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Authors List

Leading Author			
First Name	**Last Name**	**Beneficiary**	**Contact e-mail**
Theodoros	Kakardakos	MERIT	th.kakardakos@meritconsultinghouse.eu

Co-Author(s)				
#	**First Name**	**Last Name**	**Beneficiary**	**Contact e-mail**
1	Evangelia	Rontogianni	MERIT	e.rontogianni@meritconsultinghouse.eu
2	Giannis	Skiadaresis	MERIT	g.skiadaresis@meritconsultinghouse.eu

Reviewers List

Reviewers			
First Name	**Last Name**	**Beneficiary**	**Contact e-mail**
Stylianos Zikos	Quality Assurance Commission member	CERTH	szikos@iti.gr
Ms. Evgenia Kapassa	Research Assistant	UNIC	kapassa.e@unic.ac.cy

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Executive Summary

This report analyses the Living Labs methodology concept that will be implemented in the framework of the PARITY project and presents the implementation plan of the activities anticipated under the umbrella of this methodology.

More in detail, initially in this report, the general definition and the concept of the living labs methodology is given under the user driven innovation approach that the PARITY project will follow during its implementation. Following that, a definition of the PARITY living labs is provided with a connection to the user driven innovation approach and the objectives of the living labs are presented and illustrated.

After the definition of the user driven innovation approach and the connection with the living labs methodology, a relevant literature review is provided with the scope to define the available tools and the timeframe that will be followed, with the different phases of the approach. The available tools recognized for this methodology are questionnaires and interviews, focus groups, usability testing, contextual inquiry, lead user innovation and participatory design. This set of tools will be available to be used under the living labs methodology by the technology providers and the pilot site owners during the project implementation. Moreover, in this part, the proposed audience that living labs should consult is specified with the main target message that needs to be communicated from the consortium to the living labs participants and vice versa.

In the next section, the implementation plan of the living labs activities is presented. The anticipated activities include the workshops that will take place in each pilot site of the project and the questionnaires that will elicit the end user requirements. Moreover, the training seminars that will take place during the pilot workshops are presented.

In the final section of this report, the evaluation methodology of the living labs is presented. Initially, the requirements and the expected results of the living labs implementation are identified and following that, those parameters are quantified in specific Key Performance Indicators. Thus, by the end of the project those metrics will be used to evaluate the performance of the living labs towards the specified targets.

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List of Acronyms and Abbreviations

Term	Description
DER	Distributed Energy Resources
DG	Distribution Grids
DoA	Description of Action
DSO	Distribution System Operator
ICT	Information and Communications Technology
IoT	Internet of Things
KPI	Key Performance Indicators
LFM	Local Flexibility Market
LL	Living Labs
RES	Renewable Energy Sources

1. INTRODUCTION

The PARITY project addresses the "structural inertia" of Distribution Grids (DGs) by delivering a transactive flexibility framework that will increase durability and efficiency of the electrical grid, while simultaneously enabling the adoption of more Renewable Energy Sources (RES) through enhanced real time control of Distributed Energy Resources (DER) flexibility combined with novel Active Network Management functionalities. PARITY will go beyond the traditional "top-down" grid management practices by delivering a unique local flexibility management platform through the seamless integration of Internet of Things (IoT) and Blockchain technologies. By delivering a smart-contract enabled market platform based on blockchain technology, PARITY will facilitate the efficient deployment of local micro-transactions and reward flexibility in a cost-reflective and symmetric manner, through price signals of higher spatio-temporal granularity based on real-time grid operational conditions. Finally, by deploying advanced IoT technology PARITY will offer distributed intelligence (DER profiling) and self-learning/self-organization capabilities (automated real-time distributed control), orchestrated by cost reflective flexibility market signals generated by the blockchain Local Flexibility Market platform (LFM platform). Within PARITY, DER will form dynamic clusters that essentially comprise self-organized networks of active DER nodes, engaging in real-time aggregated & P2P energy/flexibility transactions.

More in detail, the PARITY project aims to enable the set-up and operation of local flexibility markets at the distribution network level via a holistic offering encompassing:

- A smart contract enabled, blockchain based LFM platform which will facilitate both peer-to-peer energy/flexibility transactions as well as the sell/purchase of flexibility to Smart Grid actors.
- IoT enabled DER Flexibility management tools - both in a peer-to-peer distributed fashion, but also through a centralized aggregator
- Smart Grid monitoring and management tools to enable the Distribution System Operation (DSO) to optimally manage the low voltage distribution network in the presence of increasing intermittent RES penetration and with the aim to contain the problems they create to grid stability

In parallel to the aforementioned technology solutions that will be created and demonstrated in the project, PARITY will also deliver all the necessary additional elements that are critical for the effective deployment, replication and proliferation of the PARITY solution. These include:

- The investigation of market coupling mechanisms that will enable to bundle and trade local flexibility potential in the national energy and ancillary service markets when it exceeds the needs of the local market and it can be monetized at higher levels of the grid,
- The definition of LFM actors and the associate business models that will ensure seamless LFM operation,

- The innovative retail energy commercial arrangements and contracts which will enable the automated provision and trading of flexibility in the LFM that will ensure grid stability
- The policy reform recommendations to shape the regulatory frameworks that will enable LFM creation in a financially sustainable manner.

PARITY will demonstrate all its results in four demonstration sites with varying characteristics in terms of climatic zones, proliferation of RES and demand device types, regulatory frameworks and market codes as well as culture and environmental consciousness. The sites are located in Granada, Spain; Athens, Greece, Malmo, Sweden and Massagno, Switzerland.

1.1 Scope and Objectives of the Deliverable

In this deliverable the Living Labs Setup and Activities Planning will be presented and analyzed. The PARITY Living Labs operation extends from the very first stages of project implementation (user requirements phase) up to the pilot evaluation phase, aiming at the establishment of an iteration and open collaboration process that will accelerate collaborative knowledge generation and integration, technology customization and validation against real market and user needs, as well as end-product definition and go-to-market strategy creation. Various interaction and collaboration mechanisms will be defined and the living labs activities will be properly organized and planned in close synergy with T8.2 "Community engagement, pilot participant recruitment and integration into local flexibility market" and T9.2 "Dissemination and communication plan" of the PARITY project.

Indicatively, in the framework of this task at least 8 targeted living labs engagement and training workshops will be performed (2 in each pilot site) to:

- Raise awareness, engagement and acceptance of pilot site occupants and stakeholders, including also the preparation and distribution of appropriate material,
- Involve end users in the requirements definition activities of the project,
- Training users and contributing to the adoption of the PARITY concept and operation in the pilot sites of the project,
- Involving all stakeholders in the evaluation of project results. The workshops will be organized by the pilot partners respectively and will be appropriately supported by the project Dissemination and Communication Manager.

The PARITY Living Labs will provide a platform for exchanging the best practices toward user driven open innovation of products and services in the integrated local energy systems, smart grids and demand response domains and to establish relevant partnerships in this sector. PARITY Living Labs is a key tool and a part of dissemination, training and exploitation, through stakeholder awareness and engagement, as presented in the following Figure 1.

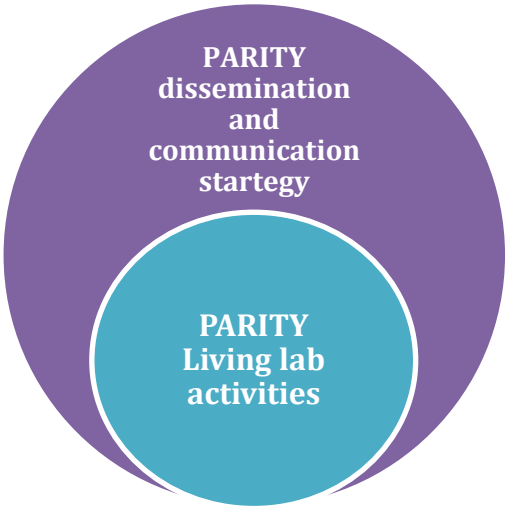

Figure 1: The living labs methodology as a part of the whole project dissemination and communication strategy

1.2 Structure of the Deliverable

In the first part of this deliverable, the general definitions and the concept of the living labs methodology is given, under the user driven innovation approach that the PARITY project will follow. More in detail, initially the user driven innovation approach, that the project will follow is presented. The adoption of this approach from the project is what created the necessity of the implementation of the living labs methodology. Following that, a definition of the PARITY living labs is provided with a connection to the user driven innovation approach. Finally, in this part, the objectives of the living labs are presented and illustrated.

After the definition of the user driven innovation approach and the connection with the living labs methodology, a relevant literature review is provided. In this review the living labs methodology is defined and the timeframe that will be followed is determined, with the different phases of the approach. Moreover, in this part, the proposed audience that living labs should consult is specified with the main target message that needs to be communicated from the consortium to the living labs participants and vice versa. Finally, in this part, the available tools that will be available and could be used under the living labs methodology are presented with the advantages and disadvantages of each.

In the next section, the implementation plan of the living labs activities is presented, as planned up to month 6 of the project. The anticipated activities include the workshops that will take place in each pilot site and the questionnaires under task 3.1 of the project. Moreover, the training seminars that will take place during the pilot workshops are presented. Finally, if any modifications or additions should be needed in this plan, they will be included in deliverable 3.2, which will be updated every six months.

In the final section of this deliverable, the evaluation methodology of the living labs is presented. Initially, the requirements and targets that needs to be fulfilled are identified and following that, those

parameters are quantified in specific Key Performance Indicators (KPIs), in order to validate by the end of the project, if the living labs have fulfilled their objectives and reached the expected results and requirements.

1.3 Relation to Other Tasks and Deliverables

As already described and illustrated in Figure 1, the living labs activities are part of the project dissemination and communication strategy. As a result, those two are strictly connected and will be organized, planned and run in close synergy during the project lifetime. More in detail, in the framework of task 9.1 "Living Labs Setup and Activities Planning", which was active during the first six months of the project, the design phase of the living labs implementation was executed and is presented in this deliverable. Then, the implementation of the anticipated actions, described in this deliverable, will be executed in the framework of task 9.3 "Dissemination and communication activities" and in the framework of task 8.2 "Community engagement, pilot participant recruitment and integration into local flexibility market" which both run throughout the project duration. If changes in the initial planning will be needed after the end of task 9.1 and submission of this deliverable, they will be implemented in a special chapter of Deliverable 9.2 "Dissemination and Communication Plan & Activities", which is foreseen to be updated every 6 months during the project duration.

Moreover, the living labs activities are strictly connected with task 3.1 "Elicitation and analysis of business/use cases and requirements for the PARITY tool suite", which will be active during the first 7 months of the project. During this task a survey will be performed through questionnaires, mock-ups and personal- and group- interviews to define the main stakeholder requirements. This tool of stakeholder requirements elicitation is part of the first stage of the living labs (the user requirements phase) and will be performed under the umbrella of the living labs methodology.

Finally, the living labs methodology will provide a toolkit that will remain available during the whole life cycle of the project and could be used by any task or work package in the framework of the project, Those tools will provide the opportunity to technology providers and pilot owners to use them under the umbrella of the user-driven innovation methodology in order to elicit end user needs, take feedback during the development of different tools or validate the developed tools according to final user needs.

