have if possible, the same participants as those in CWS1 to provide continuity in the process. The workshop is organized in groups of participants (max. 5 persons per group). The Ideas Factsheet generated in the previous step is used as a starting point for the discussion. The process finishes by shaping the actions and assumptions into an action plan per each co-creation idea

As well as in CWS1, in CWS2 the Task Force continues mapping stakeholders and gathering information to analyse the KPIs by using a short questionnaire.

- **Starting the implementation of the co-creation ideas action plan**

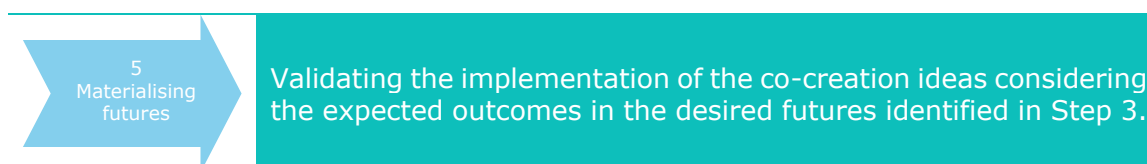The Task Force will seek that the action plan per co-creation idea is integrated implemented within the project.

To consolidate co-creation process, bi-monthly monitoring is to be carried out by the Task Force including a review of how the development of the co-creation ideas is being achieved. The Ideas Factsheet are periodically updated and shared with other stakeholders.

During this step, needs of knowledge exchange in forms of specific training will be considered to further implement the action plans

The actions of the Local Communication and Dissemination plan as well as the protocol to engage with inhabitants are still being implemented during this phase.

The stakeholders' map is updated with the newly identified stakeholders and connections.

5.2.5. Step 5: Materialising futures

| 5 Materialising futures | Validating the implementation of the co-creation ideas considering the expected outcomes in the desired futures identified in Step 3. |

Outputs from Step 5

- Validated plan to achieve the future scenarios for the building through the co-creation ideas' implementation.
- The evolved Idea factsheet for each co-creation idea with key messages for communication.
- Identification of new stakeholders and relationships (snowballing process)
- Insights for the analysis of factors influencing behavior and the choice making structure of people and perceived risks/benefits for the successful implementation of solutions integrated into the action plan.
- Information gathered for the analysis of the KIPs (indirect action).
- Sustainability CCB plan

This step will close the CCB process, where the process is being validated and an open visit to the building is organized. However, actions for the long-term planning and continuity of the group of work created should be also established in this step

- **Materialising the futures (CWS3)**

During this step a third co-creation workshop is organised following the backcasting process. The aim of this CWS3 is to validate the co-creation process and closed the CCB.

The workshop last about three hours and integrates a visit to the building. The World Café methodology is addressed in this workshop involving several consecutive rounds of discussion groups. The workshop has as many discussion groups as co-creation ideas. The task Force member will act as facilitators of the discussion groups. The representativeness of participants in this process is crucial to guarantee the effectiveness of the CCB process.

The discussion groups are to be carried out in a deliberative process using as supporting material the idea rating sheets (see Annex 6) for the validation of the action plans. The idea rating sheet helps the stakeholders to identify the strengths and weaknesses regarding the CCB process. During this process is common that other inputs are given by participants to complete the implementation of the co-creation ideas.

A final monitoring questionnaire is distributed among stakeholders to assess the entire process and to optimise the CCB process.

Once the CCB is assessed through the results of the CWS3 workshop and the KPIs indicators, a sustainability plan is prepared. The plan contains with key recommendations and actions for the continuity and long term of the engagement actions.

6. Conclusions

Through an open innovation process utilising social analysis and co-creation, this report provides insight on how engagement with local and regional stakeholders from the "Demo-site" buildings of the HOUSEFUL project have taken place. The knowledge and experience gained of the practical implementation of these processes (solution 2 of the HOUSEFUL Circular Solutions) is outlined in section 5.

The results in this report have shown who the relevant stakeholders are in this co-creation process, what their influence and interest is, how they relate to one another and finally how they participate to make the new HOUSEFUL solutions feasible and realistic from the developed solutions that add value. These results provide a unique contribution to the housing sector and specifically to building refurbishments in Catalonia and Austria where a stakeholder aiming to refurbish a building will know exactly who to engage with and how to engage with them in order to provide co-created circular solutions.

The **CCB** (section 5), describing solution 2 of the project, is presented as a unique contribution to the sector and described in this deliverable. The CCB process will be further outlined in an interactive brochure targeted to promoters that want to refurbish a building through open innovation by co-creating sustainable solutions and greater value with stakeholders and users. The CCB is presented as a step-by-step process that addresses the experience gained through the project in the process of engaging with stakeholders. The specific results of implementing the CCB in HPUSEFUL are to be addressed in the forthcoming Deliverable 3.3 and is presented here as a service.

In this report, we have also provided extensive results on the **social structure** that HOUSEFUL has addressed through its respective four demo-site buildings. The results show the connections within these social structures, who has taken part in the process, shown interest, and was engaged. The stakeholder maps have been used to make decision regarding who to invite to the co-creation workshops, assisting further in defining the governance models (further addressed in Deliverable 3.5) and understanding how communication should take place. Indeed, the generated database has been exchanged with WP7 on communication to be further used as targets for knowledge exchange actions. The generated stakeholder map will also be available in the SaaS platform as a functional output as part of the project results.

Beyond the use of the stakeholder maps for the project purposes, we strongly recommend the use of the maps as decision support tools for future actions in the demo-site contexts if other building is to be refurbished in close proximity to the demo-site in question, to ensure that all relevant actors are engaged.

