

This is the **accepted version** of the article:

Hernández-Pérez, Oskar; Domènech i Argemí, Miquel; Vilariño Freire, Fernando.
«Public libraries engaging communities through technology and innovation :
insights from the Library Living Lab». Public library quarterly, 2020. DOI
10.1080/01616846.2020.1845047

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Public Libraries Engaging Communities through Technology and Innovation: Insights from the Library Living Lab

Oskar Hernández-Pérez ^(a), Fernando Vilariño ^(b) and Miquel Domènech ^(a)

^(a) Barcelona Science and Technology Studies Group (STS-b), Department of Social Psychology, Universitat Autònoma de Barcelona, Spain.

^(b) Computer Vision Center (CVC), Universitat Autònoma de Barcelona, Spain.

Abstract

Public libraries have proven for centuries to be infrastructures both stable enough as reference centers for access to knowledge yet plastic enough to respond to the social changes of the communities they serve. In these present times of transformation, during which digitalization and the intensive use of technologies are modifying the way in which knowledge is produced, public libraries are facing new and disruptive challenges. The emergence of certain innovation ecosystems within libraries, which place the community at the center of cocreation and codesign processes between different agents, has transformed some public libraries into encountering spaces. The Library Living Lab, in the *Miquel Batllori* Public Library of Sant Cugat del Vallès (Barcelona, Spain), is an expression of this systemic change. The following paper is a case study based on that sociotechnical infrastructure and analyzes, through two singular examples, how digital technologies can be drivers of social transformation when citizen engagement is placed at the center of innovation processes. The case study also provides insights into how public libraries may become key agents in fostering and strengthening social cohesion through situated, collective, and technology-based innovation practices.

Keywords

Citizen engagement; community building; living labs; public libraries; boundary organizations.

Notes on contributors

Oskar Hernández is a PhD candidate in Science and Technology Studies (STS) in the Department of Social Psychology at the *Universitat Autònoma de Barcelona*, Spain. He holds a master's degree in Knowledge and Information Society and previous degrees in Library and Information Science and Social Work. He has more than twelve years of work experience in libraries and almost ten years in the social field. His research focuses on citizen engagement, cocreation practices, and innovation processes on a participatory basis. His current work is focused on sociotechnical infrastructures of innovation emerging in library contexts, specifically living labs and open citizen-centered laboratories of innovation.

Fernando Vilariño is the Associate Director of the Computer Vision Centre and Associate Professor at the *Universitat Autònoma de Barcelona*. His research interest is focused on image processing and machine learning, with a particular focus on novel paradigms for the transfer of computer vision-based technologies in the area of culture for the (re-) valorization of digital collections. He has implemented a model of living labs for the fast prototyping of novel products and services. He is the current president of the European Network of Living Labs.

Miquel Domènech is Associate Professor in Social Psychology at the *Universitat Autònoma de Barcelona*. His research interests cohere broadly in the field of STS, with a special focus on the relationship between care and technology and on citizen participation in technoscientific issues.

ORCID ID and Social Networks

Oskar Hernández-Pérez: 0000-0002-3514-1802

Research Gate: https://www.researchgate.net/profile/Oskar_Hernandez-Perez

LinkedIn: <https://www.linkedin.com/in/oskarhernandez/en>

Twitter: @OskarHernandez_

Fernando Vilariño: 0000-0002-7705-4141

LinkedIn: <https://www.linkedin.com/in/fernandovilarino>

Twitter: @fervilarino

Miquel Domènech: 0000-0003-2854-3659

Research Gate: https://www.researchgate.net/profile/Miquel_Domenech

Twitter: @miquelarg

Contact

Oskar Hernández-Pérez

oskar.hernandez@uab.cat

Universitat Autònoma de Barcelona, Department of Social Psychology.

Campus de la UAB - 08193 Cerdanyola del Vallès (Barcelona, Spain)

Introduction

Only a few sociotechnical infrastructures, such as libraries, have survived for centuries under the same name, in spite of performing quite different activities in each period and despite the recurrent predictions of their extinction (Battles 2003; Carrière and Eco 2009). Certainly, libraries have to deal with ambivalence: On the one hand, their social representation has remained historically stable and recognizable, and on the other hand, libraries have constantly innovated and created new services adapted to the needs of the communities they serve. Therefore, for many people the public library is a place to read, borrow books, or study; for others, it is a space to attend cultural events. It also provides for many others the opportunity to access DIY and maker technologies. How is it possible that the same object represents simultaneously different categories and meanings depending on who interprets it? And, how is it possible that, at the same time, this object could be recognized by everyone as a library, no matter where it is located in the world?

The concept of "boundary object", developed within the discipline of Science and Technology Studies (STS) but extended to other fields, Library and Information Science (LIS) included (Montoya 2017), provides some insights into both issues. The concept was introduced for the first time in the discussion of scientific cooperation to explain the use of the same object by different "communities of practice" (Lave and Wenger 1991): Whatever the object represented for each particular community, it was still the same object. "Boundary objects are objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites" (Star and Griesemer 1989, 393).

Public libraries can also be understood as "boundary objects": Infrastructures where very different "social worlds" (Strauss 1978) intersect, where diverse interests and needs converge in a shared meeting place which is open to the whole community. This last element has traditionally been one of the greatest strengths of any public library—its openness to the community. But nowadays, in an increasingly changing and uncertain global context, do libraries still maintain this strength as a sign of identity? In a world in a constant process of transformation, what are libraries becoming?

The debate on the future of libraries is indeed not new. Back in the early eighties, the technological, financial, and organizational changes that libraries experienced with the progressive integration of the first computers called into question whether "libraries may disappear like the dinosaurs; or they may, by returning to first principles, be able to adapt and successfully survive" (Thompson 1983, 245). A few years later, at the end of the last century, the transformation processes initiated with digitalization and the advent of the Internet that gave rise to contemporary information and knowledge societies (Castells 1996) resulted in a paradigm shift that caused a profound identity crisis in libraries. Steve Coffman (2012) wondered in his article "The Decline and Fall of the Library Empire" if, after 30 years of digital

revolution, libraries "have new roles to play in the digital world or old roles to play but in a new way". This identity crisis persists today and still leads to questioning the role of libraries in the digital age (Baker 2016, 2017).