The relation between different tasks and work packages is presented in the following Figure 2.

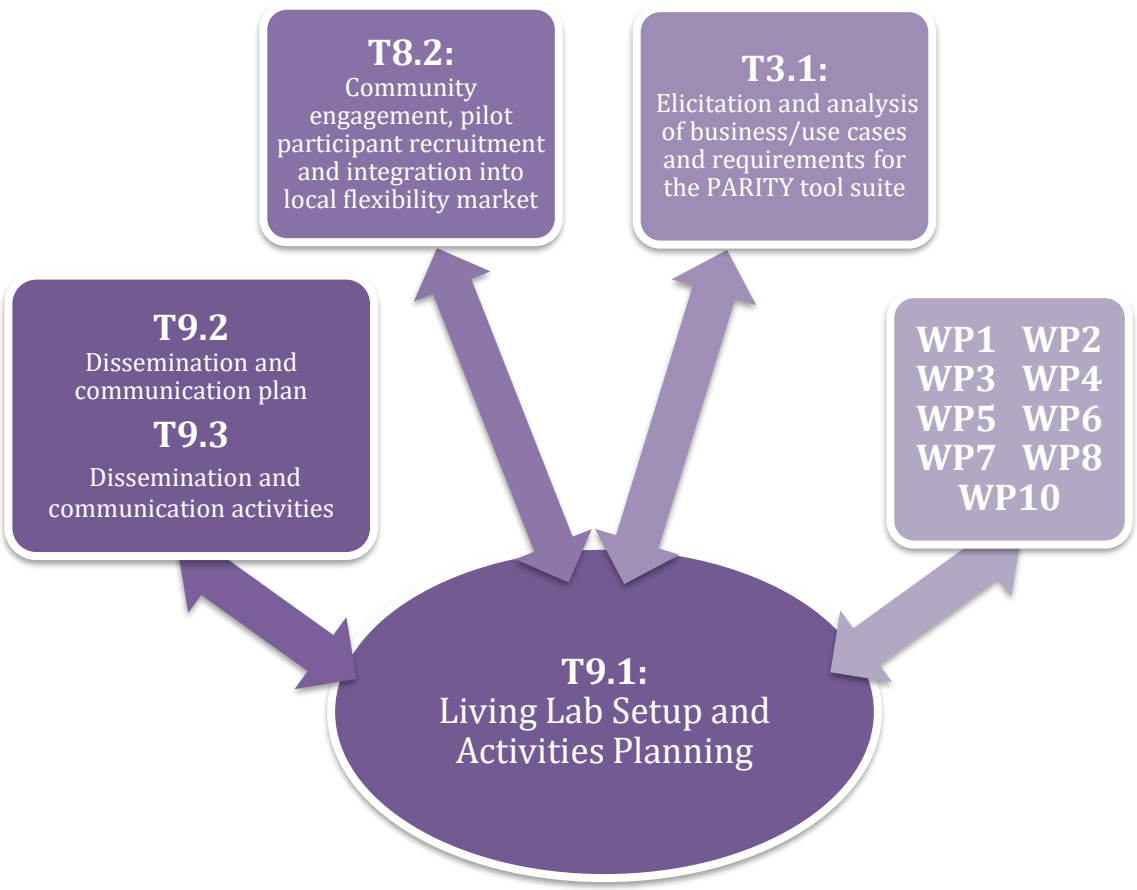

Figure 2: Interrelations with other tasks and work packages

2. THE LIVING LABS CONCEPT

2.1 The User-Driven Innovation Methodology

According to the DoA [1], in the methodological approach of PARITY, end-users and main project beneficiaries (DSOs, Prosumers, Aggregators, Retailers) are collectively placed at the center of all research, innovation, demonstration and communication activities of the PARITY project, which will adopt a User-Driven Innovation Approach towards addressing emerging end-user and market needs, critical for the successful project implementation and the realization of its anticipated impacts. The User-Driven Innovation Approach (Figure 3) aims to involve beneficiaries and buildings occupants throughout all stages of the project life cycle, as key enablers of the PARITY innovation process, towards encouraging active and collaborative contributions in the development of a unique flexibility market ecosystem. Agile ICT implementation methodologies in conjunction with Continuous Validation and Verification processes will be incorporated in the overall User-Driven Innovation Approach to manage cross-functional teams and ensure the establishment of an effective Local Energy System Optimization Framework using innovative integrated ICT solutions. Continuous interactions between beneficiaries, end-users and project team members will be encouraged to minimize deviations between expectations and final outcomes, as well as to divide the project final outcome into intermediate marketable results.

The User-Driven Innovation Methodology and Approach and Agile Development of PARITY will be supported by the establishment of the PARITY Living Labs. Its creation is motivated by the understanding that a Living Labs can provide an excellent network for experience sharing and exchange towards user and business-driven open innovation. The PARITY Living Labs activities will be oriented towards fulfilling the following objectives:

- Widely disseminate the project outcomes towards end-users, beneficiaries and energy stakeholders so as to generate a broad awareness and engagement/ involvement in the various project activities;
- Create opportunities for further exploitation and replication of the project results after completion;
- Obtain feedback from major stakeholders, end-users and targeted beneficiaries throughout project duration to optimize all project developments, so as to directly address critical needs of stakeholders involved in the operation of the PARITY framework.
- Support knowledge and experience sharing with international partners together with other selected stakeholders from the country.

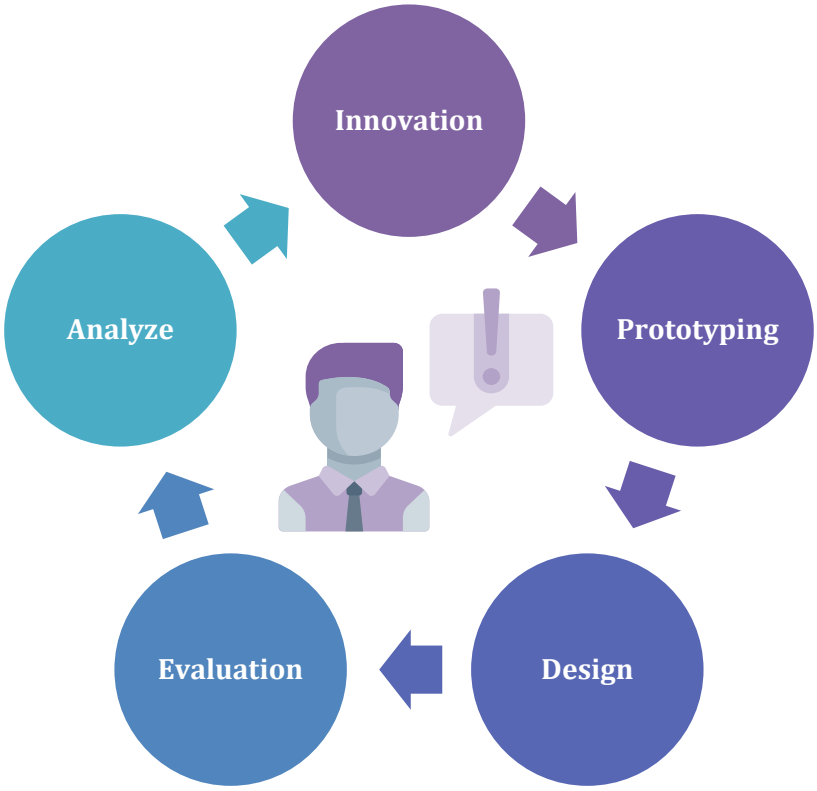

Figure 3: The PARITY user driven innovation approach

To achieve this degree of collaboration, PARITY will establish a complete awareness and communication framework with all involved stakeholders, either involved in or affected by project activities. The Living Labs methodology involves end-users and beneficiaries from the very beginning of a new idea, creating the motivation to share and discuss their experiences and requirements. This collaborative environment, where all stakeholders evaluate, appraise and disseminate solutions and learnings, will lead to a natural acceptance by users who will be empowered not only to test, evaluate and report their own experience with the PARITY solutions, but mainly to live with it, smoothly accept and incorporate PARITY in their everyday lives and operations.

2.2 Definition of the PARITY living labs

The Living Labs concept (Figure 4) is a user-driven, open-innovation environment, integrating simultaneous research and innovation processes in an agile framework. Thus, the Living Labs activities are applied through the co-creation, co-exploration, experimentation and evaluation of innovative ideas, concepts, products, services and technological artefacts in real demonstrated use cases. Those demonstrated use cases involve end users, not only as passive observers of the project but also as the main source of formation of its final outcomes. Following this approach, allows all the involved end users and stakeholders to consider and evaluate both the final performance of the project technologies

or final results together with the respective end user acceptance. As a result, the Living Labs activities should begin during the very first stages of the project implementation and elements development, in order to give the opportunity to involve the user-driven innovation approach to the entire lifecycle of the project. The Living Labs activities, which integrate both user-driven innovation approach and agile development framework, are based on the following four main principles [2]:

"***Co-creation**: bring together technology push and application pull (i.e. crowdsourcing, crowd-casting) into a diversity of views, constraints and knowledge sharing that sustains the ideation of new scenarios, concepts and related artefacts.*

***Co-exploration**: engage all stakeholders, especially user communities, at the earlier stage of the co-creation process for discovering emerging scenarios, usages and behaviors through live scenarios in real or virtual environments (e.g. virtual reality, augmented reality, mixed reality).*

***Experimentation**: implement the proper level of technological artefacts to experience live scenarios with a large number of users while collecting data which will be analyzed in their context during the evaluation activity.*

***Evaluation**: assess new ideas and innovative concepts as well as related technological artefacts in real life situations through various dimensions such as socio-ergonomic, socio-cognitive and socio-economic aspects; make observations on the potentiality of a viral adoption of new concepts and related technological artefacts through a confrontation with users' value models*"

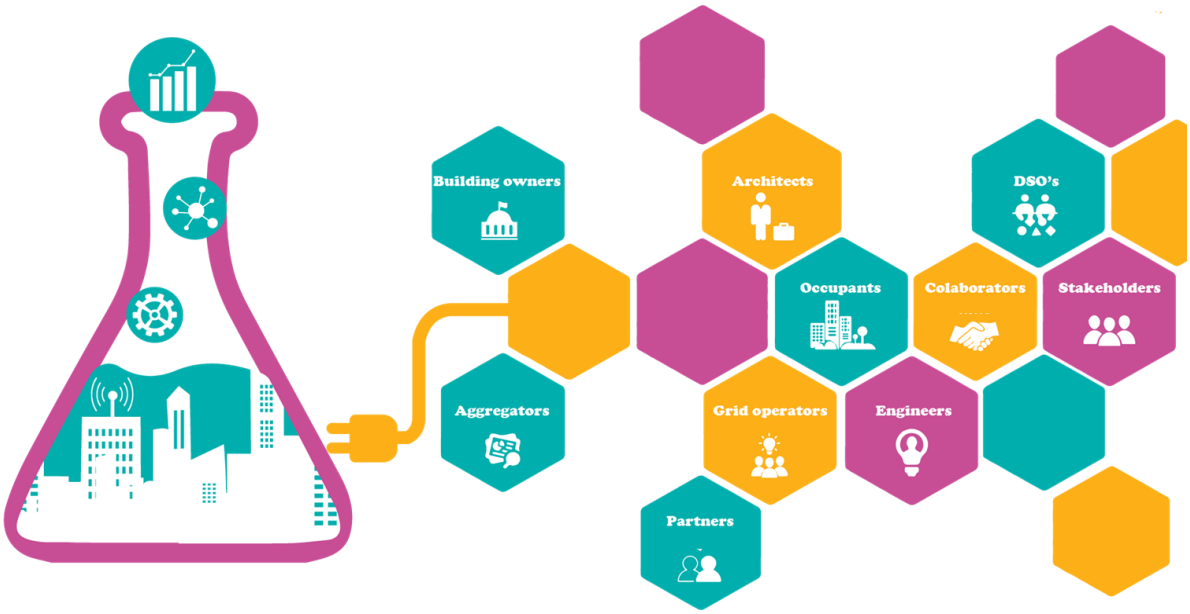

Figure 4: PARITY living labs operation principle.