The results of this deliverable further provide clarity to the housing value chain through the SNA approach, in the following key aspects:

- When approaching social housing projects, the role of public agencies is crucial, they should be not only engaged but they should be continually interacted with one another to create further value.
- As information controllers or spreaders (for e.g. circular initiatives, sustainability clusters), certain initiatives and platforms should be central elements in the social structure and to be sure that innovations are adequately address.
- More connections between different pilot initiatives are to be fostered to create further knowledge sharing and learning between them, even within the HOUSEFUL demo-site contexts there were not as many connections as we initially expected.

We have also further explored the concept of **"effective engagement"** in the co-creation of value in the housing sector. The barriers, enablers, lessons learnt and best methods to generate an effective engagement both during the project and in the long-term. This project has addressed the shortcomings generated during the COVID-19 pandemic and related social distancing requests in the planned engagement actions. The lessons learned in the development of this document reside in the importance of maintaining a participatory development even after the project ends, where stakeholders consulted have expressed interest in collaborating.

The relationships between the literature and our observations show that it is important to have a representation of the most influential stakeholders (who have been identified through the SNA analysis and the subsequent qualitative analysis); to start including these influential stakeholders in the process from early stages of development; to guarantee the continuity of the process and that the ideas proposed are also framed over the long term (beyond the project); to have participatory models that work and guarantee interaction; to be accompanied by effective communication activities supported by the WP7 and to have a clear objective of what this is intended to be.

The process of co-creation in WP3 that is coming to an end in HOUSEFUL. This process has generated further evidence for this report (coming from two previous versions) in the following aspects: the update maps of stakeholders, the update the social structure of the demos, increased learning regarding effective participation in the processes of co-creation in the circular economy and the housing sector, and the outline of the project solution 2 as a service: Co-creation Blueprint

Annex. 1 Protocol for literature review

Inclusion and exclusion criteria of the literature review

To identify relevant literature, the following search terms were used:

To identify relevant literature, the following search terms were used:

- Public perception
- Public opinion
- Public concerns
- Public behavior
- Public attitudes

And/or

- Housing
- Circular economy
- Water reuse
- Waste, biowaste
- Energy recovery
- Nutrient recovery
- Nature based solutions
- New technologies acceptance

And/or

- Acceptance
- Support
- Willingness
- Engagement

And/or

- Perceived risks or
- Perceived benefits
- Barriers
- Obstacles
- Challenges
- Prejudices
- constraints

The electronic bibliographic databases that were used on the search were as follows: Academic Search Complete, , Psychology and Behavioral Sciences Collection, SCOPUS, Web of Science, Scopus, Open Science Directory and Google Scholar. We selected those papers that related to human participants and environmental issues and social science research areas. To identify additional articles of interest, there were searched the reference lists of screened articles, the citation lists of where the article was referenced and, also, in registered protocols related to the aim of this systematic review. We also searched the reference sections of known authors in the field in Google Scholar and Research Gate.

The search was restricted to articles published between 2000 to 2018, in English, and Spanish languages.

Those very technical studies on properties of the water and from fields of engineering and physics were excluded given in this moment we are focusing on public engagement and co-creation.

Selecting appropriate sources

Citations were downloaded into a Mendeley library. Their relevance was assessed against the predetermined inclusion and exclusion criteria by three researchers who independently screened all titles and abstracts. Forward and backward citation tracking complemented the database searches. Full-text manuscripts were obtained for all studies entering the review. Any uncertainties about entering the review were resolved by consensus and, when necessary, by an examination of the full text.

Data extraction, analysis and synthesis

Two reviewers extracted data directly to an Excel spreadsheet. A framework was developed which provides a basis for organizing the literature according to comparable study contexts and allows synthesis of the results. We contrasted topic (water resources, water reuse, acceptance of decentralized technology, nutrient recovery, bio-solids, acceptance of new technologies, waste management), context, sample size, level of analysis, variables studied, data collection and data analysis.

After the removal of duplicates, 591 potentially relevant articles were identified. 179 of these were excluded for being too technical or not directly related to the topic of study. At the full text review stage, 412 articles were reviewed.

Annex 2. Questionnaire in Step 1

The following questionnaire was implemented for stakeholders of demo sites 1, 2 and 4, and was adapted for stakeholders of DEMO 3 as during the previous interview process several questions have been addressed. Hence force the questions 2-5 and 11 have been removed after an analysis of the interviews.

Introduction
This questionnaire is related to the HOUSEFUL Project (http://HOUSEFUL.eu). HOUSEFUL has as its aim implementing circular economy solutions and services to the housing sector to foster a more sustainable economy in the European Union. A total of 11 circular economy solutions have been proposed and will be implemented in four different buildings located in Catalonia (Spain) and Vienna (Austria), to achieve a more efficient resource management along the life cycle of these buildings.

The idea is to co-create a neighborhood with services and resources that support the circular economy on the base of a more sustainable environment, while efforts are as well put in the development of methodologies that promote the commitment and social participation. In this way, the possible improvements and solutions offered by HOUSEFUL, with respect to the environmental parameters: water, materials, waste, and energy encourage a better comprehension of the needs and concerns between the diverse social actors.

To succeed with these objectives, it is necessary to generate an understanding of all the parts involved to obtain comprehension of how organizations, the politicians, citizens, and so on, within the European Union interact in the regions where HOUSEFUL will be implemented.

Help us to complete this questionnaire in the name of your organization.

The questionnaire will be open between the 7/02/2019 until the 22/03/2019 and will only take 15 min of your time.

The information which we get from the questionnaire is voluntary and will only be used for research purposes. In no case, this information will be used later to identify your individual answers.

If, in any way, you feel uncomfortable completing the questionnaire, you can refuse to answer any questions or finish the questionnaire sooner.

