

September, 28th & 29th, 2023 | Valencia (Spain)

6th International Conference on  
**RETHINKING CLUSTERS 2023**  
THE PARADOX OF SUSTAINABILITY INNOVATION:  
LOCAL OR GLOBAL?



# Living Labs as an open innovation network: the ArtCast4D case study for immersive art environments

Andromachi Boikou\*, Efthimios Hamilos\*, Nikos Sarris\*, Spiros Nikolopoulos\* and Ioannis Kompatsiaris\*

\* Centre for Research and Technology-Hellas, Information Technologies Institute (CERTH-ITI)

Corresponding author: Andromachi Boikou (boikou@iti.gr)

**Special session S1 (ARTCAST4D special session):  
Immersive technology for cultural and creative sectors**

**Abstract**—In this extended abstract, an exploration of the methodological approach utilized by living labs (LL) as open innovation networks is provided, specifically focusing on the ArtCast4D case for immersive exhibition environments in arts and culture. It examines key aspects such as the purpose, significance, and phases of the LL approach, along with the roles and responsibilities of LL actors. The governance model of ArtCast4D LL is analyzed, defining the commitments of key stakeholders.

## I. INTRODUCTION

This study presents the specific issues and characteristics that are essential during the LL approach, such as analysing the LL's **purpose** and importance as well as the different **phases** of the LL, specifying the different roles and responsibilities of LL actors during the process. The ArtCast4D LL **governance model** is analysed, taking into consideration the European methodology on Living Labs [1]. In addition, the main **key-stakeholders** are defined, along with the methodology of feedback collection. The **communication and feedback mechanisms** are described, establishing the rules of how input will be handled, along with the methodology for translating this input into **requirements** and specifications.

This work is organised as follows. Section 2 presents the background information and identifies key characteristics and other key facets in the living labs literature and examines the notable advantages of LL focusing on paradigms related to arts and culture. Section 3 analyses the ArtCast4D proposed solution, further explaining the methods of putting specific strategies into action. The final section presents the overarching findings and conclusions derived from the analysis.

## II. BACKGROUND

### A. Definition

Living Labs provide an **Open innovation** approach along with a general iterative framework for involving end-users and other relevant key stakeholders in conducting research and development. This results to an immersive framework for building co-operation and co-creation, further enabling the identification of challenges and

opportunities as well as the testing and validation of novel solutions and paradigms.

Being part of the overall Open Innovation approach [2] [3], LLs also contribute in the practice of businesses and organisations sourcing ideas from external and internal sources, further sharing knowledge and information. Thus, LLs foster the three open innovation processes of: **(a) exploration**, by launching innovation activities to capture and benefit from external sources of knowledge to enhance current technological developments; **(b) exploitation**, by launching innovation activities to leverage existing knowledge or technological capabilities outside the boundaries of the organisation; and **(c) retention**, by maintaining, storing and reusing knowledge over time outside of organisational boundaries [4].

LLs are listed among the six **Test and Experimentation Platforms (TEPs)**: Prototyping, Field Trials, Testbeds, Societal Pilots, Market Pilots and Living Labs [5]. Each one provides a different approach in terms of (a) the technological readiness and maturity; (b) the research approach of focusing on testing or on designing; and (c) their openness of engaging either to in-house activities or to open platforms. [6]. LLs are eventually defined as “an experimentation environment in which technology is given shape in real life contexts and in which (end) users are considered ‘co-producers’” [5].

### B. Key elements

LLs share common elements, yet exhibit diverse implementations across various contexts: **User innovation** refers to innovation by intermediate users or consumer users, rather than by suppliers. LLs create a specific type of open innovation network that can act as an innovation intermediary between users, public and private organisations to capture and codify user in-sights in real-life environments [2]. The basic key elements constituting a living lab typically include a wide range of topics, reflecting the multi-perspective aspect, applied to address the complexity of the context in which the innovation will be implemented. These could be summarised as follows: value, sustainability, influence, openness, user-centered approach, real-life

experimentation, interdisciplinary collaboration, medium to long term continuous feedback and iteration, scalability and replication. [7] [8] [9] [4]

A number of researchers define the **real life environment** as an essential aspect in LL, used mainly in the context of collaborative development to solve complex societal needs [10]. However there are several paradigms introducing LLs as **real or virtual environments**, or plainly **interaction spaces** [11], in which users and stakeholders collaborate for creating new solutions to complex problems. In this approach, the emphasis is given in the **real life use cases** that form the basis of the research and innovation processes integrated through the co-creation, exploration, experimentation and evaluation of innovative ideas, scenarios and concepts. To this end, LLs are also defined as **networks** [12] that integrate both user-centered research and open innovation, providing a methodology for user engagement.