2.3 Objectives overview

The main objective of the living labs methodology implementation is to create a framework with available tools that could be used during the project duration by all partners in order to follow the user driven innovation approach. This set of tools that is presented in paragraph 263.5, can be used by technology providers or pilot partners under the umbrella of the user-driven innovation methodology, in order to elicit end user needs, take feedback during the development of different tools or validate the developed tools according to final user needs. Those main objectives are illustrated in the following Figure 5.

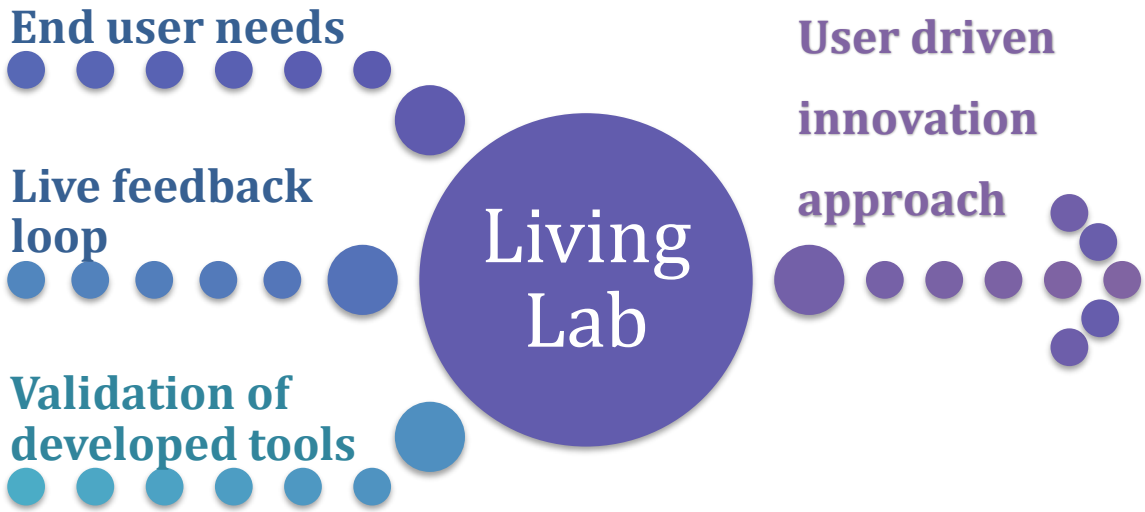

Figure 5: Living labs objectives under the umbrella of the user driven innovation approach

Moreover according to the PARITY DoA[1], for the implementation of PARITY Living Labs activities a series of workshops is planned to take place for training and engagement of final users and stakeholders. The PARITY Living Labs will be active from the very beginning of the project with local and national end-users and stakeholders in each country and their activities will take place in the pilot sites of the project.

The main objectives of the workshops are listed below:

- To disseminate widely all the results and outcomes of the PARITY project and raise awareness, engagement and acceptance towards all the targeted end-users, beneficiaries and stakeholders.
- To receive feedback from the viewpoint of involved stakeholders, ranging from prosumers, flexibility providers and system operators to aggregators, facility managers, regulators and market experts throughout the project's lifecycle, to optimize its different aspects.

- To create new opportunities for exploitation and replication of the projects results after its completion.
- To support all the various training activities of the project during the PARITY demonstration activities.

3. LIVING LABS METHODOLOGICAL APPROACH

3.1 Methodology

The recent literature [3] on innovation and design management has made significant efforts to investigate a specific approach usually referred to as user-centered design. To position the Living Labs methodology among the other methodologies, the following Figure 6 leverages on the map the research design methodologies proposed by Sanders [4], which are analyzed in the following chapter 3.5 "Channels – Toolkit "

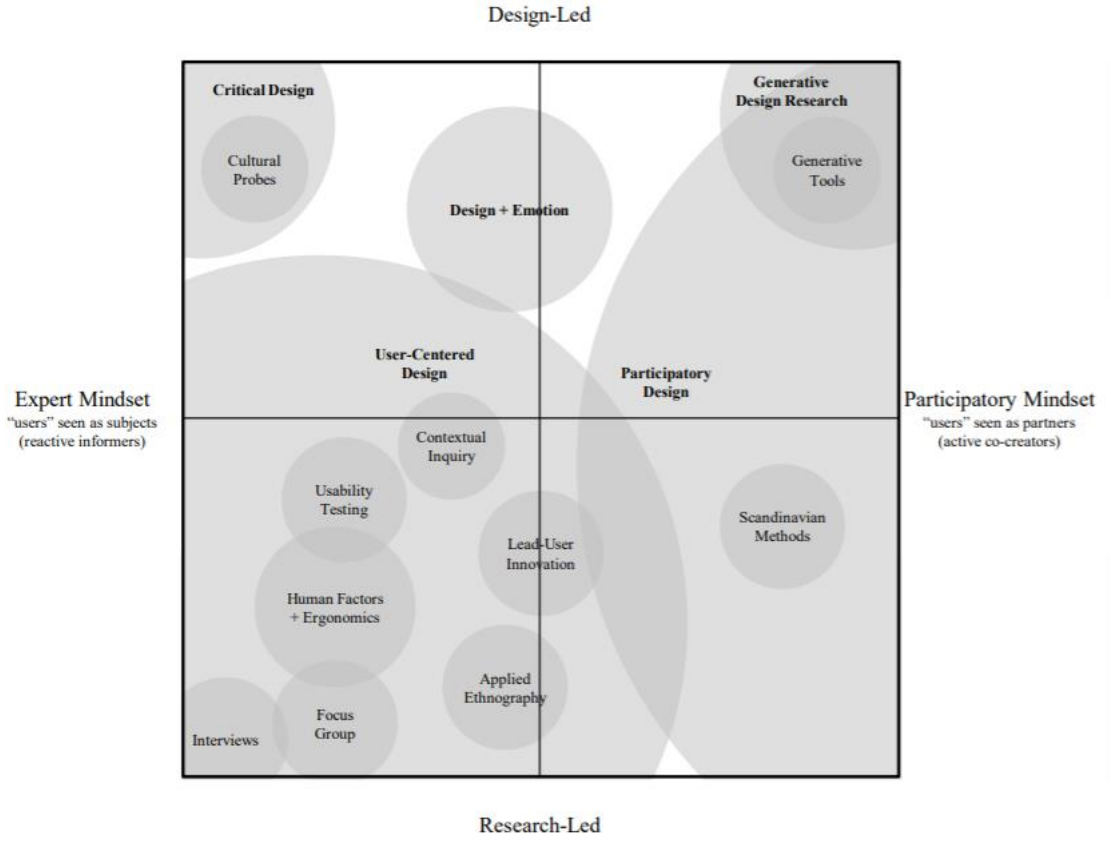

Figure 6: Map of Design Research Methodologies[4]

As per Dell'Era C and Landoni P [3] in this map, the vertical dimension describes the impetus of the design research approaches. The top half (i.e., design-led) contains design research methodologies that have been introduced into practice from a design perspective. The lower half (i.e., research-led) contains design research methodologies that have been introduced into practice from a research perspective. The horizontal dimension describes the mindsets of those who practice and teach design research. The left side exemplifies the expert mindset. At the bottom of the left side, researchers talk about the people that they do research on as subjects, or informers or users. The people are asked questions and/or requested to respond to certain stimuli and/or observed. At the top of the left side, the designer is the expert who creates things to probe or provoke response from the people who are often referred to as the audience. The right side exemplifies the participatory mindset. On this side, the researchers or designers invite the

people who will benefit from design into the design process as partners. In the following paragraphs we focus on the "research-led" methodologies mapped by Sanders [4] because of their proximity with the Living Labs methodology.

Based on experiences in developing countries [5], [6], defined Living Labs (LLs) as an environment, a methodology, or an approach that facilitates user-driven open innovation within real-life rural and urban settings/communities in which users collaborate with multiple committed stakeholders (nongovernmental organizations, small and medium-sized firms, industry, academic/research institutes, government, or donors) in one or more locations to become co-creators or co-designers of innovative ideas, processes, or products within multidisciplinary environments. Successful collaboration may result in improved processes or services and new business models together with “social inventions” (rules, procedures, programs, norms) that can be replicated (with sociocultural adaptations) to improve overall quality of life and the socioeconomic conditions in participating communities. LLs are considered to be “functional places” in real-life contexts and enablers of public–private partnerships among individuals (entrepreneurs, social entrepreneurs, and activists), enterprises, public entities, universities, institutes, and so on (the “fourth sector”). These real-life contexts may be cities, neighborhoods, towns, or rural areas that constitute “social spaces for innovation,” which support social action and are part of the innovation system. LLs, as in our case study example, are mechanisms enabling “scaffolding” endeavors and intermediation for structuring and providing governance to people participating in the innovation process ([7]; [8]).

Figure 7: Living Labs Scheme [3]

Following that principal, the PARITY Living Labs will be the main framework that will support horizontally several other aspects and tasks of the project. This framework engages end users and stakeholders from the first steps of a new idea leveraging motivation to share and discuss all the

experiences as well as any requirements and needs. Moreover, another novelty of the PARITY Living Labs methodology is the involvement of end users and stakeholders throughout the project lifecycle in a in the co-creation framework under the user driven innovation approach.