The global financial crisis that started in 2008 also had a strong impact on libraries around the world, not only in terms of budget reduction but also with much more drastic consequences. In the United Kingdom, for example, budget cuts have resulted in the closure of one-fifth of the country's public libraries since 2010, over 800 libraries in total (Flood 2019). In Spain, only 5% of public libraries closed during the period 2010–2016, but the reduction in public spending was dramatic: In 2016, spending on library acquisitions decreased by 35.8% with respect to 2010, and investment spending went down from 60 million euros in 2012 to 24 million in 2016 (Arroyo-Vázquez et al. 2019).

Both the identity and financial crises are drawing new scenarios for public libraries. In addition to the former, libraries are confronted with new uncertainties, such as those generated in the context of the COVID-19 pandemic, which are questioning their traditional processes and are pointing even more intensively towards the digital transformation. Facing this changing picture, many digital natives are still wondering why they should go to a public library when, from anywhere in the world, through a computer and an Internet connection, it is possible to access large amounts of information. Government data on the most common activities of people visiting a public library provide valuable insights into this.

In France, lending is still the main activity of municipal libraries, but this is barely preceded by other services. The most recent study on uses of municipal libraries (Ministère de la Culture 2016), shows that loans represent 40% of the reasons for visits, uses related to collections 38%, the use of libraries as places to work or study 15%, and attendance at public libraries for purposes related to cultural programming 11%. In Spain, comparative data between 2010 and 2017 offer similar results: Lending is the main reason for visiting a library, but the number of people who use the library as a place to study, work in groups, and meet other people increases over the years (Ministerio de Cultura y Deporte 2018). In summary, it seems that, in these times of change, the use of spaces in public libraries is an emerging issue; furthermore, in an increasingly digitalized information context, it looks like the library is no longer the reference place for accessing knowledge that it used to be.

However, have issues related to collection management, spaces, or user needs ever been secondary concerns for public libraries? What is new in the challenges that are emerging in these uncertain times? Are we facing new "old challenges", or is it something particularly distinctive that is emerging? These are the matters on which this paper will be focused.

To begin with, we will briefly examine the shift in concerns that can be observed as having taken place for some time in public libraries and how current challenges are focusing on issues related to citizen participation and community interaction.

Following that, we will consider how these questions are in dialogue with living labs, a specific type of sociotechnical infrastructure open to citizenship that has been incorporated over the past few years into innovation ecosystems around the world. To do so, we will focus on a case study, the Library Living Lab, a citizen innovation laboratory fully integrated within a public library in the metropolitan region of Barcelona.

Public libraries facing new challenges

Collection development and curation, both digital and physical, still play a central role in library activity. Acquisitions, technical processes, and collection dissemination are everyday activities which contribute to building that robust identity to which we referred earlier concerning what a library is. Users also enjoy having books around, seeing them on the library shelves, even if only because of a symbolic attachment to the book as an object (Cohen 2019). Nevertheless, in the last two decades, it has been observed how collection management increasingly shares resources, assets, and also spaces with other library services. In many of our public libraries, in addition to books, magazines, and DVDs, we find study rooms, Wi-Fi connectivity, access to digital information resources, and quiet places to sit and read the written press: This set of physical and digital items coexists with the physical collection in different spaces of the library. “Space is therefore conceived as both physical and virtual, and libraries face competition in both realms” (Elmborg 2011, 339).

In recent years, much has been written about how libraries can address this issue of space (Hanson and Abresch 2016). One of the approaches that still has a significant impact in the European library world is that developed by Jochumsen, Rasmussen, and Skot-Hansen (2012), based on their research in the Nordic countries. These authors propose a library model articulated in four different overlapping spaces, each one addressed to a singular purpose: inspiration, learning, meeting, and performance. The model underlines the possibilities for experiencing, discovering, participating and creating that libraries should offer their users.

Users, rather than collections, are therefore at the center of these new trends and proposals in librarianship. Some authors place the debate precisely in that context: “The challenge for libraries in the digital age is to extend their reach well beyond educating and informing into a realm where they increase social capital, rekindle civil society, and expand public participation in democracy” (Kranich 2012, 80). Starting from this approach, expanding it, and without losing sight of the importance of collections and the need to confront such emerging issues as the use of space, the current challenge for us is more about transforming libraries into strategic agents for citizen engagement.

Citizen engagement

Citizen engagement, briefly explained, consists of involving non-expert citizens in participatory processes related to public issues (e.g., policy forming, agenda setting,

knowledge production processes), conferring on citizenship an active role in discussing, assessing, and making decisions regarding aspects of the social life about which they may be concerned. In contrast, the expertization model is a non-citizen-centered model, in which a few (the experts) decide on the topics to generate new knowledge or how to produce innovation (Callon et al. 2001). Since in this model crucial decisions are only made by experts and at levels not directly subject to the influence of citizens (Bucchi and Neresini 2008), some authors have pointed out that "when it affects deliberative processes and political decision-making, this role [the role of expert knowledge] questions the quality and nature of contemporary democratic systems owing to the distance it sets up between citizenship and public matters" (Domènech 2017, 125). In order to bridge this gap, public participation has proved to be a decisive dynamic in coproduction processes (Jasanoff 2004), as it contributes to redefining the meanings of "citizenship", "the public", and "democracy" while becoming a key element for community building.