### C. Types

Living labs can be classified into different types based on various criteria, such as their focus, scope, and level of collaboration with stakeholders. The list below indicates the more common types of living labs [3] [13]: **(a) Domain-specific**; **(b) Open** to participation from a wide range of stakeholders; **(c)** using **virtual** or simulated environments; **(d) regional**, focusing on a specific geographic region; **(e)** aiming to **social innovation**, addressing social and environmental challenges, **(f) utilizer-driven** by the needs and requirements of end-users; **(g) Enabler-driven** developing and testing the underlying technology and infrastructure that will enable new solutions and services, rather than on the development of specific products or services; **(h) Provider-driven** by a specific provider or organisation, such as a corporation, public authority, or research institute that takes a leading role in the development and implementation of new solutions and services; **(i) User community-driven** by a community of end-users and placing a strong emphasis on user engagement and participation, developing and testing new solutions and services.

### D. LLs in arts and culture

The LLs engage cross-disciplinary participants with their different roles (as users, enablers, designers, entrepreneurs, activists, etc.) in every phase of an open participatory process; from the identification and definition of a challenge, the concept or prototype design and the experimentation, towards the pre- and post-launch of a novel product, service, social innovation or other solution [14].

EnoLL [15] has registered a range of LL paradigms that specialize in arts and culture, each with their own unique approach to engaging diverse stakeholders with different backgrounds and expertise. These living labs involve stakeholders in co-creating, co-designing and co-evaluating new solutions and services. In the arts and culture sector, LLs provide a space for museums to prototype and test exhibition concepts before full implementation, enabling them to evaluate different design elements, interactive features, and technologies in a controlled environment. In addition, through data collection methods, cultural organizations can gather insights on visitor engagement, learning outcomes, and emotional responses.

## III. ARTCAST4D LIVING LAB APPROACH AND IMPLEMENTATION

### A. Objective & Type

The objective of the Artcast4D project is to develop an accessible open-source program based on the proven AAASeed real-time 2D/3D software [16] [17]. The project's innovation lies in its ability to create **immersive environments** in open spaces, with minimally intrusive projection technology, through the design of **interactive**

**applications that sense the presence, motion and gestures of visitors**, based on available open-source solutions. Artcast4D aims to approach **culture as an emotionally engaging “communicative experience” in public spaces**, bringing together creative actors and industrial partners with citizens.

In Artcast4D, LLs will provide a collaborative space for artists, designers, and technologists to work alongside museums and cultural organizations on creating immersive and interactive experiences. By leveraging their expertise, cultural organizations can incorporate cutting-edge technologies, artistic perspectives, and interdisciplinary approaches to enhance the quality and innovation of their exhibitions.

To this end, the Artcast4D LL will follow a **hybrid model of provider-driven infrastructure with utilizer-driven approach** [3]. By combining elements of both approaches, the Artcast4D LL will **maximise the benefits of each**: Provider-driven approach will provide a rapid path to market for new technologies and solutions, while utilizer-driven approach will ensure that innovations meet end-users' needs and expectations. The provider-driven approach actively involves end-users in the validation phase, providing feedback and insights on the technology's usability, functionality and suitability to their needs. However, as Artcast4D's LL will also incorporate the utilizer-driven approach, they will also focus on addressing end-users' needs and challenges and co-creating solutions with them. This will be achieved through the continuous feedback to be gathered through the project's various workshops and events, where end-users will be involved in the entire innovation process by providing their feedback and suggestions in Artcast4D's immersive exhibition technology solution.

In addition, Artcast4D LL acquire a **domain-specific** characteristic as it mainly focus on art and culture installations and aims to be **Open** to participation from a wide range of stakeholders, including professionals, businesses, and public authorities. A combination of **virtual and real-life settings** will be used in regards to the chosen environments to test and validate Artcast4D new solutions and services.