If you want to continue your collaboration, please accept the privacy policy.
Privacy Policy
Responsible: WE&B. Main goal: the realisation of this study reviewed in this document. Legal basis of treatment: express authorization of the participant, by signing this document (art. 6.1, letter 'a' of the GDPR). Criteria for conservation: your contact information will be saved only in the case that you have indicated your willingness to register the update of the results. The rest of the data, configured by the answers given to the responsible person, will be

anonymized and stored indefinitely. Rights of the participant in the study: You have the right to agree in any moment, to access, rectify and remove your personal data, and right for limitation and opposition to the treatment. You can also file a claim with the corresponding control authority if you consider that the treatment does not conform to the current regulation. Data transfer: In case that you have decided to register the results of the study, your data will be transferred to WE&B, who will manage the sending and management. Contact data to exercise your right: info@weandb.org.

1. I accept the privacy policy
- Yes
- No

Circular Economy
In this section we would like to analyse how the housing sector can move towards the approach of "circular economy" which is looking for a greater sustainable use of resources.

2. Does your organization know of, or is it related to, the circular economy approach?
- No relation/Never heard of it
- Not very much
- Somewhat
- A lot

3. In case your organisation is somewhat familiar with the circular economy approach (answers in the previous question: not very much, somewhat, a lot) could you please indicate the projects/initiatives in which your organisation participates in the circular economy?
(Open ended answer)

4. Although your organisation does not participate in the circular economy approach, do you know of any other project regarding the circular economy? If so, could you give us an example?
- Yes
- No Don't know
- Example of project/initiative (open ended answer)

5. According to your own opinion, please indicate the level of importance you consider that the following environmental aspects can more or less be easily applied within the housing sector (being 1, not applicable and 5, very applicable)
- Energy efficiency/energy saving
- Water reuse and efficient water management
- Recycling of household waste
- Building materials reuse
- New forms of co-management and participation
- Indicate here if you identify other topics that are not mentioned above (open ended answer)

6. Could you please name the organisations with whom you are collaborating that may be relevant for us to contact in the field of circular economy approach?
(Open ended answer)

The housing sector
Since three of the four buildings where the HOUSEFUL project is going to be implemented are social housing estates, while the other building is privately managed, we are therefore interested in analysing your perspective in this sector.

7. What type of housing is your organisation linked to?

- Option A: Social housing
- Option B: Private housing
- Option C: Collaborative housing (cooperative)
- Option D: Not linked to the housing sector
- Other, please indicate which:

8. How would you rate the following risks with regards to the implementation of circular approaches in the housing sector? (being 1, low risk and 5, high risk)

- Technical barriers and scientific uncertainties
- Low acceptance from the user of the new circular systems
- Low acceptance in the current housing plans and programs
- Poor development of the circular technologies
- High maintenance requirements
- Low acceptance of the products to be reused: reuse of water, nutrient recovery, etc.
- Very strict standards of legislation for reuse in the housing sector
- Lack of financing to stimulate required change involved
- None of the above
- Other, please add them:

9. How would you rate the following benefits with regards to the implementation of circular approaches in the housing sector? (being 1, low benefit and 5, high benefit)
- A change of paradigm in the housing sector towards sustainability
- Increased environmental awareness
- Optimisation of long-term costs
- None of the above
- Other, please add them:

10. In the context of the project we have identified some actors that we consider as key stakeholders that can be involved in the project. To what extent do you know the following organisations? (where 0 is that you have no relation and 5 is where you have a significant relationship, where you share some project / initiative at the moment)
(different lists for: Austria, Spain and European contexts are provided)

11. For each of the following stakeholder categories, can you indicate other stakeholders with whom we should interact within the housing sector and circular economy?
- Technology suppliers
- Designers/Architects
- Public agencies
- Academic sector (research)
- Civil Society Organisations
- Policiy makers
- Others, please specify

12. From the organisations mentioned above in the two previous questions, could you briefly describe how we could contact them on order to get them involved in the project? (through you, you could provide us with a contact, through contacts of yours, etc.)
(open ended answer)

About the HOUSEFUL project
The project aims to implement circular solutions and services in the housing sector. Within the project activities it includes the co-creation of solutions. This implies a high need for stakeholder engagement, therefore we would like to explore with you how we can achieve effective engagement.

13. From the following list of project activities, to what extent would you like to be involved for each one of them? (high interest / something from time-to-time / no involvement)
- Participation in the co-creation workshops for circular housing solutions (3 workshops in total)
- Other face-to-face meetings with a technical approach
- Online meetings, e-seminars, etc.
- Respond to interviews / consultations about the project
- Receive news about the project
- I do not have time / interest in being part of any of these activities

14. Now that you know about the HOUSEFUL project, what is the aspect that motivates you the most about the project?
- Participatory character - co-created solutions
- Application of the HOUSEFUL solutions in 4 pilot cases of the housing sector.
- The circular economy approach in the housing sector

General questions
We would like to acquire information of the profile of the person that has undertaken the questionnaire, and the institution that they represent, to ensure the scientific rigor of the investigation.

15. In which of the following groups would you best fit?
- Technology Suppliers
- Designers /Architects
- Public agencies
- Research centres / Universities
- Civil Society Organisations
- Policy Makers
- Other, please specify

16. Please provide the name of your organization
(open ended answer)
17. Location (country)
- Austria
- Spain
- Other, please specify

18. Gender
- Male
- Female

19. How old are you?
- 18 – 29 years old
- 30 - 49 years old
- more than 50 years old

20. Do you have any comments regarding this survey and the questions within it? Please write down your comments

Information about data processing
This questionnaire was developed by the HOUSEFUL project, your response and participation are very important for the development of the project as they will help us to analyze the social context of this project.

The HOUSEFUL project may contain certain personal information about you as part of our general project activities (such as your address and contact details, educational background, areas of expertise). We have become aware of your information in a number of ways - directly from you, from others or over time through our relationship with you - and may have received it and/or retained it in various forms (whether in writing, electronically, verbally or otherwise).