Public libraries building community

Although the role of public libraries as relevant actors in community building is part of their own mission (IFLA 1994), in the last few decades a more specific concern about this transformative capacity has emerged. Some studies started to conceptualize cultural extension activities promoted by the public library as tools for social transformation (Boaden 2005). In other studies, the library was rethought as a *civic agent*, a place where people can learn about complex public issues and practice deliberative democracy (Willingham 2008). Additionally, some approaches have clearly defined a set of principles and guidelines that could be useful in assisting public libraries in community building (Hill 2009).

Specific research on the role of public libraries and librarians as community agents strengthening social cohesion is still being conducted. Some authors point out that public libraries encourage social inclusion and equity by empowering the public (Reid and Howard 2016; Scott 2011). Others emphasize that "public librarians are to embrace their *de facto* community-anchor identity by functioning as gatekeepers to vulnerable populations, a characterization that the mission of the public library has demanded, both historically and contemporaneously" (Giesler 2019, 36).

So, far from becoming useless places to attend, warehouses for books, or spaces devoid of people, public libraries remain as community reference points, especially in times of crises. Several studies suggest that public libraries are key services in periods of recession (Castillo-Fernández, Gómez-Hernández, and Quílez-Simón 2010; Giannopoulou and Tsakonas 2015), and evidence reveals that their usage rises as the economy declines (Rooney-Browne 2009). People at risk of social exclusion, for example, find shelter in public libraries due to the fact that they are open to everyone because of their extended opening hours and thanks to the facilities they provide (Richter et al. 2019).

Recent studies also highlight citizen engagement as the answer to the challenge posed by the current processes of library transformation. Nicholson (2019, 15), identified five trends in public library innovation that are moving public libraries “towards a model in which their focus is on active engagement with their communities”: participation, making and creating, learning, new outreach, and partnerships. The study *Public Libraries as Platforms for Civic Engagement*, conducted by the University of Washington Information School, also underlines that “libraries have evolved in recent years from an internal focus—providing what they have to the community—to an external focus, listening to community needs and addressing those together” (Coward, McClay, and Garrido 2018, 11).

The follow-up question to be asked is the following: How can libraries become strategic agents to promote citizen engagement in their communities? Among the many answers that can be given to this question, the Library Living Lab is a specific expression that shows how it is possible for public libraries to strengthen social cohesion and foster collaborative community practices through situated innovation processes.

The Library Living Lab

The Library Living Lab is an open, participatory, and experiential space, fully integrated into the public library, where people, technology, and innovation meet and become drivers of social transformation (Vilariño, Karatzas, and Valcarce 2018).

The Library Living Lab covers an area of 110 m² within the Miquel Batllori Public Library, in the Volpelleres neighborhood (Sant Cugat del Vallès, Barcelona, Spain). The architectural definition of the Lab was the result of a cocreation process of multiple stakeholders who established that the space had to be coherent with the purposes of the infrastructure: It had to be open, flexible, and interconnected—just how it has been since 2015, when it was inaugurated, an open space, separated from the rest of the library by a simple glass wall and with physical elements that are mobile, portable, and easily adaptable to any activity (Figure 1).

The aim of the Library Living Lab is to explore how, through collaborative innovation processes, technology can transform the ways in which communities experience culture and interact with them. The library thus provides the context of an encountering space where diverse communities of practice come together and innovate on the basis of living lab perspectives and methodologies.



Figure 1. The Library Living Lab is located inside the Miquel Batllori Public Library in Sant Cugat del Vallès (Barcelona, Spain). Photo credit: Adrià Goula / Biblioteca Miquel Batllori (Forn, Piferrer, and Orteu 2017).

Living Labs: Innovation placed in real citizen environments

Living labs are defined by the European Union as user-centric innovation environments (Eskelinen et al. 2015), in which creators, managers, and users participate in cocreating innovations with a significant social impact. For this impact to produce an effective transformation in the community, an open and trustworthy ecosystem of several agents is needed: a) researchers (carriers of new ideas and technologies), b) administrators (policy-makers and driving actors for the transformation of ideas into services), c) private organizations (enabling sustainable models), and d) citizenship (the community for, with, and by whom innovation is taking place).

This multistakeholder schema of participation, which takes as a reference the Quadruple Helix model of knowledge and innovation (Carayannis and Campbell 2009), is one of the five basic elements identified by Ballon and Schuurman (2015) which, combined, ignite the collaborative innovation processes that take place in living labs. The other four are: a) active user involvement, b) a real-life setting, c) a multimethod approach, d) and cocreation. Living labs are thus spaces where it is possible to design prototypes of new tools and services, as well as “real-life environments or arenas, where both open innovation and user innovation processes can be studied and experimented with, and where new solutions are developed” (Evans et al. 2019, 11).

The innovation process in the Library Living Lab is developed in three phases. In the first place, a social challenge has to be identified: For a project to be accepted as innovative, it has to seek to have a concrete social impact on the community. Secondly, it is necessary to design a concrete action related to the challenge to be

addressed: This may be a prototype, a pilot scheme for a new service, or testing new uses for a particular technology, to name a few examples. The third phase consists of defining the expected returns of such action, that is, the concrete return that the community as a whole will eventually achieve at the end of the process.

Projects are then carried out through specific cocreation methodologies and from an inclusive approach, ensuring that any user can participate in the activities regardless of their technological skills. Furthermore, the outcomes can be easily delivered to the community through the library network, municipal services, or local companies, thereby guaranteeing the scalability of the project and closing the innovation circle.

From this perspective, the Library Living Lab transforms the library space into a place where multiple stakeholders, and in particular public library users, meet together and are invited to participate in the innovation process of defining potential real services, projects, or products which have an impact in the whole community. At the same time, the way in which this innovation process takes place transforms the social dynamics of the community in terms of social cohesion and community engagement.