In their study, Nyström et al [14] outline a comprehensive compilation of LL main roles:

- **End-users/ testers**, The focus of a LL is on understanding the needs and requirements of end-users, who are actively involved in the co-creation and evaluation process,
- **Facilitators**, offering resources for the use of the network and playing a key role in coordinating and managing the LL,
- **Coordinator**, managing and coordinating a group of participants,
- **Gatekeeper**, possessing resources,
- **Planner**, participating in development process and providing intangible resources,
- **Messenger**, forwarding and disseminating information in the LL network,
- **Contributor**, collaborating with other actors,
- **Webber**, acting as the initiator and deciding on potential actors,
- **Advocate**, having more of a background role and distributing information externally,
- **Accessory provider**, being Self-motivated to promote products, services and expertise,
- **Informant**, bringing users' understanding knowledge to the LL,
- **Co-creator**, co-designing a product, service, process,
- **Instigator**, influencing actors' decision-making processes,

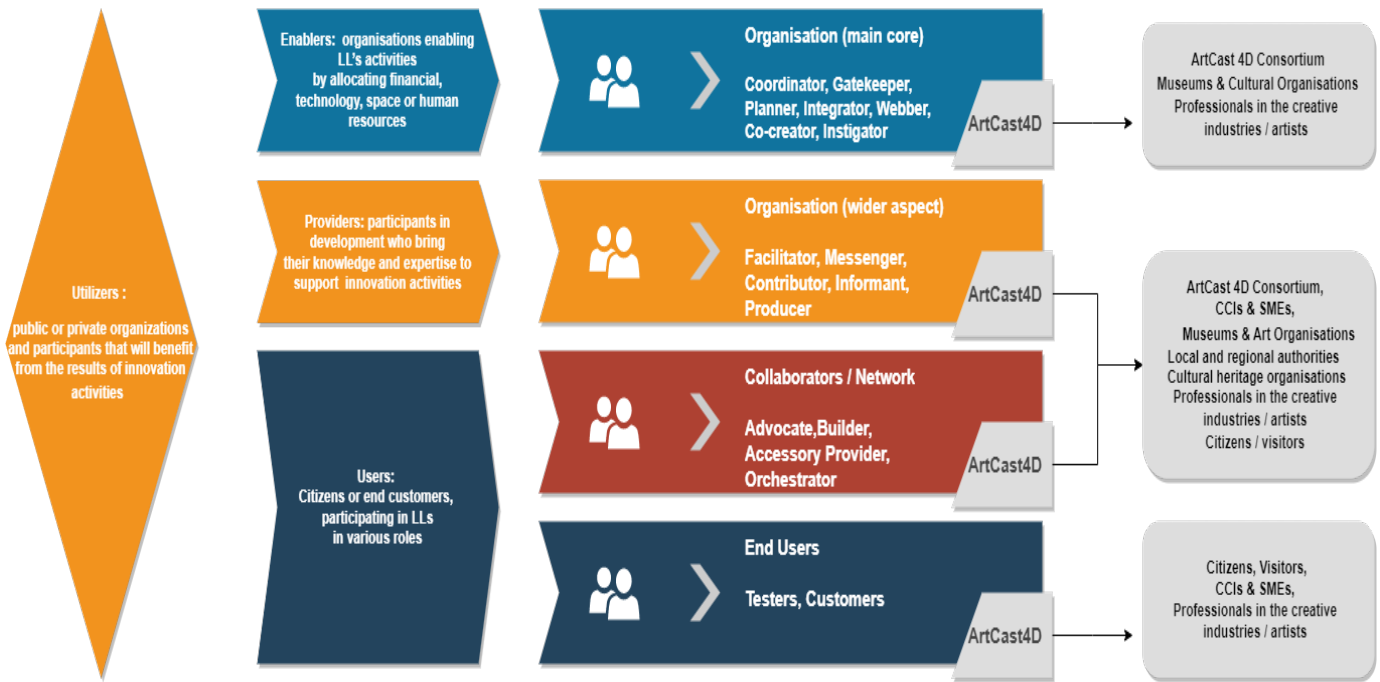


Fig. 1. ArtCast4D Living Lab model - main roles and key actors

- **Producer**, contributing to the development process,
- **Builder**, establishing and promoting the emergence of close relationships between various participants,
- **Orchestrator**, guiding and supporting networks activities; trying to establish trust to boost collaboration.