3.2 Timeframe

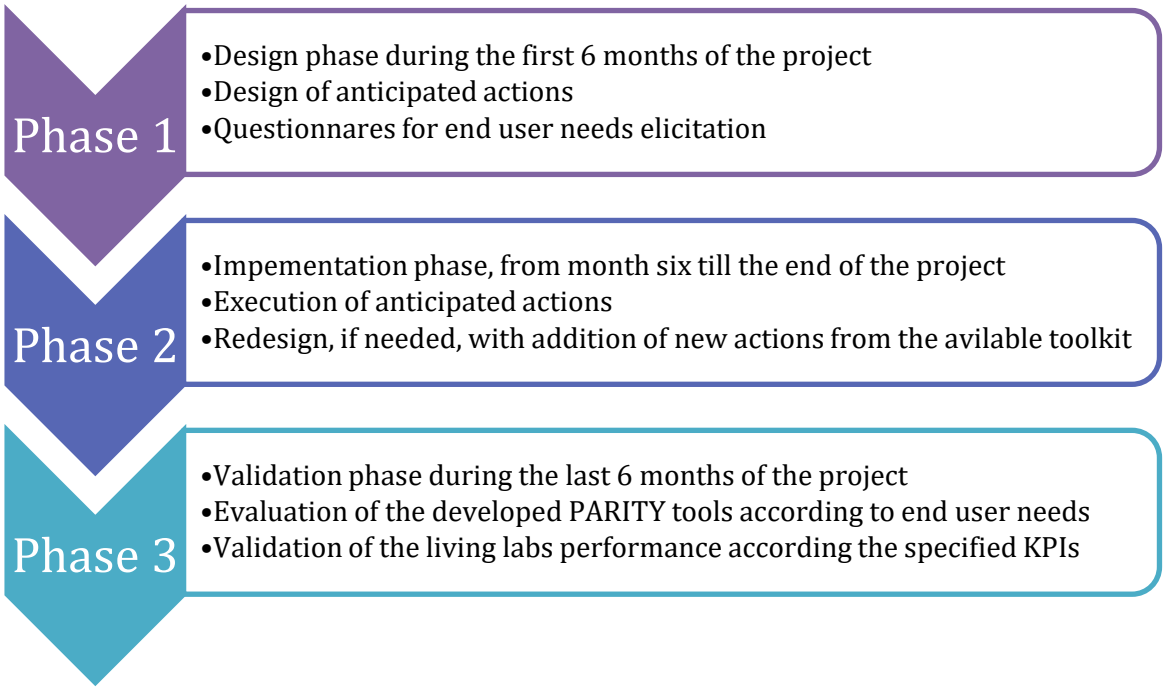

Figure 8:The phases of the living labs implementation

The main activities under the Living Labs methodology are planned to be executed in three following phases (Figure 8):

- The first phase of Living Labs is the **design phase**. During that phase, that will last for the first six months of the project, all the upcoming activities of the living labs methodology will be planed and determined. Moreover, in cooperation with Task 3.1 "Elicitation and analysis of business/use cases and requirements for the PARITY tool suite", a series of surveys and questionnaires will be answered by residential users and pilot site owners and users, all of them being part of the project's living labs community. Those initial requirements will then be then used as the primary core of the user-driven innovation approach.
- The second phase of the Living Labs activities is the **Implementation phase**. This phase is the main phase that the Living Labs are going to be executed were the live feedback loop between the project stakeholders and the project technology providers, will be active. More in detail, the stakeholders during the implementation phase are asked to provide live feedback for the features of PARITY during their development in order to establish a live feedback loop under

the umbrella of the user-driven innovation approach framework and maximize their effect on the characteristics of PARITY tools. To achieve this goal, various interaction and collaboration mechanisms will be used during the implementation phase, including workshops, with specified user groups in order to receive their feedback their feedback and implement their needs in the PARITY tools, or online demonstration of PARITY tools to specific user groups. Finally, as presented in the following Figure 9, during the implementation phase, the PARITY solution validation and demonstration will take place in four steps to catch potential incompatibilities or bugs early in the development process during the pre-validation phase by utilizing Labs Setups in nonoperational and operational buildings.

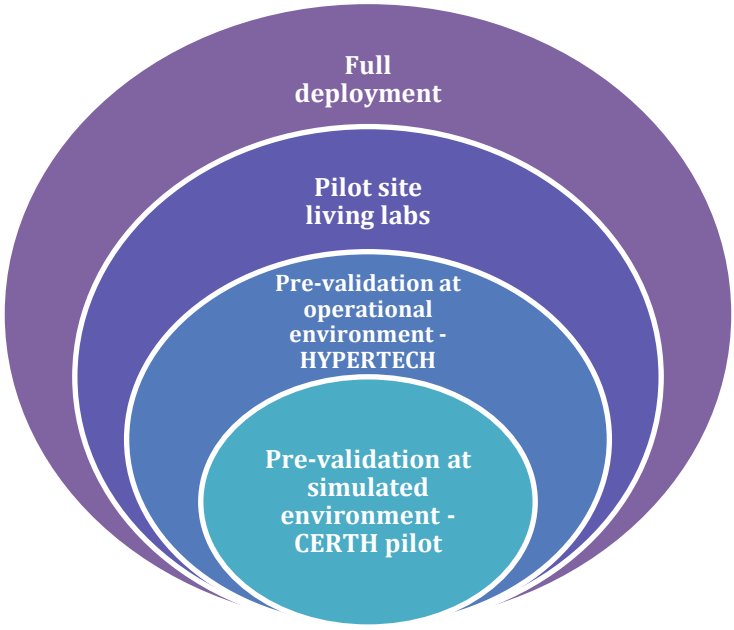

Figure 9: Agile development under the Living Labs Approach

- The third phase is the **Validation phase**. During that phase the evaluation of living labs would be performed in accordance to the specified targets set for the living labs implementation. Moreover, during that phase, a validation of the PARITY tools should take place. In that scope the stakeholders and end user groups will be actively participating in the end-product definition and go-to-market strategy creation. In addition, by the involvement of the final users and stakeholders to the final workshops in the pilot sites and by involving the participants in the training activities and other dissemination activities of the project, the project will have the chance to validate if their initial needs were fulfilled by the project tools functionalities. As a result, those activities will establish the open collaboration framework that will accelerate the collaborative knowledge generation, the technology customization and validation towards real market and final user needs, together with the final-product definition and the go-to-market strategy creation.

3.3 Audience

Getting more into the specifics of PARITY Living Labs in the pilot sites, it is evident that they include a different target group, respectively. For the case of Spain, the end users and stakeholders that will participate in the Living Labs are a mix of commercial and residential users, as also in Greece. For the Malmo pilot the participants are expected to be a mix of residential users and users of commercial facilities, while in Switzerland it should be a mix of residential users with users of educational institute.

Table 1: The PARITY pilots' audience

Pilot Site	Living Labs audience
Lachar & Escuzar, Spain	• Office Users • Sports center users • Residential users
Luggagia Innovation Community, Switzerland	• Educational institute users • Residential users
Athens and petrol stations, Greece	• Commercial premises users • Residential users
Malmo facilities, Sweden	• Commercial users • Residential users

3.4 Key Message

The goal is to establish an open collaboration process between PARITY partners and formulated PARITY Living labs, which will include participants from the pilot sites.

PARITY partners will interact with the Living labs participants in order to:

- Raise awareness and engagement by informing them about the objectives and concept of the project, as well as the advantages of the proposed solutions, using the appropriate material.
- Provide them with the proper knowledge through training sessions regarding the use of PARITY solutions that will be developed.

Living labs participants will provide to PARITY partners their feedback on:

- definition of user requirements
- the solutions that will be developed and installed at the pilot sites. In this case, the feedback of the user group members will be used to evaluate and improve/re-adapt the PARITY solutions.

3.5 Channels – Toolkit

In addition to the message that will be communicated in the Living Labs, in this paragraph it is defined through which channels this information could be communicated and how a live interaction between the consortium members and Living Labs participants could be established in an efficient way, as per Dell'Era C and Landoni P. [3]:

3.5.1 Questionnaires and Interviews

The methods traditionally used to identify end user needs presuppose that the end user knows best the characteristics that he or she desires to implement in a product; the tools used in this context include questionnaires and interviews with the intention of inducing end user communication of his or her own needs. The principal problem of this method is that the basic assumption is not completely exact, and it is only applicable to explicit needs. However, the end user often does not know his or her own needs, much less the needs of others or the needs that he or she may manifest in the future. That scarce knowledge about a subject's own needs is primarily evident during the initial phases of new product development. In the case of radical innovations, the relationship and the interaction between end user and product change completely; consequently, the end user rarely recognizes the conceptual schemes necessary to interpret the innovation. Another underlying problem associated with this method is the researcher's interviews and questionnaires may influence the collected answers; questions may be too intrusive, irritate the end user and lead to reluctant collaboration and encourage fake answers that compromise the results of the analysis [3].

3.5.2 Focus Groups

The focus group represents a primarily qualitative and contemplative research method compared with questionnaires and interviews that the project uses to consider what the end user reports to other participants and directly expresses to the project. The participants in a focus group must constitute a representative sample of end users. The participants are invited to a workshop and encouraged to discuss specific problems connected to products or services that the project wants to develop. In some focus groups, it is possible to observe the interaction between the participants and a prototype of the product or service with the purpose of analyzing user behavior. Moreover, focus groups are subject to the social norms of the group and do not allow identification of certain needs that the end user prefers not to explicitly reveal in the presence of others. Thus, it is possible that some subject evaluations are conditioned by other opinions and expected opinions [3].

3.5.3 Usability testing

Usability testing is a technique used in user-centered interaction design to evaluate a product by testing it on users. This can be seen as an irreplaceable usability practice, since it gives direct input on how real

users use the system. This is in contrast with usability inspection methods where experts use different methods to evaluate a user interface without involving users. Usability testing focuses on measuring a human-made product's capacity to meet its intended purpose. Examples of products that commonly benefit from usability testing are foods, consumer products, web sites or web applications, computer interfaces, documents, and devices. Usability testing measures the usability, or ease of use, of a specific object or set of objects, whereas general human-computer interaction studies attempt to formulate universal principles [3].

3.5.4 Contextual inquiry

Contextual inquiry is a user-centered design research method. A contextual inquiry interview is usually structured as an approximately two-hour, one-on-one interaction in which the researcher watches the user do their normal activities and discusses what they see with the user. It calls for one-on-one discussion sessions wherein users' daily routines or processes are discovered so that a product or software can be best designed to either work with the processes or help shorten or eliminate them altogether. Contextual inquiry comprises preparation, evaluation, analysis, and design phases.[3].

3.5.5 Lead User Innovation

Lead user innovation foresees the observation of particularly resourceful end-users that have autonomously developed "ad hoc" solutions to better satisfy their needs stemming from a certain degree of dissatisfaction with a product. Lead users differ from opinion leaders by determining functional and semantic changes to traditional products or services at a functional level and proposing previously unknown market solutions. Lead users directly interact with a product or service used daily. The literature proposes the following three categories of lead users[3]:

- Lead users in the target application: This group may include lead users who have actually experimented with developing prototypes
- Lead users in analogous markets: This group may include lead users from other markets and underlie a sort of innovation osmosis from one industry to another. and
- Lead user involved in more complex realities: This group may include lead users who use their knowledge to solve problems that are not directly connected to their area of competence.

Naturally, lead users are unknown people, for whom the project must encounter to access lead user knowledge and innovativeness. The great difficulty of identifying a person with the aforementioned characteristics; he or she often realizes personal solutions that cannot be diffused on the market. However, this research methodology offers numerous advantages. In addition to allowing the company to acquire articulated and reliable information about consumer needs, this method obtains information about desired characteristics and performance during the first phases of new product development. This method discovers potential problems before the market launch of the product and offers the company the possibility to proactively remedy a problem in the market [3].