Living labs and makerspaces

This specific cocreation methodology is probably what most distinguishes a living lab from other sociotechnical infrastructures that have emerged in recent decades, such as makerspaces, fablabs or hackerspaces (Cavalcanti 2013). The maker culture (Anderson 2012), associated with do-it-yourself practices (Wohlsen 2011), the revival of traditional technologies (e.g., crafters), and the diffusion of some digital technologies once within the reach of very few (arduino, 3D printers, laser cutters), is based on the idea of reuse, creative thinking, and specific fabrication adapted to individual or community needs (Dougherty 2012). Several makerspaces have been located in public libraries and have contributed to produce a shift towards community issues (Johnson 2016; Slatter and Howard 2013).

Living labs share with makerspaces this conception of a community space (Taylor et al. 2016) that offers access to a set of technologies, tools, and fabrication equipment which allow the materialization of different sorts of projects. Both spaces have a clear focus on "the making", testing, and experimenting. Those that receive public funding are usually open spaces that seek citizen participation. We could find still more points in this connection; the first technological artifact provided by the Library Living Lab was, in fact, a 3D printer, and many of the projects developed in the Living Lab have involved the use of digital production technologies, as will be shown later in one of the examples. Is it enough, however, to provide a space and technological infrastructure to foster citizen engagement?

The singularity of the living lab model is that, after identifying together with the community some social challenges that the community itself has decided to face, technologies are just the enablers to make it possible. The whole process is a social

innovation one since it is performed through cocreation and codesign practices that place the community at the center of the process.

The project: The result of a bottom-up initiative with multiple stakeholders involved

The Library Living Lab is the result of a bottom-up initiative started in 2011, when the Neighborhood Association of Volpelleres (Sant Cugat del Vallès, Barcelona, Spain), started to work on a proposal about the needs that should be covered by the projected new public library. The neighborhood (12,000 inhabitants) is a completely new suburb of Sant Cugat del Vallès (Barcelona metropolitan area), which at that time was facing the challenge of a lack of diversity in the typology of services available in the area. Due to its proximity to many academic institutions and after orienting the focus of the library towards issues related to technological innovation, the proposal arrived at the Computer Vision Centre (CVC), a leading research center in the area of Artificial intelligence for image and video analysis and in which the regional government of Catalonia and the *Universitat Autònoma de Barcelona* (UAB) participate. At that time, the CVC was implementing a strategy aimed at the application of its core technologies in the field of culture while exploring new paradigms for the rapid transfer of research results to the public.

This combination of factors led the CVC to guide the Neighborhood Association's proposal towards the creation of a living lab within the context of the new library. The project received institutional support from the municipality and the library network of the Barcelona Provincial Council (*Diputació de Barcelona*), which counts 227 libraries and 10 mobile libraries, and offers services to 5.5 million citizens (including 2.8 million registered users) (Diputació de Barcelona 2019, 267–268). All agents participated in a cocreation process that led to the opening of the Library Living Lab in May 2015. In the following two years, a pilot project was carried out with intense activity and the deployment of several prototypes of both products and services (see Figure 2 for a summary of facts and figures for 2015–2016). During 2017–2019, specific programs and projects were addressed based on the results of the pilot project, and the final sustainability model was agreed upon by all stakeholders.

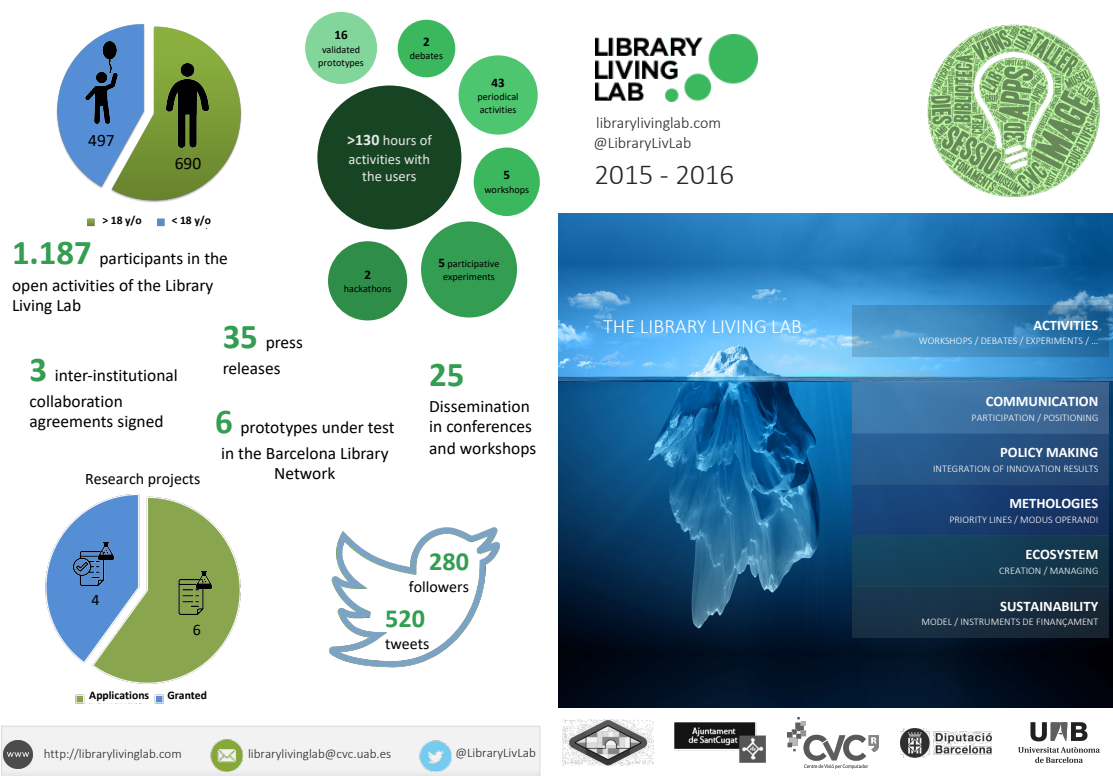


Figure 2. The Library Living Lab: Facts and figures (2015–2016).