It is important to note that the roles in a LL can be flexible and overlap, and that its successful functionality depends on the effective collaboration and communication among all stakeholders. In ArtCast4D approach, these roles could be grouped to the level of involvement in the LL organisation as shown in figure 1, further categorized according to Westerlund & Leminen [18] key actors for ArtCast4D: enablers, providers, users, and utilizers.

#### B. ArtCast4D Living Lab phases

Given the fact that the planning phases of LL can vary depending on the specific context and goals of the initiative, the Artcast4D LL phases will be based on the approach described in [19] and [20] as below and illustrated in figure 2:

- 1) **Plan development (month 1-6)**, where a concept development is prepared defining the purpose, and identifying the key stakeholders and partners that will be involved
- 2) **Co-creative technical design (month 7-17)**, determining the physical infrastructure, technology platforms, and resources that will be required
- 3) **Deployment and operation (month 18-28)**, recruiting and training participants involved in all LL processes and launching the installations that will be carried out within the ArtCast4D project
- 4) **Testing and evaluation (month 28-33)**, monitoring and evaluating its performance and impact

- 5) **Refinement (month 33-36)**: Based on feedback received during the earlier stages of the innovation process, this phase aims to refine the proposed technologies and ensure that they meet the needs of end-users and stakeholders, being ready for commercialization.

#### C. Feedback collection methodology in ArtCast4D

In order to reach potential end-users to collect data on their preferences, needs and expectations, a wide range of different LL methodologies will be used as a structured / semi structured or open process for acquiring feedback during the course of Artcast4D:

- **Questionnaires and online surveys** (Webpage, Social Media, email)
- **Interviews**, focus groups and observation
- **Brainstorming** / other workshops to create ideas for solutions
- **Data analysis**: Data from existing sources, such as social media, website analytics, and customer feedback, can also provide insights into user needs.

In addition, a various range of workshops and events will be conducted:

- **User-testing sessions**, addressing to potential end-users in order to observe their behaviour, collect feedback, and gather insights regarding their needs
- **Co-creation and co-design sessions**, involving end-users in the design process, allowing them to provide feedback and insights into their needs and preferences
- **Usability and feedback workshops** where end-users have the chance to try out, test, validate and improve the proposed solution

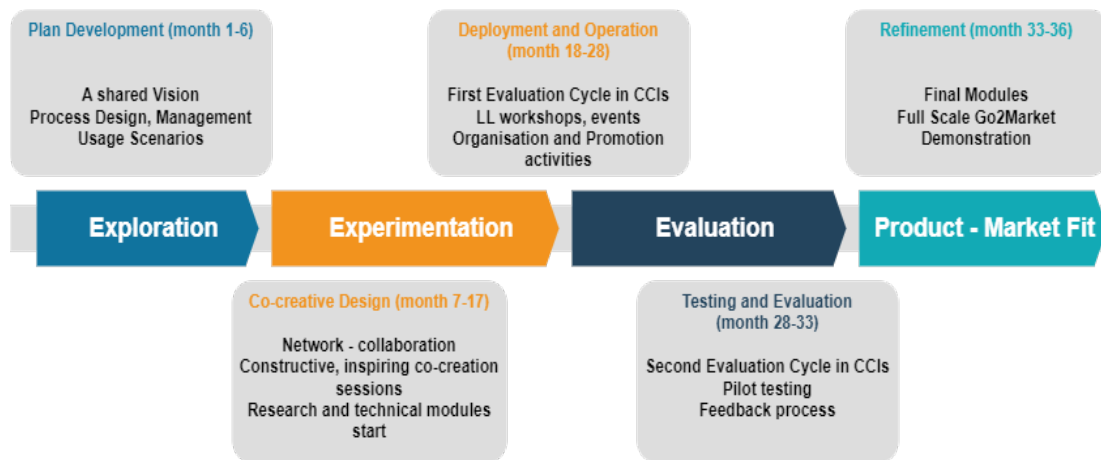


Fig. 2. Artcast4D Living Lab phases

#### IV. CONCLUSION

LLs in arts and culture provide a unique opportunity for cross-disciplinary collaboration and co-creation of new solutions and services. Enoll has registered a range of living labs paradigms that specialize in arts and culture, each with its own unique approach to engaging diverse stakeholders with different backgrounds and expertise. The Artcast4D project aims to create immersive and interactive exhibition experiences through a hybrid model of provider-driven infrastructure combined with an utilizer-driven approach. The success of the Artcast4D LL will depend on effective collaboration and communication among all stakeholders, with a focus on incorporating cutting-edge technologies, artistic perspectives and interdisciplinary approaches to enhance the quality and innovation of cultural exhibitions. As the different roles of living lab participants can be flexible and overlap, it is essential to establish trust and close relationships between stakeholders to achieve the desired outcomes.