3.5.6 Participatory design (Scandinavian Methods)

According to Dell'Era C and Landoni P. [3], participatory design is an approach to design that attempts to actively involve all stakeholders (e.g. employees, partners, customers, citizens, end users) in the design process to help ensure that the product designed meets their needs and is usable. In participatory design participants are invited to cooperate with designers, researchers and developers during an innovation 10 process. Potentially, they participate during several stages of this process: they participate during the initial exploration and problem definition both to help define the problem and to focus ideas for solution, and they participate during development to help evaluate proposed solutions. That participatory design attempts to involve future "users", to the extent that is possible, throughout the design development process. Participatory design, which is used to engage actual users in design activities, represents an example of a research method developed to support design work during concept generation and development phases. This type of approach is particularly diffused in computer science, where participatory design is defined as a set of theories, practices and studies related to end-users as full participants in software and hardware development, products and activities [3].

3.6 Living labs channels and user needs

To summarize, the recent literature development of processes attempts to describe the interconnections between user needs and context of use as paradigm shift from "design for users" to "design with users" [9]. Traditional marketing function analyzes aim to identify explicit needs (what people say), while typical designer observations of contexts of use intend to identify what the customers do with the products (what people do and what people make) [3]. This connection with the available living labs tools is presented in the following Figure 10.

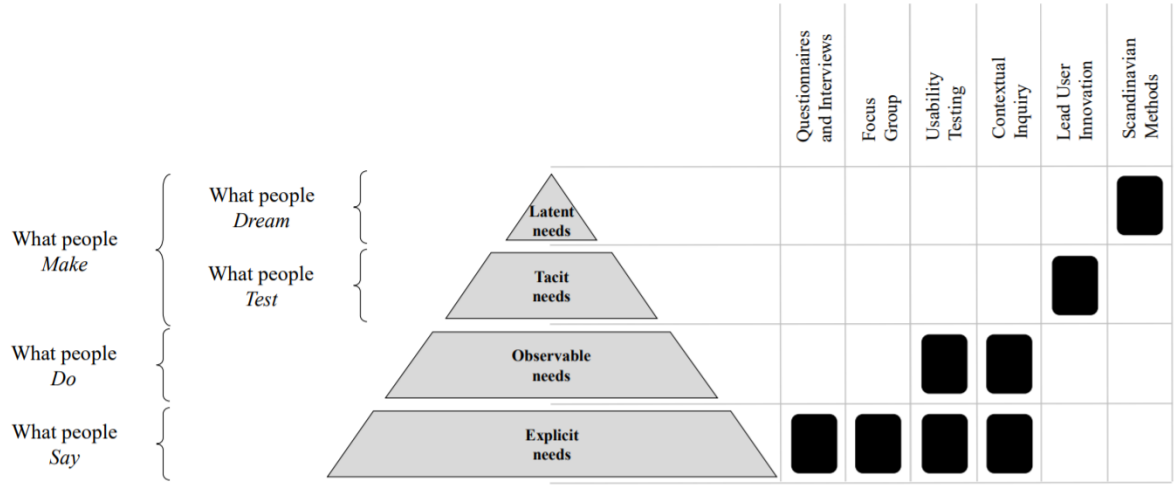

Figure 10: Living labs methodologies and user needs [3]

From the above presented living labs toolkit, the most efficient and relevant tools will be chosen for the PARITY living labs activities to be performed. The selection will be done following the user driven

innovation approach principal, as presented in the PARITY DoA [1], and with the scope to maximize the participation of end users in the PARITY implementation. The selected tools will be implemented according to time plan presented in the following chapter 4 “LIVING LABS ACTIVITIES IMPLEMENTATION” and could be updated, if needed, during the project implementation.

4. LIVING LABS ACTIVITIES IMPLEMENTATION

4.1 Design phase

In the framework of task 9.1 "Living Labs Setup and Activities Planning", the design phase of the living labs implementation will be executed and presented in this deliverable. During that phase the detailed action plan for the living labs will be developed and the initial channels from the toolkit presented in chapter 3.5, will be chosen. Moreover, the initial time plan for the actions' execution shall be identified according to project's needs. The implementation of the anticipated actions, described in this deliverable, will be done in the framework of task 9.3 "Dissemination and communication activities" and in the framework of task 8.2 "Community engagement, pilot participant recruitment and integration into local flexibility market" which both run throughout the project duration. If changes in the initial planning will be needed after the end of task 9.1 and submission of this deliverable, they will be implemented in a special chapter of Deliverable 9.2 "Dissemination and Communication Plan & Activities", which is foreseen to be updated every 6 months during the project duration. The flowchart of actions under the living ab activities methodology, according to PARITY tasks, is presented in the following Figure 11.

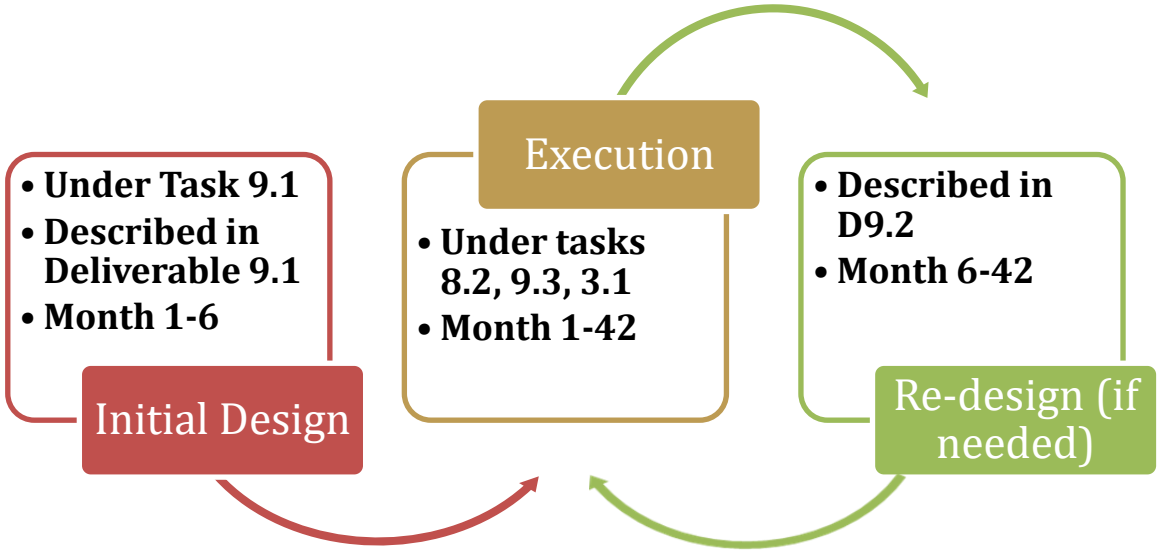

Figure 11: Design, re-design and execution of living labs in the framework of PARITY tasks

4.2 Implementation phase

Following the design phase of the PARITY Living Labs activities, as described in the previous paragraph, the implementation phase will start. During this phase, the project consortium will implement and set in place the anticipated activities and tools planned in the design phase. Moreover, during this phase, the initial design will be amended, with the addition of more actions and tools, if needed according to the needs of the technology providers and the pilot owners. In the initial plan of the living labs activities, workshops, training sessions will take place, while questionnaires for end user requirements elicitation will be answered.

4.2.1 Workshops

As described in the PARITY DoA [1], two workshops will take place in each pilot site. According to the living labs planning (Figure 12), the first one in each pilot, will take place before month 18 of the project, in order to identify the end user needs and give the opportunity to the technology providers to receive feedback from the end user for the – under development – tools of PARITY. Moreover, it will enable testing & validation in real-world conditions, yet limited, and receive feedback from a controllable number of end users to ensure reliability, scalability and user acceptance. This procedure will initiate the live feedback loop between the end users and the technology providers, a procedure that lies in the heart of the user driven innovation approach. From the channels presented in the toolkit of chapter 3.5, the questionnaires-interviews and the focus groups will be implemented. If necessary and according to the need of the technology providers, usability testing, contextual inquiry or Scandinavian methods might be used.

The second workshop in each pilot, will take place by the end of the project, with the scope to validate the developed PARITY technologies according to the end user needs. In addition, in the last workshops in each pilot, the possibility of training sessions to the end users will be investigated and might take place. From the channels presented in the toolkit of chapter 3.5, the questionnaires-interviews will be used in the second round of workshops. As a result, 8 Living Labs workshops in total will take place, in the 4 pilot sites of the project. In the following Figure 8, the living labs workshops planning is illustrated. The participants will be categorized in target groups according to their occupation/role. The Living Labs Database will be then used as the pool for future dissemination activities and will be continuously updated though the development of the project.

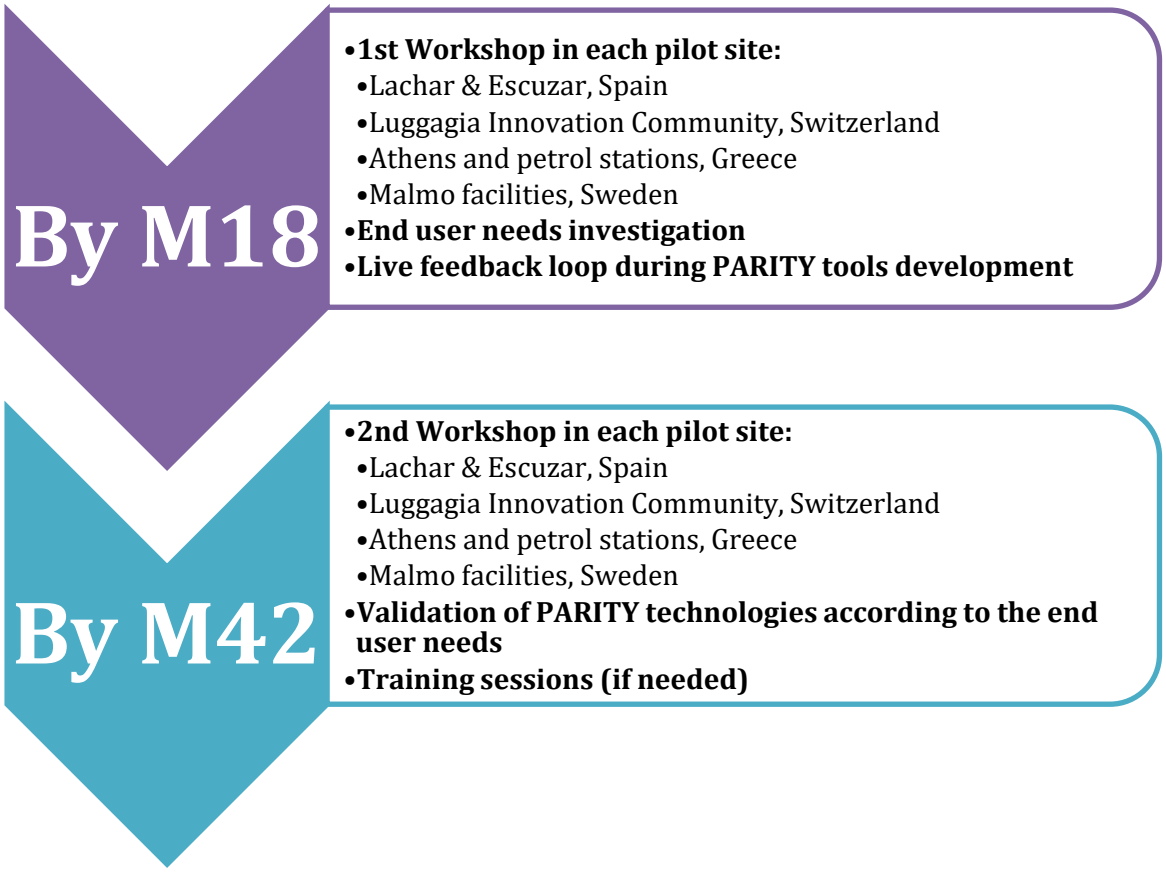

Figure 12: The living labs workshops planning

4.2.1.1 Lachar & Escuzar, Spain

The Granada Living Labs is envisioned as a "living" energy ecosystem which contains much more than a technical environment, as characterized by a set of energy generation and storage devices, communication, control, and IT infrastructure. The Granada Living Labs aims to create a test platform to implement new ideas and business models supported by the digital utility of the future. There are 2 main characteristics that differentiates the Granada Living Labs from other real-life demonstrators:

1) Its openness to the community of researchers, innovators, and entrepreneurs working in the energy field to test innovative technology approaches, prototypes, and business models within the scope of smart grids

2) A community of end users willing to, not only test new technologies, but to actively participate in the product/service development process. People sharing their pains, their motivations and, which is very important, giving feedback. We believe, this will help innovators not only build new products, but what is most important, to build products people love.

A portion of the distribution network operated by Grupo Cuerva in the region of Granada will be used as the main electricity infrastructure to set the Living Labs. The MV distribution grid is connected to

the ENDESA HV network by a substation also operated by Grupo Cuerva. This distribution network feeds two small communities nearby Granada city: Escúzar and Láchar.

Láchar area has a peak load close to 3 MW, mostly residential consumers, and a photovoltaic generation of 8,2 MW peak. Due to its small size and isolatable conditions, this area is ideal for exploring microgrid related use cases or testing different early stage approaches for distribution grid operation, since a significant impact can be achieved only with low capacity control and storage devices as well as with small number of participant consumers. Additionally, in this area, we have installed ten fast-charging Tesla Supercharger of 120 kW each. The Supercharger is being fed by 1 MW transformer of 20kV/400V.

The Escúzar area has a peak load of 13 MW and photovoltaic power plant of 4.3 MW peak. This part of the grid will be used to explore use cases involving grid scale control and storage technology and massive consumers participation. Also, the connection with the substation can be used to explore bottom-up energy services, i.e. from the distribution to the transmission system.

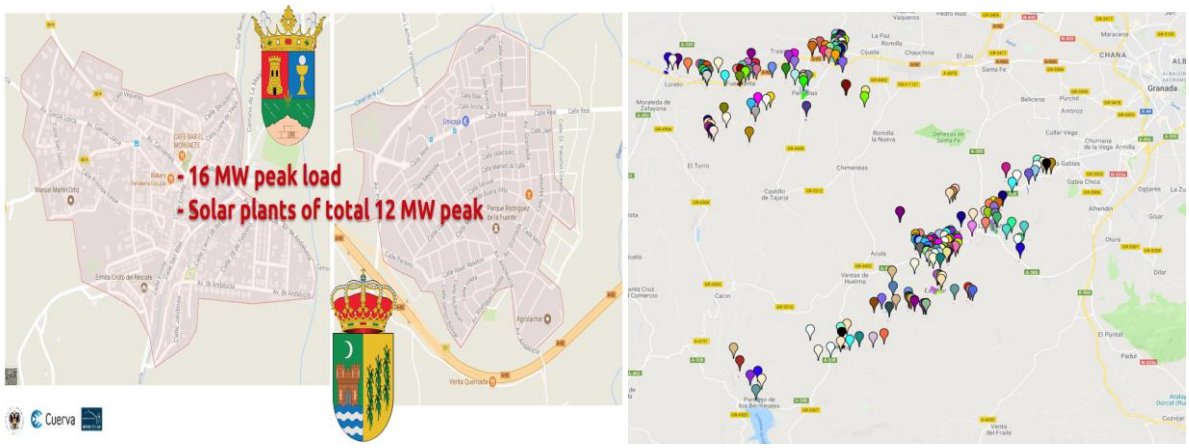

Figure 13: Lachar &Escuzar LL location

Table 2: Spanish LL description of the Dwellings and End Users on the Site

Description of the Dwellings and End Users on the Site:	
Ownership:	Private
Types of Dwellings:	Apartments and houses. Additionally, we have mining, recycling, olive oil and food processing industry.
Types of End User:	The population is pretty diverse: Young families (3 to 5 people). Middle age families (2 to 4 people). Elderly living with partner. Single-person homes (middle age and seniors) The socioeconomic level is predominantly middle, same as sociocultural level. Regarding their energy consumption, average power contracted

	is 5,33KW for residential users and 24,91KW for commercial users.
Number of Dwellings on the pilot site:	3.569 total clients, +85% residential
Number of Users/occupants:	Between 2 to 4 people.
Profiles/demographics of users:	Rural zone with a diverse population that includes different ages and type of families with socioeconomic and sociocultural level predominantly middle. Most of the population are original from these towns, but it's increasing the number of people coming from other areas, especially in Láchar which is especially becoming kind of a dormitory town. This provides the labs with a representative household infrastructure that involves single households and residential buildings. We have already conducted a first characterization phase in which more than 700 residential and commercial users have participated.
Are the home owners willing to provide their data and sign a document to say so:	Yes, we already have signed an agreement with the councils. In addition, all users sign a "participation agreement" at the beginning of every project that includes data transfer.

Health and fitness chain Spain Living Labs, Spain

The Health and fitness chain Spain Living Labs is characterized by a set of consumption devices mainly air-conditioning system, communication, control, and IT infrastructure. The Health and fitness chain Spain Living Labs will include a data controller EnergyBox with IoT technology and high information processing capacity managing in real time all kinds of networks that monitor and control temperature, consumption and electrical loads appliances. The Health and fitness chain Spain Living Labs aims to create a test platform to evaluate flexibility, capacity cost and minimum prize to offset the additional costs as well as calculate the optimum consumption curve.

The Health and fitness chain Spain Living Labs is differentiated from other real-life demonstrators in its openness to researchers to install the data controller EnergyBox and end users willing to participate in the LFM to develop the service according the specific factors conditioning the service sector. URBENER Sistemas Urbanos de energías renovables has approximately 400 tertiary buildings as representated direct consumers in the electricity market nowadays, therefore could be an important provider of flexibility for a minimum of 1 MWh aggregated demand response between their clients following the requirements of the Spanish legislation.

The MV distribution grids are connected to the ENDESA DISTRIBUCIÓN ELÉCTRICA S. L. network, IBERDROLA DISTRIBUCIÓN ELÉCTRICA, S.A.U network, DISTRIBUCIÓN CANTÁBRICO network, UNIÓN FENOSA DISTRIBUCIÓN S.A. network.

The Health and fitness chain Spain Living Labs have the following peak loads: 102 kW, 90 kW, 94 kW, 88 kW, 102 kW, 167 kW, 146 Kw, 156 kW and 212 kW.

Figure 14: Health and fitness chain location

Table 3: Health and fitness chain description of the Buildings and End Users on the Site

Description of the Buildings and End Users on the Site:	
Ownership:	Private
Types of buildings:	Terciary buildings
Types of End User:	The population is diverse: Young, Middle age and Elderly. The socioeconomic level is predominantly middle, same as sociocultural level. Regarding their energy consumption, electricity tariffs and contracted powers for terciary building users are: 3.0A P1 160, P2 160, P3 73; 3.0A P1 100 P2 100 P3 100; 3.0A P1 95 P2 97 P3 59; 3.0A P1 115 P2 130 P3 40; 3.0A P1 125 P2 125 P3 90; 3.1A P1 181 P2 190 P3 190; 3.1A P1 169 P2 179 P3 200; 3.0A P1 216 P2 203 P3 85; 3.0A P1 213 P2 261 P3 102.
Number of Buildings on the pilot site:	9

Profiles/demographics of users:	Urban area located in different climatic zones of Spain. The demonstration site provides several scenarios of demand response.
Are the owner willing to provide their data and sign a document to say so:	Yes, we already have signed an agreement with the owner to install and adapt the electrical installation and agree data transfer.

4.2.1.2 Luggagia Innovation Community, Switzerland

The pilot site is located 6 km north of Lugano in a small district belonging to Lugaggia community. This district is fitted with 18 buildings, with a yearly total electricity consumption of 183'750 kWh. The yearly end user average consumption is 10'210 kWh. Other data of the pilot site:

- Load peak at the grid coupling point: 151 kW.
- Number of heat-pumps: 11. Average heat-pump's capacity: 3.1 kW.
- Number of electrical boilers: 15. Average boiler's capacity 5 kW.
- Number of auxiliary resistances: 6. Average boiler's capacity 3 kW.
- EV station: 1, 16A connection.

The total PV installed capacity is 90 kWp, with a total estimated yearly production of 103'500 kWh.

For each user of the pilot site AEM installed Landis & Gyr E450 smart meters, which are able to supply indications on active and reactive power and the tension level for each POD. AEM realized a dedicated broadband for collecting all those data each 15 minutes. AEM also installed a district battery with a storage of 50 kWh and a bidirectional charge/discharge capacity of 50 kW in order to store the photovoltaic solar energy not immediately needed.

AEM is also setting up smart contracts with all the end users inside the pilot and two balancing tools, one centralized with OPTIFLEX and the other one decentralized with HIVE POWER.

Figure 15: Aerial view of Lugaggia (left), Landis & Gyr E450 smart meter (right)

With its pilot site AEM aims to achieve three goals:

- prevent potential imbalances
- increase both DER predictability and controllability

- optimize and increase local self-consumption and reduce outputs into the grid.

This would mean reducing the costs for both the DSO and the end users.

To achieve these goals AEM is interested to test the following aspects:

- the integration of DER within a Local Flexibility Market Platform
- IoT platform (Oracle)
- the use of buildings as a battery
- DSO management using algorithms (currently testing)
- the development of new business models
- the execution monitoring activities (currently testing)

AEM is discussing with AET, one of the main Swiss utility, a new business model for optimising PV generation. For economic and efficiency reasons, the battery capacity doesn't have redundant capacity. Therefore, during summer weeks, due to the low night consumption, it could happen that at night the storage can't be emptied, and the battery would be full before midday. For this reason, AEM will empty the battery at night, supplying an AET hydro pump and getting back the power (minus the pump losses) at a future stage (paying the transmissions costs).