Since 2015, the Library Living Lab has been a member of European Network of Living Labs (ENoLL), which is an international non-profit association, as well as a platform for knowledge sharing and collaboration. ENoLL provides cocreation methodologies, tools, and support in order to stimulate and accelerate innovation processes that are based on user and community involvement (*Helsinki Manifesto* 2006). Although ENoLL initially consisted only of European initiatives, which were admitted to the network after a benchmarking exercise, nowadays ENoLL comprises living labs from all over the world.

The multistakeholder cocreation process that led to the launch of the Library Living Lab shows how it is possible to engage different community agents around an innovative infrastructure placed and merged within a library. It also shows how the results of the collaboration were reintegrated in the community and improved the social conditions for citizens. Thus, the Neighborhood Association achieved the goal of its proposal, which was based on a community needs assessment study, and the community was provided with a new facility, the Library Living Lab. The municipality of Sant Cugat del Vallès, in turn, offered cultural and community services through a new library and, at the same time, started to receive from the Library Living Lab a new open space for any citizen to experience culture through technology. The Provincial Council of Barcelona provided a network of libraries where the results of the innovation processes carried out in the Lab could potentially be extended throughout the entire network. Finally, the academic agents (CVC and UAB) also contributed with technological and knowledge infrastructures, and in return the Library Living Lab

successfully extended research activities beyond the limits of the university campus and attracted the attention of other potential audiences.

Other stakeholders continuously join the activities of the Library Living Lab. In addition to the members of the consortium, the Lab actively collaborates with different public and private institutions of the Barcelona metropolitan area in the fields of culture, citizen science, and responsible research and innovation.

Lines of work and scalability of the Library Living Lab: The BiblioLab program

The Library Living Lab currently operates six lines of work: 1) (re-)valorization of digital collections, 2) collaborative creation in 3D, 3) libraries in connection with museums (GLAM), 4) best practices on educational apps, 5) linking of physical and digital documents, and 6) novel paradigms of storytelling. Each of these lines of action offers a set of five different activities: open workshops, prototype creation, scientific experiments, open debates, and scheduled activities. As an example of this, Figure 3 shows the activities carried out in the Library Living Lab during the first year after opening its doors (2015–2016).

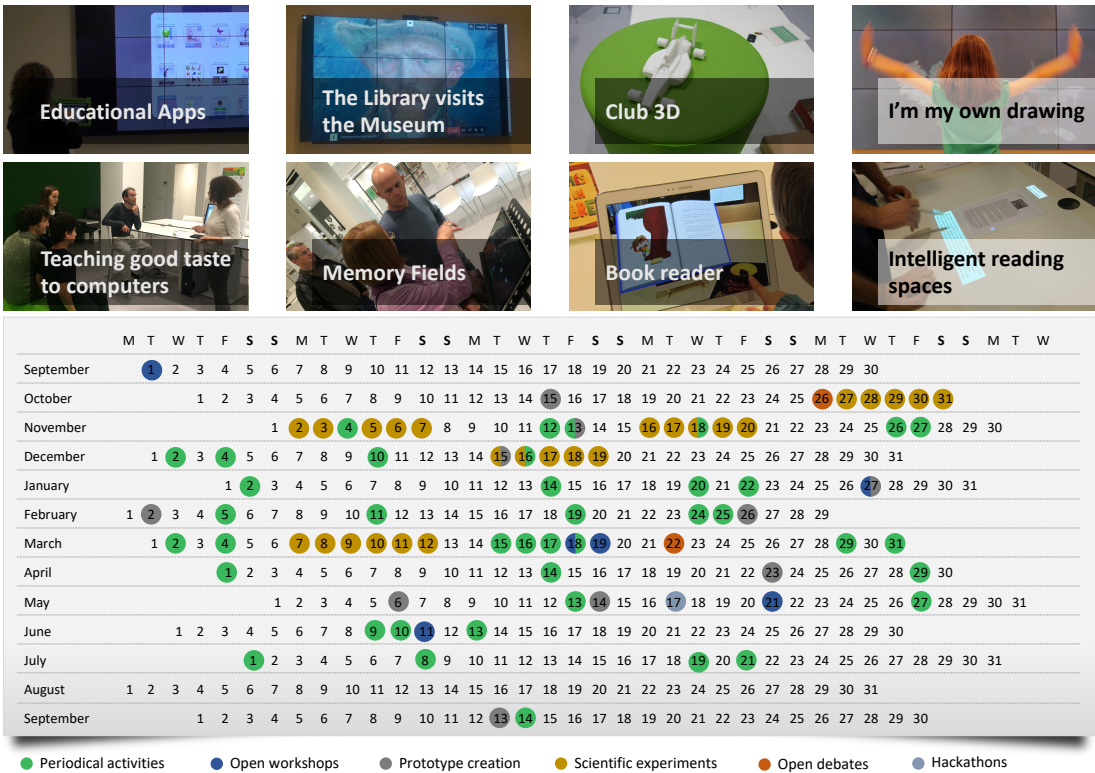


Figure 3. Set of activities developed in the Library Living Lab during the first school year after opening its doors (2015–2016).

The innovation approach implemented in the Library Living Lab at a local level has been scaled up to the entire library network in the province of Barcelona. The creation of the Library Living Lab innovation framework—in which concepts such as artificial intelligence are connected to cultural heritage or citizen science—which brings

together technology and library users through innovation and which involves communities, has led to a systemic change in the network library policy. The new *BiblioLab* program (Diputació de Barcelona 2016) emerged from the experiences of the Library Living Lab and was launched in May 2017 as the umbrella program on cocreation, experimentation, and innovation for the 227 public libraries of the Barcelona province library network.

The starting point of the *BiblioLab* program is that libraries, in addition to having appropriate collections and offering good services, can also be transformed into spaces that encourage citizen participation as well as individual and collective learning. The central idea of the program is to transform the library into a key agent for creating knowledge and citizen innovation through collective experimentation in a completely open environment.