We use this information for a variety of project-related purposes only. For example, we need this information to identify participants for the HOUSEFUL events, for expert interviews and workshops, etc. For interviews and focus group discussions, personal data will be kept in a protected file, separate from the users' anonymized responses. You can be rest assured that we will not use your personal information for commercial purposes. We take steps to ensure that your personal data is stored safely.

If you participate in the HOUSEFUL events, if you agree, your name, organisational affiliation and email address may be distributed and made available to other HOUSEFUL partners. This is necessary to achieve two of the main HOUSEFUL specific objectives:

- To achieve the implementation of an innovative engagement strategy to stakeholders involved in co-creation activities by using backcasting (a workshop methodology) exercises, and
- To raise the public and stakeholder's awareness by stimulating the acceptance and fostering the replication of HOUSEFUL services.

Stay in touch with HOUSEFUL; join our newsletter: http://HOUSEFUL.eu/news/

If you wish to retract your personal data, please identify yourself and please contact us via email:
info@weandb.org

Again, thank you very much for the participation and for your time,

The HOUSEFUL team

Annex 3 Methodological limitations of questionnaires and interviews

Annex 3.1. Limitations of the questionnaire process

Due to the nature of the methods employed to gather responses from the key stakeholders identified at this stage - i.e. the questionnaires - certain constraints are raised. These constraints are listed below:

- *Low responses rate.* This is a common problem that is specific to social science research, including SNA research (Lubell et al., 2017[33]). Although this a limitation for big target questionnaires, in HOUSEFUL we are following this step with and interview where we can gather more detailed responses.
- *Lack of understanding*. The respondents were not supported in the questionnaire process. This led to the constraint that some questions were not fully understood which potentially resulted in the questionnaires not fully completed.

Regarding the respondent's behaviour, some general and not HOUSEFUL specific constraints and risks can also be identified. However, these are also true for questionnaires developed in HOUSEFUL. The constrains and risks are as follows:

- *Sincerity*: while there are many positive aspects related to the use of questionnaires, a lack of sincerity can be a potential problem. The respondents may not be 100% honest in their answers. This can happen for several reasons, including the social desirability bias and the desire to protect privacy. To avoid the lack of sincerity, respondents have been informed that the process does not require personal identification.
- *Conscientious answers*: there is no way of knowing if the respondent has thought about the question before answering. Sometimes the answers are chosen before reading the whole question or the possible answers. Sometimes respondents move from one question to another quickly, or make decisions in a fraction of a second, affecting the validity of the data.
- *Understanding and interpretation*: the problem of not asking questions face-to-face is that they can be interpreted differently. Without someone to explain the questionnaire and make sure that each individual understands the same, the results can be subjective. Respondents may also find it difficult to understand the meaning of some questions that are clear to the creator. Thus, this lack of communication can lead to biased results.
- *Feelings and emotions*: a questionnaire cannot fully capture the emotional responses or feelings of the respondents. Without administering the questionnaire face-to-face,

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[33] Lubell, M., Jasny, L., and Hastings, A. (2017). Network governance for invasive species management. Conserv. Lett. 10, 699–707. doi: 10.1111/conl.12311

there is no way to observe facial expressions, reactions or body language. Without these subtleties, important information may go unnoticed. It is for this reason it is so important to undertake step 2 (Deepening) of this consultation framework.

- *Respondents own motivation*: as with any type of research, bias can be a problem. The participants of the questionnaire may be interested in your product, idea or service. Others may be participating because of the questionnaire theme. These trends can lead to inaccuracies in the data, generated by an imbalance in the respondents who think disproportionately positively or negatively on the subject.

- *Influence of previous engagement:* local Demo 2 and 3 questionnaires have been developed after the interviews (step 2) as otherwise the co-creation engagement of these actors would have been compromised. This has been an adaptation of the initial strategy to cope with the change in demo sites 2 and 3. As a result, the questionnaires from these actors have been adapted and responses can be influenced by their previous engagement through the interview process.

- *Representativeness of lower ranked groups.* Questionnaires have been criticized for prioritizing top-ranked (often more powerful) stakeholders, leading to underrepresentation of lower ranked groups (Grimble and Chan 1995; Calton and Kurland 1996; MacArthur 1997). In this sense, we are addressing questionnaires in a targeted manner, to ensure answers are gathered.

Annex 3.2 Limitations of the Interview process

The majority of the limitations from the questionnaire procedure were solved with this in-depth consultation of face-to-face interactions. However, some limitations were still encountered.

Regarding logistical issues:

- *A lack of availability of* participants or a need to speed-up the process due to another appointment*.
- *Timing of interviews* for the local context of Demo 2 and 3 was before the development of step 1 as otherwise the participation of stakeholders in co-creation activities would have been hampered.

Regarding the facilitator's attitude, some constraints and risks are identified:

- *Positioning and facilitator's own motivation:* every facilitator tried not to interfere in the respondent's opinion, but due to the consciousness and commitment to the HOUSEFUL project, some answers or conversations could potentially have been biased by the enthusiasm or interest shown by the facilitator.
- *Previous information on the local context of Demo 2 and 3* based on step 1 was missing. This could have made the interview process more difficult as insights for the

interview protocol were based on the regional context of Catalonia and Austria, and the local context of Demo 1 and 4.

- *Facilitators not from social sciences:* interviews have been facilitated by local partners involved in T3.1 that belong to diverse fields of expertise and some are not experts in social sciences. Hence the level of detail and information derived from interviews can vary depending on who facilitated the interview.

Regarding the participant's behaviour, some general and not HOUSEFUL specific constraints and risks can also be identified. However, these are also true for interviews developed in HOUSEFUL. The constrains and risks are as follows:

- *Respondents' own motiv*ation: as with any type of research, bias could have been a problem. The participants may have been interested in the project. Others could have participated because they would like to interact and exchange ideas with the participants or facilitator to look for future opportunities (networking). These trends can lead to inaccuracies in the data, generated by an imbalance in the respondents who think excessively positively or negatively on the subject.
- *Sincerity*: while there are many positive aspects with face-to-face interactions, a lack of sincerity can still be a problem. The respondents may not be 100% honest in their answers. This can happen for several reasons, including the social desirability bias and the desire to protect privacy or confidentiality issues from the organisations they represent. To avoid the lack of sincerity, respondents have been informed that the process does not allow for personal identification.