4.2.1.3 Athens and petrol stations, Greece

The pilot site of BFS will be implemented in three different categories of end users in Greece. Those categories are:

- Commercial users of the headquarters of Motor Oil Hellas group, in which BFS belongs
- Residential users which will be provided by NRG energy provider which belongs to the same group of companies with BFS and is committed to support the project,
- Fuel stations and EV charging infrastructure which is managed by BFS.

More in detail:

Motor Oil Hellas group headquarters:

Figure 16: BFS commercial pilot, MOH headquarters

The first pilot site is located in the north suburbs of Athens, Greece and it's the headquarters of the Motor Oil Hellas group of companies. It is a five-storey office building with total covered area of about 24,000 m2 and two underground floors for parking, electromechanical plants and storage. The building also includes a bank brunch, a café, a medical clinic and a post office. The building is used daily by about 650 employees. The building has two medium voltage substations powered up by 2x1600 KVA transformers, a diesel generator of 650 KVA and two UPS of total capacity 120KVA as a back-up protection of the data center. The building is equipped with two gas boilers for heating purposes (one backup) each one of 500kWh and the heat is distributed in the building with fan coils in the office and public areas. Moreover, for cooling, two chillers are used, each one of 300 TONs/1.2MW placed on the roof. The lighting has been replaced recently with LED fixtures integrated in the ceiling to a percentage of 85%, while the windows are double glazed aluminum profile tilting or non-opening. Finally, the building has a BMS system which controls the lighting system, the heating and cooling system, as well as the ventilation equipment. The total annual electricity consumption of the buildings exceeds 2.8MWh and peak demand occurring in summer months due to the high cooling loads.

Residential Buildings:

NRG energy supplier, which is committed to support the project and belongs to the same conglomerate with BFS, will provide 40 residential premises as part of their clientele, to be used as pilot sites. The residential premises are located in the metropolitan area of Greek capital, Athens and can be grouped in two categories. The first group could be the low-consumption users with consumption less than 2,400kWh per year and the medium to high-consumption users with consumption from 3,750kWh per year. Those customers mainly use oil or natural gas as a fuel source for heating and electricity for cooling, lighting, domestic hot water, cooking, appliances and any other type of home equipment.

Fuel stations – EV charging infrastructure:

BFS is responsible for the facility management, renovation plan and business extension plan of approximately 500 car service stations among Greece that are property of Motor Oil Group. The stations have an average annual energy consumption in the area of 150MWh amounting to 15,000 €/y. Three of those service stations are going to be equipped with Building Integrated Photovoltaics with a total installed capacity of 10kWp in the PVadapt H2020 project. In the business extension plan of the next 2 years BFS has anticipated the installation of 20 charging points needs and integrate them gradually in all stations as a part of provided services, in order to meet the predicted growing demand due to the increased usage of electric mobility. Three fuel stations will be selected based on location, distribution network, usage and self-generation capabilities in order to validate the synergies of local generation and charging point load/storage as well as the holistic integration of the electromobility in P2P trading by assessing V2G techniques and interaction with the developed local energy market.

Figure 17: Typical AVIN fuel station managed by BFS

4.2.1.4 Malmo facilities, Sweden

The Swedish pilot site will be hosted in and around Malmö, in southern Sweden. It will comprise of two locations with different architectural characteristics and usage. Both sites will be chosen from the pool of E.ON Energilösningar customers and will already be equipped with PV installations. The selection of these sites will be finalized during the starting months of the project as part of the work packages within the PARITY project.

The first location is a cluster of three residential buildings, each of which contains: one 50 A connection to the electricity grid, one connection to the gas grid and one solar installation of 40 kW DC / 30 kW AC, as well as one EV charging station. In total, approximately 50 apartments would serve as end users for the implementation of PARITY technological solutions. The apartment buildings also contain communal gas-powered heaters which can be optimized with the installation of electric water heaters. Energy flexibility would be introduced using surplus solar energy for this electrical heating thus reducing gas consumption and costs. In addition to serving as a VVP testbed location, this site contains EV car charging stations, and the possibility of controlling the comfort level in each apartment if agreed upon by the end users.

The second location will be of different use to the first as to increase the flexibility of the PARITY solution as well as the variation of feedback during its development. It is an industrial/commercial site and characterized by a larger PV production and electricity use than the residential buildings. It consists of a large commercial building with operational hours from 8:00 to 19:00 which coincides with their

peak electricity consumption. The building has a 400 A connection to the electricity grid, and a roof mounted solar installation of 255 kW DC / 230 kW AC is planned for summer of 2020. The parking lot contains 10 EV charging stations to be used by customers and employees.

The two Swedish pilot locations have been decided upon to ensure that they are the perfect candidates to both validate as well as demonstrate the PARITY framework, especially aspects related to the ancillary flexibility market. In addition to optimizing our pilot users' self-consumption and offering peak cost shaving capabilities by means of installed batteries, we plan to use the existing local generation and storage and demand flexibility from these pilot users in a trading scheme within the local energy market formulation.

In order to achieve the optimization of self-consumption and peak shaving as well as the trading scheme proposed within the Swedish frequency regulation markets via a virtual power plant (VPP), we plan the installation of NiMH battery racks of approximately 57 kWh capacity at the residential site, and 114 kWh at the industrial/commercial site.

4.2.2 Questionnaires

Two approaches have been followed in the process of collecting information from users in the scope of the task 3.1: interviews and surveys. The selected method for each actor has been in function of the number of targets, and the type of information to be collected.

In order to define this correctly, the following process has been followed. On the one hand, the actors' beneficiaries (aggregators, facility managers, retailers, DSOs, LFM coordinator, and DER network operator) of each business case has been identified in Table 4: Beneficiaries of PARITY's business cases. Thanks to that, main actors to be considered in the questionnaires regarding PARITY's goals have been found out.

Table 4: Beneficiaries of PARITY's business cases.

BC	Description	Beneficiary	Markets
BC1	BC1 Aggregator as an active player in the LFM and national energy/AS markets (including optimal trading of flexibility under control across available markets for revenue maximization and adequate liquidity safeguard)	Aggregators, Facility managers	LFM Wholesale market; Ancillary services
BC2	BC2 Energy Retailer as a P2P flexibility trading facilitator to (including flexibility, day-ahead, intraday, balancing & ancillary market trading optimization)	Retailers and Aggregators	LFM Wholesale market; Ancillary services

BC3	BC3 DSO as a market coordinator (the trusted party capable to operate an LFM to ensure independence and fairness to all involved market actors)	DSO as LFM coordinator	LFM
BC4	BC4 DSO as a DER enhanced network operator (including the use of novel smart grid management tools and infrastructure that enable more cost-efficient ways to ensure power quality and grid stability in the distribution grid and consideration of flexibility	DSO as DER network operator	Grid services: Balancing, congestion mgmt.

On the other hand, PARITY's use cases have been initially analyzed, and they have been related with their respective beneficiaries and business cases, pointed out in Table 5. In addition, PARITY's pilot-sites related with each use case have been identified. Therefore, the information expected to be received from each pilot-site has been identified.

Table 5: Beneficiaries and business cases related to PARITY's use cases.

UC	Use Case title	Pilot SItes	Beneficiary	BC
UC1	UC1 Building-level P2H/BAB flexibility estimation & automated provision to aggregator for LFM participation	All	Aggregators	BC1
UC2	UC2 Aggregated P2H flexibility estimation and provisioning for market participation pre-qualification	All	Aggregators	BC1, BC2
UC3	UC3 Aggregated V2G flexibility estimation and provisioning for market participation pre-qualification	PS1 PS5	Aggregators	BC1, BC2
UC4	UC4 Human-centric and contract-safeguarding participation in LFM, on the basis of context-aware flexibility profiles.	PS3 - PS6	Aggregators	BC1, BC2, BC3
UC5	UC5 Forecasting, scheduling and dispatch of DER flexibility for coordinated management of the LFM grid	PS3 - PS6	Aggregators	All
UC6	UC6 Flexibility exchange triggered by smart contracts for automated grid balancing	PS4 PS6	DSOs, BRP	BC3, BC4
UC7	UC7 Smart grid management using enhanced PQ services for grid instability limitation	PS3	DSOs, BRP	BC4
UC8	UC8 Ancillary services provision by STATCOM to TSO for overlay network stability	PS3	TSO, DSOs	BC4
UC9	UC9 Congestion management by DSO through operation of LFM to increase DER penetration	PS3	DSOs, BRP	BC4

UC10	UC10 Operation of local flexibility market in a grid constrained area	PS4 PS6	Aggregators	BC3
UC11	UC11 Provision of ancillary services to overlay ancillary service market operated by TSO	PS6	TSO, DSOs, BRP	BC3
UC12	UC12 Participation of LFM-enabled flexibility to national wholesale energy market	PS4 PS6	Traders, Aggregators	BC1, BC2, BC3
UC13	UC13 Red light (emergency) grid management using automated control of distributed DER (through smart contracts)	PS3 PS6	DSOs, BRP	BC4
UC14	UC14 Energy/flexibility credit exchange in the LFM jurisdiction	PS4 - PS6	Traders, Aggregators	BC1, BC2, BC3
UC15	UC15 Flexibility enhancement through synergies with neighbor distribution networks and/or LFMs.	PS4 PS6	DSOs, BRP	BC3

Finally, the previous explained classification has been useful to define the involved roles in the PARITY project, as well as their relationship with the business cases and the best approach in which participation have been asked. Table 6 resumes this classification effort.

Table 6: Roles description in PARITY project

Roles	Role description	PARTNERS	BC	Participatory process
1	Residential prosumers	CERTH, AEM, CWATT	BC1, BC2, BC4	online survey
2	Office building users	HYPERTECH, BFS, EON, URBENER	BC1, BC2, BC4	online survey
3	Facility managers / ESCOS	CERTH, HYPERTECH, CWATT, AEM, URBENER, BFS	BC1	interview
4	DSO	CUERVA, HEDNO, AEM	BC3, BC4	interview
5	Aggregators	URBENER, CWATT, EON, AEM	BC1, BC2	interview
6	Tech developers	CERTH, HYPERTECH, CIRCE, CWATT, SUPSI, HIVE, QUAL, UDEUSTO		

Summarizing: actors involved have been identified; information to be get has been identified; and how to collect the information from each actor has been defined. Following, a first draft of both surveys and interviews have been elaborated. In particular, the following questionnaires were defined:

- Interviews: Aggregators, DSOs, and facilities managers.
- Surveys: tertiary building users, and residential consumers.