The *BiblioLab* program is implemented in two ways: a) by financing innovative projects promoted by groups of citizens (civic organizations, associations, research centers, private initiative, etc.) and carried out from the library, and b) through specific experimental spaces fully integrated into public libraries. Within the first ones, thanks to the program, citizen science projects have been undertaken with objectives as heterogeneous as identifying and documenting the animals that live in a neighborhood of a large city, mapping the urban mobility of a small municipality, or diagnosing the hydrological and ecological status of a river (Perelló et al. 2019). With respect to the latter, *BiblioLab* has made possible the opening of new citizen laboratories for experimentation and innovation inside public libraries, with focuses of interest as varied as a multicultural kitchen laboratory (*Espai Cuines del Món*, Chavarría 2017), or a citizen data lab (*Ateneu de dades*).

Public libraries in the province of Barcelona are being transformed into emerging innovation infrastructures, and the experiences acquired at the Library Living Lab have substantially contributed to this systemic change (Romero and Sabater 2019).

How to build community from the library with living lab methodologies?

Two projects carried out in the Library Living Lab are particularly illustrative of how to answer this question: *@BrossaInedit* and *3D Capitals*. In both cases, living laboratory methodologies were applied, multiple stakeholders were involved, and groups of citizens actively participated in innovation processes related to cultural heritage. In *@BrossaInedit*, the community of library users had the chance to choose which unpublished poems of a digitalized collection would be made public for the first time. In *3D Capitals*, the community itself cocreated new digital content based on physical cultural heritage, placing this new knowledge inside and outside the library.

Brossa Inèdit (@BrossaInedit): Community uncovering the library's digital collection

Brossa Inèdit (Unpublished Brossa) is a transdisciplinary project which aims at the (re)valorization of digital collections through the participation and contributions of the

public. Joan Brossa (Barcelona, 1919–1998) was a Spanish poet in the Catalan language, who started his creative career in the 1950s in the field of experimental poetry. Influenced by the avant-garde movements (particularly Surrealism and Dadaism), his visual poems have the appearance of a wordplay, often satirical and ironic and, on other occasions, irreverent and comical. In 2016, the Joan Brossa Foundation, with the aim of promoting and disseminating the poet's work, developed a joint project with the Library Living Lab upon the basis of a digitalized collection of more than a thousand unpublished visual poems. The project had several levels of performance, including interactions with technological artifacts and the use of social networks in disruptive ways, and sought from the very beginning to involve the community in collective processes of enriching digital narratives.

On a more specific level, *@Brossalnedit* was built around an open, interactive installation that was placed in the Library Living Lab for two weeks and which consisted of a double-screen interface: a touch screen and a large-format screen monitor. The tactile display allowed anyone to interact with the digital collection in four different ways: a) browsing the 1.120 digital visual poems through a “digital roll”, b) selecting one specific item that will be displayed on the main screen and therefore shared with everyone in the Lab, c) zooming in on the desired sections of the selected item, and d) adding a personal narrative to the visual poem selected. Narratives were added through the Memory Fields, a prototype developed at the Library Living Lab consisting of a green region located along the base of the touch screen representing a grass field in which it was possible to add digital objects in the form of flowers.

When someone browsed the digital collection of unpublished poems, selected a piece, read it, and had an evocation that he or she would like to keep (an emotion, a memory, a concept), Memory Fields allowed the person to create a “memory” of that whole experience: It was enough to “plant a flower” in the grass field. The flower was then a digital object that contained the unpublished visual poem along with the evocation, which the person would have had to write in less than 280 characters in a text file.

It was not an individual experience but was shared collectively. On the one hand, it was shared with those people who were physically in the Living Lab since the whole process was projected on the main screen of the installation, making it public and open to anyone who was in the library and wanted to participate in it, and on the other hand, it was shared with the Twitter community since each flower planted in the Memory Field generated a tweet on the open channel *@Brossalnedit* (<https://twitter.com/brossalnedit>). Figure 4 shows different views of the installation and the process described above.