Regarding the transcription of interviews, the following constraint, and risk can be identified:

- *Interview transcription literality*: after the development of interviews each partner of the HOUSEFUL project transcribed interviews. According to the established protocol transcriptions should be translated into English and be literal. However, some transcriptions have captured main ideas and not the whole dialogue. This to a certain point can influence the descriptive analysis of interviews as subjective viewpoints can be lost during the process.

Annex. 4 Questionnaire in Step 5

1. Introduction

This questionnaire is related to the HOUSEFUL Project (http://houseful.eu). HOUSEFUL has as its aim implementing circular economy solutions and services to the housing sector to foster a more sustainable economy in the European Union. A total of 11 circular economy solutions have been proposed and are being implemented in four different buildings located in Catalonia (Spain) and Vienna (Austria), to achieve a more efficient resource management along the life cycle of these buildings.

The idea is to co-create a neighborhood with services and resources that support circular economy on the base of a more sustainable environment, while efforts are as well put in the development of methodologies that promote commitment and social participation. In this way, the possible improvements and solutions offered by HOUSEFUL, with respect to the environmental parameters of water, materials, waste, and energy, encourage a better comprehension of the needs and concerns between the diverse social actors.

To succeed with these objectives, it is necessary to understand how all the parts involved within the European Union (organizations, politicians, citizens, etc.) interact with each other in the regions where HOUSEFUL is implemented.

The results of this questionnaire will be visualised in a stakeholder map that will be published through project communication channels. So, please, help us in visualising the connections that key players in the housing sector have!

The questionnaire will be open until de 4th November and will only take 5 minutes of your time.

The information we would get from the questionnaire will only be used for research purposes. In no case this information will be used later to identify individual answers.

If, in any way, you feel uncomfortable completing the questionnaire, you can refuse to answer any questions or finish the questionnaire sooner.

If you want to continue your collaboration, please accept the privacy policy.

Privacy Policy

Responsible: WE&B. Main goal: the realisation of this study reviewed in this document. Legal basis of treatment: express authorization of the participant, by signing this document (art. 6.1, letter 'a' of the GDPR). Criteria for conservation: your contact information will be saved only in the case that you have indicated your willingness to register the update of the results. The rest of the data, configured by the answers given to the responsible person, will be anonymized and stored indefinitely. Rights of the participant in the study: You have the

right to agree in any moment, to access, rectify and remove your personal data, and right for limitation and opposition to the treatment. You can also file a claim with the corresponding control authority if you consider that the treatment does not conform to the current regulation. Data transfer: In case that you have decided to register the results of the study, your data will be transferred to WE&B, who will manage the sending and management.

Contact data to exercise your right: info@weandb.org.

* 1. I accept the privacy policy

○ No ○ Yes

* 2. Which is your organisation?

[   ]

2. The Housing Sector

In the context of circular economy in the housing sector we have identified actors that we consider as key stakeholders. To what extent do you collaborate with the following organisations? (0 means no collaboration and 5 means a significant collaboration, where you share some projects / initiatives at the moment)

	0 "no collaboration"	1	2	3	4	5 "significant collaboration"
ACR+ European Promotion	○	○	○	○	○	○
AEE-INTEC	○	○	○	○	○	○
Agència Catalana de l'Aigua (ACA)	○	○	○	○	○	○
Agència Catalana de Residus	○	○	○	○	○	○
Agència de l'Habitatge de Catalunya (AHC)	○	○	○	○	○	○
Agencia Local Energia de	○	○	○	○	○	○

Barcelona (AEB)

Aiguasol

Alchemia-Nova

Austria Solar – Verein zur Förderung der thermischen Solarenergie

CARTIF

CCDR-N

Cleantech-Cluster

Cradle to Cradle

Catalan Water Partnership (CWP)   ○   ○   ○   ○   ○   ○

Departament de Territori i Sostenibilitat de la Generalitat de Catalunya   ○   ○   ○   ○   ○   ○
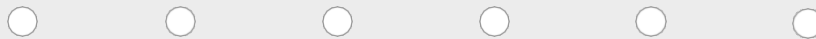
Energieinstitut Vorarlberg   ○   ○   ○   ○   ○   ○

FH Technikum Wien

Greener

Gremi de Constructors

d'Obres de Barcelona i Comarques	○	○	○	○	○	○
HomeBiogas	○	○	○	○	○	○
Housing Europe	○	○	○	○	○	○
Institut Català de la Energía (INCAEN)	○	○	○	○	○	
Institut Català del Sòl (INCASOL)	○	○	○	○	○	○
LEITAT	○	○	○	○	○	○
NEUES LEBEN	○	○	○	○	○	○
MA 48 - Abfallwirtschaft, Straßenreinigung und Fuhrpark	○	○	○	○	○	○
Passivhaus Institut	○	○	○	○	○	○
Sostre Cívic	○	○	○	○	○	○
Veolia Servicios	○	○	○	○	○	○
Wohnbund consult	○	○	○	○	○	○
Water Europe (WE)	○	○	○	○	○	○

For each of the following stakeholder categories, could you indicate other stakeholders with whom we should interact within the housing sector and circular economy in the European region (regional, national, local leveles...)?

Technology Suppliers

Designers /Architects

Public agencies

Academic sector (research)

Civil Society Organisations

Policy Makers

Others, please specify

3. General questions

We would like to acquire information of the profile of the person that has undertaken the questionnaire to ensure the scientific rigour of the investigation.