#### REFERENCES

- [1] "European network of living labs (enoll)," <https://enoll.org/>, accessed: 2023-05-18.
- [2] E. Almirall and J. Wareham, "Living labs and open innovation: Roles and applicability." *The Electronic Journal for Virtual Organisations and Networks.*, vol. 10, pp. 21–46, 2008.
- [3] S. Leminen, M. Westerlund, and A. Nyström, "Living labs as open-innovation networks." *Technology Innovation Management Review*, vol. 2(9), pp. 6–11, 2012.
- [4] V. de Vrande, J. P. de Jong, W. Vanhaverbeke, and M. de Rochemont, "Open innovation in smes: Trends, motives and management challenges." *Technovation*, vol. 29(6), pp. 423–437, 2009.
- [5] P. Ballon, J. Pierson, and et al., "Fostering innovation in networked communications: Test and experimentation platforms for broadband systems." *Designing for Networked Communications: Strategies and Development.*, pp. 137–166, 2007.
- [6] D. Schuurman, L. Marez, and P. Ballon, "Open innovation processes in living lab innovation systems: Insights from the leylab." *Technology Innovation Management Review*, vol. 3, pp. 28–36, 2013.
- [7] CoreLabs, "Living labs roadmap 2007-2010: Recommendations on networked systems for open user-driven research, development and innovation." *OpenDocument*, 2007.
- [8] M. Hossain, S. Leminen, and M. Westerlund, "A systematic review of living lab literature," *J. Clean. Prod.*, vol. 213, pp. 976–988, 2009.
- [9] B. Bergvall-Kåreborn, Marita Holst, and A. Ståhlbröst, "Concept design with a living lab approach." *Proceedings of the 42nd Hawaii International Conference on System Sciences*, pp. 1–10, 2009.
- [10] E. Almirall and J. Wareham, "Living labs: arbiters of mid-and ground-level innovation." *Technology Analysis Strategic Management*, vol. 23(1), pp. 87–102, 2011.
- [11] B. Bergvall-Kåreborn, C. I. Eriksson, and A. Ståhlbröst, "Places and spaces within living labs." *Technology Innovation Management Review*, vol. 5(12), pp. 37–58, 2015.
- [12] S. McNamee and D. Hosking, "Research and social change: A relational constructionist approach." 2012.
- [13] L. Compagnucci, F. Spigarelli, J. Coelho, and C. Duarte, "Living labs and user engagement for innovation and sustainability," *Journal of Cleaner Production*, vol. 289, 2021.
- [14] A. Nyström, S. Leminen, M. Westerlund, and M. Kortelainen, "Actor roles and role patterns influencing innovation in livinglabs," *Industrial Marketing Management*, vol. 43(3), pp. 483–495, 2014.
- [15] "Living labs, european network (enoll)," <https://enoll.org/network/living-labs/>, accessed: 2023-05-18.
- [16] "Aaaseed software," <http://aaaseed.org/>, accessed: 2023-05-18.
- [17] "Artcast4d project," <https://www.artcast4d.eu/>, accessed: 2023-05-18.
- [18] M. Westerlund and S. Leminen, "Managing the challenges of becoming an open innovation company: experiences from living labs." *Technology Innovation Management Review*, vol. 1(1), pp. 19–25, 2011.
- [19] K. Steen and E. van Bueren, "Urban living labs: A living lab way of working." *Technology Innovation Management Review*, 2017.
- [20] J. G. Guzmán, A. F. del Carpio, R. Colomo-Palacios, and M. V. de Diego, "Living labs for user-driven innovation: A process reference model," *Research-Technology Management*, vol. 56(3), pp. 29–39, 2013.