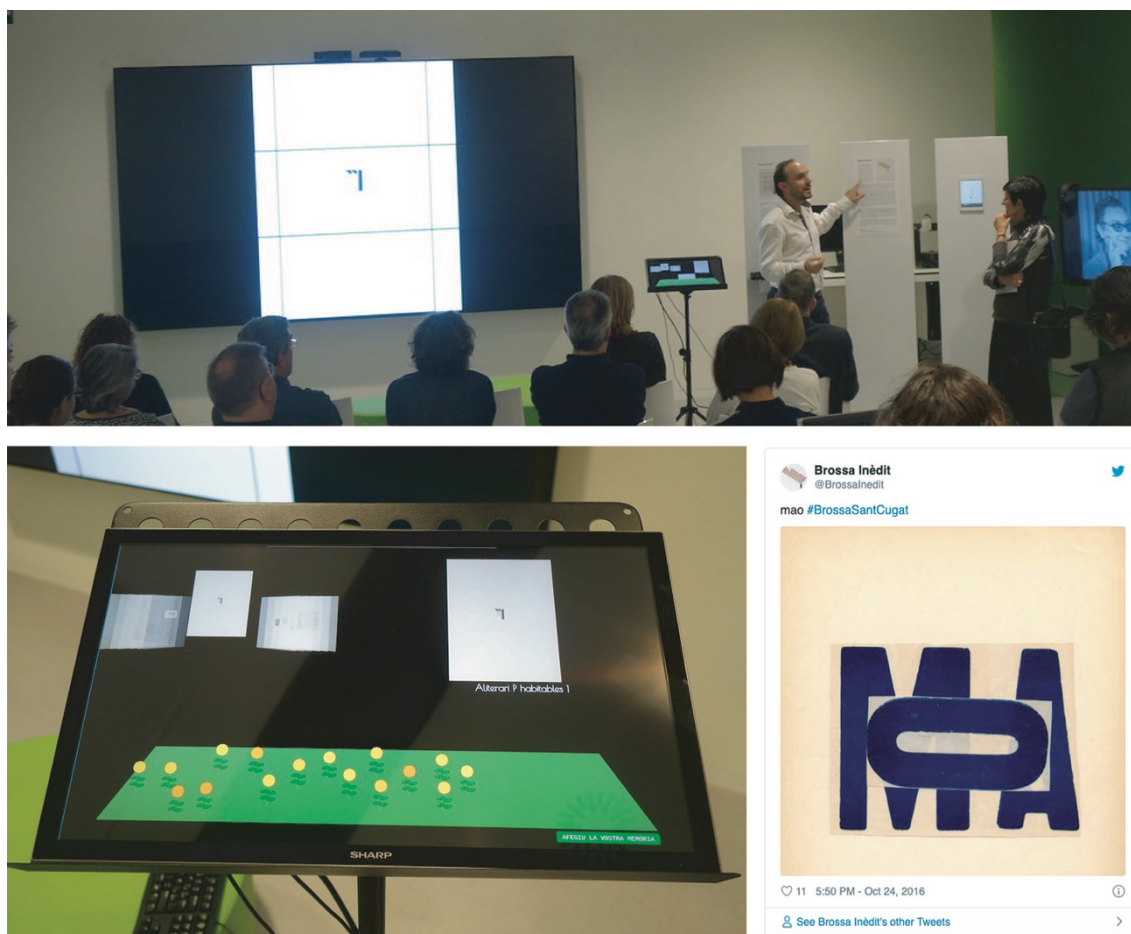


Figure 4. *Brossa Inèdit* installation. On top, the opening session of the project with a view of the double-screen interface; bottom left, Memory Fields' tactile interface showing one of Joan Brossa's unpublished poems; bottom right, one of the poems enriched by the evocation of a participant ("mao") and made public through the @Brossalnedit channel on Twitter. Photo credit: Library Living Lab.

The flower became an assemblage in a distributed agency sample (Latour 2005) since many actors were needed to build it and none of them was fully responsible for its creation. In other words, the flower was not possible without this whole network of actors and the relationships that were established between them. The flower was, at the same time, the result of the creative action of the poet Joan Brossa (the visual poem in a digital format), the product of a choice (made by the person who had interacted with the installation in the Library Living Lab), and a set of concrete meanings (the evocations that the reading of the poem had generated in that particular person).

After two weeks in the Library Living Lab, the @Brossalnedit project contributed to building new relationships between users and the collections that the library made available to them. During this time, all the physical items of the poet's work available in the library were exhibited in the Living Lab so that the people who participated in the project simultaneously had access to the unpublished digitalized poems along with the physical collection. Both collections were available to the library users in the same space, the Library Living Lab, but were experienced in different ways. A total of 49 unpublished digital poems created by the poet became public for the first time

during these two weeks via the Library Living Lab, through the public library, and over Twitter.

Twitter became the repository of these new narratives and the amplifier of the action that took place within the physical framework of the library. The tweets on the @Brossalnedit channel obtained more than 12,219 impressions during these two weeks. This means that those new narratives built in the Library Living Lab and those visual poems that were made public for the first time in the library attracted the attention of more than 12,000 people. Among them, 826 people interacted directly with the visual poems in the form of likes (144), retweets (56), interactions with the multimedia content (434), and other types of clicks anywhere in the tweets (192) (Figure 5).

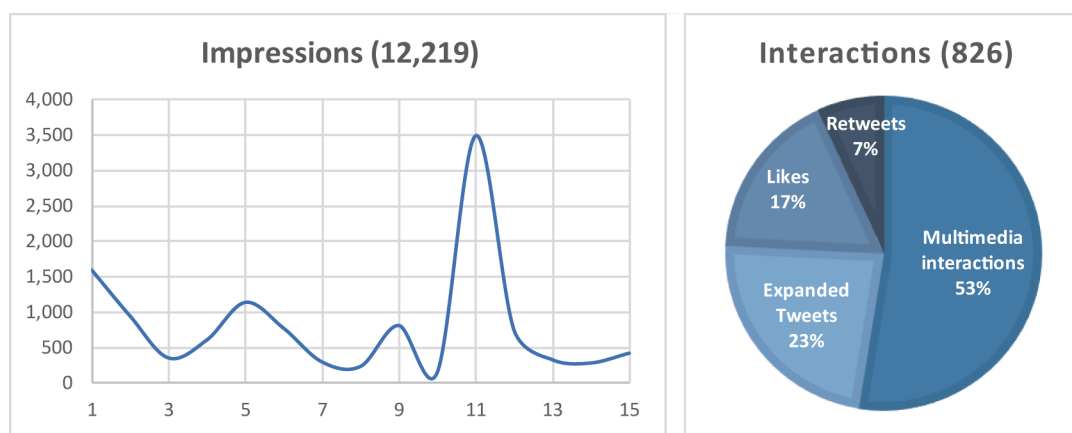


Figure 5. Impressions and interactions metrics obtained by the Twitter channel @Brossalnedit during the two-week installation at the Library Living Lab (October 14–28, 2016).

Finally, the project also allowed library users to build new narratives from a given collection. Thanks to the use of certain technologies developed at the Computer Vision Center (the Memory Fields prototype and the interactive installation), Joan Brossa's unpublished poems were transformed in the Library Living Lab: Participants incorporated their personal experiences into the poems, reused the poems to create something new, and launched these creations into the world from a common Twitter account, @Brossalnedit. The collection was therefore expressed in different ways, by different people, and opened up on Twitter to a new potential audience. The final result was an experience of collective creation.