5. Gender

○ Male ○ Female

6. How old are you?

○ 18 – 29 years old

○ 30 - 49 years old

○ more than 50 years old

7. Do you have any comments regarding this survey and the questions within it? Please write down your comments

[text box]

4. Information about data processing

This questionnaire was developed by the HOUSEFUL project, your response and participation are very important for the development of the project as they will help us to analyze the social context of this project.

The HOUSEFUL project may contain certain personal information about you as part of our general project activities (such as your address and contact details, educational background, areas of expertise). We have become aware of your information in a number of ways - directly from you, from others or over time through our relationship with you - and may have received it and/or retained it in various forms (whether in writing, electronically, verbally or otherwise).

We use this information for a variety of project-related purposes only. For example, we need this information to identify participants for the HOUSEFUL events, for expert interviews and workshops, etc. For interviews and focus group discussions, personal data will be kept in a protected file, separate from the users' anonymized responses. You can be rest assured that we will not use your personal information for commercial purposes. We take steps to ensure that your personal data is stored safely.

If you participate in the HOUSEFUL events, if you agree, your name, organisational affiliation and email address may be distributed and made available to other HOUSEFUL partners. This is necessary to achieve two of the main HOUSEFUL specific objectives:

To achieve the implementation of an innovative engagement strategy to stakeholders involved in co-creation activities by using backcasting (a workshop methodology) exercises, and

To raise the public and stakeholder's awareness by stimulating the acceptance and fostering the replication of HOUSEFUL services.

Stay in touch with HOUSEFUL; join our newsletter: http://houseful.eu/news/

If you wish to retract your personal data, please identify yourself and please contact us via email:

info@weandb.org

Again, thank you very much for the participation and for your time, The Houseful team

Annex. 5 Co-Creation Idea Factsheet

CO-CREATION IDEA FACTSHEET	*TITLE*

Context
To add about the context of the idea: region, demo, etc.

Description
Short description of the co-creation idea concept considering "design", "problem/objective", "strategic consideration", and "normative consideration" of the idea)

List of assumptions (*from CWS2*)
Expectations and needs from housing sector to achieve the desired futures that should be thought of in the CWS2.

Roles and responsibilities
Identification of actors responsible for the implementation of the idea and its development alongside with their roles (this can be initiated in btw. CWS1 and CWS2)

Tasks
List of designed activities that have to take place in order to further develop the idea (this can be initiated in btw. CWS1 and CWS2)

Planning (*to be developed in CWS2*)
Action plan for the development of the co-creation ideas gathered in the Idea Factsheet. This cell is to be developed together with stakeholders in the CWS2. The idea is to organise the previous cells (tasks, roles and responsibilities) into one strategic plan per each idea. The planning should have at least the three elements of the table below (tasks, responsible, and timing)

Task	*Responsible*	*Timing*

Requirements for the full implementation of the idea
What would be required during the course of HOUSEFUL project to develop this idea. To identify resources available and non-available.

Targeted audience
Describe which community/ies (or types) this idea is aimed at/affected, as precisely as possible.

Working group members	**Co-creation process: related HOUSEFUL Project Tasks (Tasks)**
• *Organisation (Name, Surname)* • *Organisation (Name, Surname)*	*To be filled by HOUSEFUL members. HOUSEFUL wp leaders will validate the list*

HOUSEFUL Solutions (CEBOs)	**Communication tips**

To List what are the "affected" HOUSEFUL solutions by this co-creation idea	*Lessons learnt for the communication of HOUSEFUL CEBOs*

Sources of Information
Here information sources to develop the co-creation idea can be placed. This will contribute to the development of the idea in the CWS2

Annex 6 List of HOUSEFUL Solutions

CEBOS			
Number	**Name**	**Domain**	**Description**
S0	SaaS – Software as a Service	Holistic	Aimed at evaluating building circularity, while offering different 11 circular solutions to stakeholders as innovative services to improve it, achieving an efficient management and use of water, waste, energy and material resources in housing sector.
S1	Service Definition of a new method for the analysis of Building circularity	Holistic	Focused on the development of an innovative methodology for the quantification of building circularity considering current management and use of water, waste, energy and material resources in all stages of housing value chain.
S2	Social engagement for co-creation	Holistic	Will provide capacity development activities for co-creation of new circular business opportunities to stakeholders in current housing value chain.
S3	Development of 4 Material Passports based on advanced 3D model	Materials	Focused on sharing data about materials used in new and existing buildings and their impacts on the environment in a digital format to stakeholders across buildings' value chain will be provided.
S4	Searching local building material	Materials	Focused on sourcing more than 50 types of building materials (existing or new commercial products) from secondary material platforms, databases and/or local producers, contributing to debate about quality, origin and potential material reuse at local scale.
S5	Efficient treatment and reuse of rainwater and greywater	Water	Greywater and blackwater can be separated with retrofitting measures in

			existing buildings. Greywater can be treated using innovative nature-based solutions for indoor application in multi-level green walls with minimum energy cost (<1.5kWh/m3) and disinfected using commercial O3/UV systems for >90% water reuse.
S6	Efficient treatment and reuse of un-segregated water	Water	The liquid fraction of this combined wastewater can be separated from the solid fraction using centrifugal force and gravity. The liquid fraction can be treated with NBS indoor, at facade and outdoor with a minimum energy cost (<1.5 kWh/m3) and allowing >95% water reuse. The effluent water can be disinfected (by using O3/UV) and used for toilet flushing, urban gardening and compost production. The solid fraction can be used for biogas production in a dry anaerobic digestion unit (Solution 8).
S7	Blackwater and Bio Waste treatment for biogas production	Waste	Based on the joint treatment of blackwater and grinded bio waste at building (pilot) scale for wet anaerobic digestion using AnMBR solution. The solution foresees the recovery of >95% food waste and >95% organic matter from blackwater.
S8	High quality fertiliser/compost of local origin	Waste	Stabilised blackwater from anaerobic digestion systems (AnMBR or dAD, Solution S7), will be used as compost for local gardening
S9	Optimal management of waste at the end of building life cycle	Waste	Focused on the analysis of maximum recovery and valorisation potential of existing materials in buildings at refurbishment or demolition stage, providing demolition guides to guarantee the best and safety management of waste streams.
S10	Improvement of energy efficiency by active and passive solutions	Energy	Energy improvement solutions such as envelope interventions, solar thermal