Firstly, the expected outcomes to be obtained from each questionnaire was defined, and it was used to write down the appropriate questions for every issue. The following topics were covered for each questionnaire:

Table 7: Topics covered in each questionnaire

Participatory process		Topic
Topics	**Residential consumers**	Sample characterization questions: age, gender, position, location…
		Dwelling Type and size
		DER availability
		Generation system
		Electricity contract
		Annual Consumption
		LFM Participation involvement
		Willingness for flexibility participation
		automated, semiautomated participation
		type of aggregation contract
		Intrusiveness and data security preferences
		Contractual preferences and consumer rights protection
		Information sharing and interface
		Comfort preferences
		Barriers identified
		Others. Please specify

	Office building users	Building type
		DER availability
		LFM Participation involvement
		Willingness for flexibility participation
		Information sharing and interface
		Barriers identified
		Comfort preferences
		Others. Please specify
	Facility managers	Building Type
		DER availability
		Generation system
		Electricity contract
		Annual Consumption
		LFM Participation involvement
		Willingness for flexibility participation
		automated, semiautomated participation
		type of aggregation contract
		Intrusiveness and data security preferences
		Information sharing and interface
		Contractual preferences and consumer rights protection
		Barriers identified
		Others. Please specify
	Aggregators	Characterization and company profile
		Type and number of flexibility providers
		Current relationship with them and liabilities

		Interest for flexibility market participation
		Interest for Retail market participation
		Interest for AS market participation
		Current IT system architecture
		Type of integration of new aggregation tools with current systems
		Current availability of data from flexibility providers
		Barriers identified
		Others. Please specify
	DSOs	Characterization and company profile
		Size and type of grid assets.
		Type of grid management
		Interest of DR for RES generation matching
		Interest of DR for grid balancing
		Interest of DR for grid stability and congestion management
		Interest of becoming a LFM operator
		Interest of becoming a DER network operator
		Current IT system architecture
		Current availability of data from flexibility providers
		Type of integration of new flexibility tools with current systems
		Barriers identified
		Others. Please specify

Surveys were oriented to be multiple-choice options to make it easy for the user and facilitate to get more feedback, and interviews were oriented to be open answered to be able to obtain details from experts of the sector. The time duration of the questionnaires was taken into account also to avoid

tiredness from users filling up the questionnaire. After that, an iteration process was followed in which the questionnaires were revised and tested and, later, were translated to all languages for which the questionnaires were intended. Finally, the surveys were sent, and the interviews were celebrated. All the information collected has been analyzed, and conclusions will be documented in D3.1, which is the report of task 3.1.

5. LIVING LABS EVALUATION

The living labs methodology implementation will be monitored for its performance during the whole life cycle of the project and will be finally evaluated during the last six months of the project, when all actions will be finalized, and the results will be available. In order to evaluate and constantly monitor the performance, firstly the requirements of the living labs need to be identified and the expected results from the implementation should be recognized. Following that, the expected outcomes will be quantified with KPIs which will be the guide for the constant evaluation of the living labs performance. This procedure is illustrated in the following Figure 18.

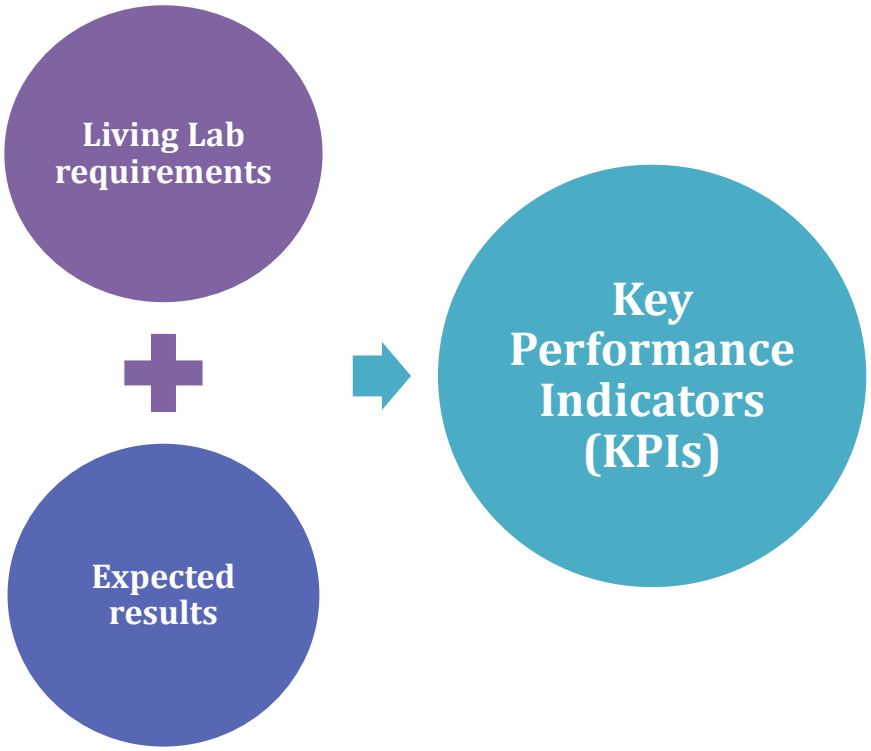

Figure 18: The living labs evaluation principle

5.1 Living Labs requirements

The main quantified targets for the living labs are already set by the PARITY DoA [1]. As stated, in each pilot site 2 living labs workshops should take place, thus, at least 8 targeted living labs and training workshops will be performed. The scope of these workshops should be to a) raise awareness, engagement and acceptance of pilot site occupants and stakeholders, including also the preparation and distribution of appropriate material, b) involve end users in the requirements definition activities of the project, c) training users and contributing to the adoption of the PARITY concept and operation in the pilot sites of the project, d) involving all stakeholders in the evaluation of project results.

Moreover, the activities of task 3.1 will be performed under the umbrella of the living labs methodology. Thus, a study on identifying the needs of targeted end-users of the PARITY solutions will be held. A 3-step approach will be implemented: 1) Internal (consortium) and external stakeholders' groups will be assembled to create a balanced cluster of electricity market stakeholders and flexibility providers (prosumers), based on selected criteria, such as age, gender, technology literacy. 2) A survey will be performed through questionnaires, mock-ups and personal- and group- interviews to define the main user requirements. The key areas of interest are: identification of major challenges that affect their willingness in accepting the new technologies (e.g. cost, technology understanding, regulations); preferred business cases per user group and what is their view on them (e.g. aggregators could fear a peer-to-peer market structure, or see it as an opportunity for establishing more profitable business models); desired automation and control levels; expectations towards comfort vs efficiency and ownership of infrastructure; aptitude towards privacy, trust and security issues.

5.2 Expected results

The main goal of the living labs is to establish an open collaboration process between PARITY partners and formulated PARITY Living Labs, which will include participants from the pilot sites. Thus, PARITY partners will interact with the Living Labs participants in order to raise awareness and engagement by informing them about the objectives and concept of the project, as well as the advantages of the proposed solutions, using the appropriate material. Also, will provide them with the proper knowledge through training sessions regarding the use of PARITY solutions that will be developed throughout the project lifecycle.

From the other hand, the Living Labs participants will provide to PARITY partners their feedback on the definition of the project requirements and on the solutions that will be developed and installed at the pilot sites. In this case, the feedback of the user group members will be used to evaluate and improve/re-adapt the PARITY solutions.

5.3 Key Performance Indicators

After the definition of the requirements set by the PARITY DoA [1] and the following determination of the expected results, the quantified KPIs, which will be the guide for the constant evaluation of the living labs performance, should be defined.

Hence, in the following Table 8, the KPIs for the living labs activities recognized are set. The KPIs are presented in two separate categories, namely the end user questionnaires and the living labs workshops. For those categories different targets are set according to the requirements by the PARITY DoA and according to the expected results of the living labs. By the end of the project, the real results of the living labs actions, will be evaluate, using this table, towards the target Key Performance Indicators.

Table 8: Living labs Key Performance Indicators

Activity	Field	Target KPI	Result performed	Evaluation of result
End user questionnaires	Number of Residential questionnaires shared	230		
	Number of Residential questionnaires answered	115		
	Number of Tertiary buildings users' questionnaires shared	500		
	Number of Tertiary buildings users' questionnaires answered	250		
	Number of interviews	10		
Workshops	Number of workshops up to month 18	4		
	Total participants of workshops up to month 18	40		
	Number of workshops from month 19 to month 42	4		
	Total participants of workshops from month 19 to month 42	40		

6. Conclusions

Conclusively, the PARITY Living Labs methodological approach will support the user-driven innovation methodology as well as the agile development of the PARITY framework by creating and consulting a network of end users and stakeholders that could be used for experience sharing and exchange using the user and business-driven open innovation. This sharing will be realized by using the available tools recognized in this report.

The PARITY living labs methodology, as described, involves end-users and beneficiaries from the very early stages of the project and throughout its implementation in order to enable the collaborative framework of the project implementation and in order to include the end users' opinion and requirements in the development of the PARITY tools. Moreover, by the end of the project, the living labs methodology will evaluate if those requirements were fulfilled by the PARITY tools.

Moreover, the PARITY Living Labs are expected to play a significant role for the dissemination of PARITY results, as it is expected to support the knowledge transfer and experience sharing framework in the open innovation ecosystem.

As for the next steps, the first round of the PARITY Living Labs workshops will be organized shortly, by month 18 of the project, one in each pilot site. The technical material that will be created for those events, the moderator guidelines, the expected discussion structure, the generated outcomes and the feedback received will be documented in the reports produced under the framework of tasks 8.2 and 9.3. Moreover, the results of the end user requirement questionnaires and interviews, will be documented in the reports produced under the framework of task 3.1.

Finally, the evaluation of the living labs results will be reported in the final version of deliverable 9.2, by the end of the project. In this report the metrics of the realized actions will be evaluated towards the specified KPIs, in order to evaluate the overall living labs performance.

7. References

[1]. The PARITY EU research project Description of Action, GA Number 864319

[2]. Pallot M. (2009). Engaging Users into Research and Innovation: The Living Labs Approach as a User Centred Open Innovation Ecosystem. Webergence Blog. "Archived copy".

[3]. Dell'Era C and Landoni P (2014). Living Labs: A Methodology between User-Centred Design and Participatory Design. Creativity and Innovation Management, Vol. 23, No. 2, Pp. 137-154. (DOI: 10.1111/caim.12061)

[4]. Sanders EB (2006). Design research in 2006. Design Research Quarterly 1, No. 1, Design Research Society, September 2006.

[5]. Mónica E. Edwards-Schachter, Cristian E. Matti, Enrique Alcántara (2012). Fostering Quality of Life through Social Innovation: A Living Labs Methodology Study Case. Review of Policy Research, Volume 29, Number 6 (2012) 10.1111/j.1541-1338.2012.00588.x

[6]. Cunningham, P., Herselman, M., & Cunningham, M. (2012). Supporting the evolution of sustainable living labs and living labs networks in Africa. IIMC International Information Management Corporation Ltd. Retrieved from http://www.ist-africa.org/home/files/Supporting_the_Evolution_of_Sustainable_Living_Labs_and_ Living_Labs_Networks_in_Africa.pdf

[7]. Moulaert, F., & Mehmood, A. (2010). Spaces of social innovation. In A. Pike, A. Rodriguez-Pose, & J. Tomaney (Eds.), A handbook of local and regional development (pp. 212–225). London: Routledge

[8]. Volckmann, R. (2010). Integral leadership. In R. A. Couto (Ed.), Political and civic leadership: A reference handbook (pp. 121–127). Los Angeles, CA: Sage Publications

[9]. Sanders EB (2002). From user-centered to participatory design approaches. Design and the Social Sciences.