			systems, shared photovoltaic systems, etc will be proposed to reduce the energy demand of buildings and increase the share of renewable energies, contributing to reach Nearly Zero Energy Buildings.
S11	Guarantee the energy saving/production in buildings	Energy	Pay for performance business models are encouraged to be applied for installing energy technologies. For example, a pay per performance service applied to renewable energies can consist in that an energy service company supplies, installs and maintains a solar thermal (ST) or photovoltaic (PV) system, guaranteeing an annual solar production to the owner/tenants during the length of the contract.

Annex 7 Description of all co-creation ideas

Co-creation idea 1.1: Training protocol for the use and maintenance of solutions	
Rationale of the Co-creation idea	A protocol for the training and good use of technologies by inhabitants that includes the key messages for an effective communication and the use of common terminology. The manual will promote an efficient and sustainable use of energy and water.
Description of Co-creation idea	Helping dwellers understanding the benefit of an efficient use of energy and water in their building, for their own benefit and for sustainability purposes. The manual will provide simple examples on how to better manage their consumption, and it will support the acceptance of the Housefull solution, as well as promoting positive behaviors that will help maintaining high performances also after the project ends.
Benefits expected	Project acceptance, efficient use of resources, long lasting performances of Houseful solutions.

Co-creation idea 1.2: Visualization of benefits of HOUSEFUL solutions	
Rationale of the Co-creation idea	The relation between Houseful actions and the benefits that generate should be communicated to inhabitants and stakeholders, with special emphasis on economic aspects, but also environmental and energy data. This can increase tenant's acceptance and collaboration in the correct performance of the solutions. In addition, involving other stakeholders (investors and public administrations) can promote replication of the Houseful actions.
Description of Co-creation idea	Implement Communication actions before and after the renovation. Online and physical meetings are being organize to interchange information with stakeholders and with the future inhabitants and after, the renovation and information panel will be posted on the building's entrance. In addition, a video showing the Benefits of Houseful solutions (and training information) will be distributed between tenants. Moreover, AHC website will have a page dedicated to Houseful project and the democases in local language and a QR code in the information panels will link with AHC website. Inhabitants and stakeholders will be also invited to SaaS where they could visualize the benefits of Houseful solutions.
Benefits expected	Increase inhabitant's comfort and a feeling of pride that the place they are living in is better than before

	the renovation or even compared to the average building. Between other stakeholders, this could allow to replicate Houseful actions in other buildings/districts.

Co-creation idea 1.3: Reducing costs of the HOUSEFUL solutions

Rationale of the Co-creation idea	It is important that a circular house does not result in higher operational or maintenance costs, therefore the project must look for ideas on how to minimize costs while these solutions are based on the needs of the inhabitants
Description of Co-creation idea	Identification of the different type of costs in all the Houseful Solutions implemented in Demo 1. Get data from LCC. Calculation of total cost ownership.
Benefits expected	Total Ownership Cost for each solution and globally for the Solutions implemented in Demo 1. Be able to show the final users the benefits through all the Life cycle of each solution.

Co-creation idea 1.4: Social support in the long term of HOUSEFUL solutions

Rationale of the Co-creation idea	Social housing management involves uncertainties in terms of shifting inhabitants, managers, etc. Therefore, it is necessary to provide ideas for the social accompaniment of these buildings in the long term, taking into account scenarios of possible changes.
Description of Co-creation idea	Support provision during change and rotation of tenants; ensuring Houseful solutions have no impact on housing affordability; considering the building as an integral part of the neighborhood and taking advantage of the common areas to create a community and governance structures with the facilitation of a dedicated person to it; considering the effects that climate change might have; providing occupants with the necessary information, involvement and learning spaces.
Benefits expected	Addressing the long-term perspective in terms of capacity building in social housing.

Co-creation idea 2.1: Visualization of benefits of Houseful solutions

Rationale of the Co-creation idea	The relation between Houseful actions and the benefits that generate should be communicated to inhabitants and stakeholders, with a special emphasis on economic aspects, but also environmental and energy data. This can increase tenant's acceptance and collaboration in

	the correct performance of the solutions. In addition, involving other stakeholders (investors and public administrations) can promote replication of the Houseful actions.
Description of Co-creation idea	Implement Communication actions before and after the renovation. Online and physical meetings are being organize to interchange information with inhabitants/ stakeholders and after information panels are being posted on the building's entrance. In addition, a video showing the Benefits of Houseful solution (and training information) will be distributed between tenants. Moreover, AHC website will have a page dedicated to Houseful project and the democases in local language, a QR code in the information panels will link with AHC website. Inhabitants and stakeholders will be also invited to SaaS where they could visualize the benefits of Houseful solutions.
Benefits expected	Increase inhabitant's comfort and a feeling of pride that the place they are living in is better than before the renovation or even compared to the average building. Between other stakeholders, to replicate Houseful actions in other buildings/districts.

Co-creation idea 2.2: Training protocol for the use and maintenance of solutions	
Rationale of the Co-creation idea	A protocol for the training and good use of technologies by inhabitants that includes the key messages for an effective communication and the use of common terminology. The manual will promote an efficient and sustainable use of energy and water.
Description of Co-creation idea	Helping dwellers understanding the benefit of an efficient use of energy and water in their building, for their own benefit and for sustainability proposes. The manual will provide simple examples on how to better manage their consumption, and it will support the acceptance of the Housefull solution, as well as promoting positive behaviors that will help maintaining high performances also after the project ends.
Benefits expected	Project acceptance, efficient use of resources, long lasting performances of Houseful solutions.

Co-creation idea 2.4: Co-management of shared HOUSEFUL services and community building fostering community responsibility	
Rationale of the Co-creation idea	It is relevant, especially in a context of social housing, to keep stakeholders engaged (specially inhabitants) during the use and maintenance of the solutions to guarantee their effective implementation.

Description of Co-creation idea	Of importance is the involvement of inhabitants to identify their needs related to the functioning of the solutions and to create a space for them to communicate their problems when using the solutions. The aim is to establish an effective community cohesion. For this, two elements are central, to create a co-responsible neighbour community and a strong relationship within different public administrations and between these and the inhabitants (the neighbour community should also establish relationship to other actors that can provide a support to their actions).
Benefits expected	Increase the social cohesion in the building and surroundings. Develop local channels for communication.

Co-creation idea 3.1: Effective communication of HOUSEFUL activities including the use and maintenance of HOUSEFUL solutions considering aesthetics of these	
Rationale of the Co-creation idea	A key aspect of disseminating and replicate circular Houseful Solutions is effective communication. Potential skepticism or prejudices (e.g., odour) can be addressed in order to resolve them.
Description of Co-creation idea	Effective Communication of Houseful solutions to diverse target groups and through different formats: Authentic communication; activities should include solutions in action. Communicate environmental impacts of linear models Develop a long-term strategy for the dissemination of solutions Communication mechanism to identify and mitigate potential pitfalls.
Benefits expected	Positive stakeholder feedback concerning dissemination activities; long-term increasing trust and interest in circular Houseful solutions.

Co-creation idea 3.3: Use and maintenance of HOUSEFUL solutions: training activities	
Rationale of the Co-creation idea	An important aspect is operation and maintenance. It is beneficial if the residents have a basic understanding of nature-based technology and its functionality. External training activities can support awareness raising and dissemination.
Description of Co-creation idea	• Implementation of basic training to facilitate maintenance of Houseful solutions for Cambium inhabitants, where possible. • Implement training at Cambium to facilitate participation and increase understanding for nature-based solutions (schools, universities, municipalities, follower buildings, etc.).

Benefits expected 👍	Engagement and positive handling of the Solutions by Cambium Community; better understanding of Houseful Solutions strengthens trust and interest.

Co-creation idea 4.1: Identification of circular materials for the housing sector	
Rationale of the Co-creation idea 💡	Incorporating circular materials in projects, which is the main objective, is not always easy. Among other factors, it depends both on the experience of the technician and the ease of accessing to information on existing products on the market and also the availability of suppliers close to the building site.
Description of Co-creation idea 📊	The objective of this idea will be to co-create with the Houseful teams a vision on Materials. Important here will be to determine: the costs of these materials, where they are from (local, regional, etc.), explore the possibility to determine the applicability of the materials in concrete cases, and have a critical perspective to help on the decision making. Important concepts are recycled content, embedded energy, durability, flexibility variability and disassembly of materials/products.
Benefits expected 👍	Reachable, comparable, clear and structured information that reduces cost, waste prevention and increase circular economy potential.

Co-creation idea 4.2: Key messages for future communication on HOUSEFUL solutions	
Rationale of the Co-creation idea 💡	In order to upscale the Houseful solutions, relevant local stakeholders must be firstly 'engaged' and secondly 'informed' about the possibilities of the circular solutions.
Description of Co-creation idea 📊	It is important to get non-technical experts excited about the possibilities of the Houseful solutions. This can be achieved by creating easy to digest and assimilate 'key messages' and content focusing on the positive results of the solutions. This will be communicated through videos, podcasts, and publications.
Benefits expected 👍	Idea 4.2 will provide a number of new communications tools, specifically aimed at reaching a broader audience and promoting the replication of the Houseful solutions.

Co-creation idea 4.3: Means to promote the participation of actors in the HOUSEFUL solutions

Rationale of the Co-creation idea	In this Demo-site, the context of the Houseful ideas englobes a vision of sustainability and circular housing in Vienna. For the future, what is aimed for is a socially heterogeneous city with a stronger neighborhood network of mutual support. At the building level, the objective is to reduce the contradictions between sustainability and affordability while increasing the share of circular solutions. To achieve these goals, there is a need to involve all stakeholders in the building sector.
Description of Co-creation idea	This idea will deal with the decision-making structure around Houseful solutions. For that it is important to define which stakeholder groups have interest in or influence on the Houseful solutions. A guide will be developed to depict which aspects are relevant to consider before, during and after the implementation of the Houseful solutions to facilitate the uptake of the solutions by the housing value chain. Here it is important to consider mechanisms to control the socio-economic requirements for a successful application of the ideas, how to define roles and responsibilities and mechanisms to communicate before the implementation, during the implementation and once the solutions are installed.
Benefits expected	Policy brief about recommendation on governance circular housing; development of Network of Social Housing Supporters; establishment of minimum requirements about governance with and for Tenants.

Co-creation idea 4.4: The principles of Aesthetics for circular HOUSEFUL solutions	
Rationale of the Co-creation idea	Aesthetics as a means for effective communication: the aim would be to evidence that sustainability and circularity as a such should be considered as the better chance to be aesthetic and valuable.
Description of Co-creation idea	The objective is to disseminate the message that smart nature-based and circular solutions allow a different relation to the living space. This relation is a good one and can be seen as aesthetic. Important is also the aspect of functionality. If solutions are not functional, they won't be used and cannot be seen as beautiful.
Benefits expected	Supporting effective communication, increasing trust and engagement and therefore replication of Houseful solutions.