3D Capitals: Citizens cocreating the city's digital cultural heritage

3D Capitals (<http://librarylivinglab.cvc.uab.cat/home/capitals>) is an ongoing project led by the Computer Vision Centre (CVC) and the UAB that contributes to giving answers to one of the challenges that research centers currently face—technology transfer with social value, a notion comprised in the Responsible Research Innovation framework (Owen et al. 2012; Stilgoe et al. 2013; von Schomberg and Blok 2020). Digital humanities are becoming a fertile field of experimentation in this direction, and various projects are testing the use of 3D modeling and printing technologies in

order to revalue the public cultural heritage and disseminate it to society (Ackerman and Glekas 2017; Merchan et al. 2019; Scopigno et al. 2017). In this context, the CVC, together with the Sant Cugat Museum and the Library Living Lab, launched an Open Citizen Science project in 2018 with the aim of digitalizing the 144 capitals of the Sant Cugat del Vallès monastery cloister, which are a masterpiece of European medieval art representing biblical scenes, plant motifs, fantastic animals, and delicate geometric figures. The capitals are one of the most iconic manifestations of the city's cultural heritage.

The project was developed in the Library Living Lab in two phases: an initial prototyping phase and a series of participatory rounds that started in 2018 and are expected to last until the end of 2021.

In the prototyping phase, a promoter committee was formed by representatives of the CVC, the museum and the laboratory users. This working group had the initial mission of designing a protocol that would allow everyone, regardless of their initial technological capabilities and skills, to participate in scanning and modeling the capitals of the monastery using 3D technologies. The prototyping process was based on Living Lab methodologies. It gave an answer to the social challenge of making it easier for any citizen to experiment with the cultural heritage of their own city from a digital perspective, different agents were involved, and citizens were placed at the center of the codesign process, as shown by some significant decisions that were made. In this sense, the working group established that: a) the scanning protocol should be affordable on a large scale, since the citizen should be the protagonist of the cultural action; b) the scanning tool should be familiar to the users, instead of them using complex or inaccessible technologies; and c) the final result should benefit all citizens so that everyone can have the opportunity to reuse, redesign, and revalue it.

The resulting protocol was designed to be completed in 6 sessions (14 hours) within four stages of performance: 1) initial training, consisting of a workshop on the fundamentals of photogrammetry and 3D scanning; 2) photographic capture of the capitals in context, at the monastery cloister; 3) construction of 3D models of the scanned capitals; and 4) production of outcomes, both digital (publication of the models created on the Library Living Lab website) and physical (3D printed replicas of the capitals) (Figure 6).

In accordance with previous decisions, the protocol established that the main scanning tool would be the participants' mobile phones. Familiarity with the technological device facilitated the participation of heterogeneous members of the community of extremely varied ages, social realities, and cultural backgrounds. The ease of use of the tools, since no specific photographic devices were needed, also encouraged the community's reaction.

Finally, the protocol demonstrated the willingness to actively contribute from the public library to the ecosystem of knowledge creation, both locally and globally. An

example of this is that it was designed taking into account its scalability potential, that is, that it could eventually be implemented anywhere in the context of a citizen science project focused on cultural heritage and 3D technologies. Likewise, the 3D models were licensed under a Creative Commons Attribution-Non Commercial 4.0 International License, which means that anyone is allowed to use the cocreated results for future non-commercial actions.



Figure 6. Different stages of the protocol. On top, training session on photogrammetry at the Library Living Lab; bottom left, capture session in the Monastery of Sant Cugat del Vallès; bottom right, first 3D printed capitals exhibited at the Library Living Lab. Photo credit: Library Living Lab.

The prototype was first tested in May 2018 by 15 participants in 11 cloister capitals, which were digitalized and printed in 3D. These first results were disseminated in different ways with the dual purpose of presenting the project to the community and of encouraging citizen participation in the next phases of the project. The main dissemination actions, carried out between May 2018 and April 2019, consisted of: a) an open session at the library to explain the process and show the first outcomes; b) an exhibition of the printed capitals in the Living Lab; c) the launch of a specific section in the Library Living Lab website where the digitalized models could be accessed; d) specific actions, such as television interviews, to ensure the presence of the project in the media; and e) a workshop for young people in the framework of an Open Science program organized by the Library Living Lab.

In April/May 2019, a second open call for participation was launched, and 20 library users of different ages participated in the digitalization of a further eleven capitals. Five more rounds are planned for 2020–2021, engaging different neighborhood associations, researchers from the surrounding universities, and high school students from the city. More than 100 participants will be invited to attend these rounds, and it is expected that, when completed, the remaining 122 capitals will have been digitalized.

During these two years, any citizen interested in the medieval capitals of the monastery could visit the local section of the Miquel Batllori Public Library to borrow a book about them, and they also had the chance to join the Library Living Lab to participate in the *3D Capitals* project. This second alternative offered the community the opportunity to approach their cultural heritage from other points of view: a) interacting with it more directly, b) participating in digital creation processes that bring that heritage closer to the community, and c) being part of a collective learning experience. Thus, the library no longer only contributes to the dissemination and promotion of the city's cultural heritage through a collection of documents. The existence of the Library Living Lab and the launch of the *3D Capitals* project is transforming the library into an agent that can cocreate with the community digital artifacts (the digitalized 3D models), which have the potential to build new knowledge related to local cultural heritage.

The project is still ongoing, and many of the impacts are yet to be seen. In this sense, some questions that could be explored in further studies are the following: Will the community, in any way, revalue the original physical heritage? What will it imply for the museum to have all capitals digitalized in 3D? And, what kind of uses will the community give to this new digital cultural heritage that is being cocreated by the community itself?

Discussion

The examples described above reveal that the Miquel Batllori Public Library in Sant Cugat del Vallès (Barcelona) is a place where many other things occur besides traditional collection curation, collection dissemination, and cultural extension activities. Users meet technology, interact with it in multiple ways, and create new things together with other people; in the Library Living Lab within the public library citizens innovate collectively.

Brossa Inèdit suggests something more than the classic action of digitalizing a collection in order to enhance it or disseminate it to a wider audience. In *@Brossalnedit*, the digitalized collection shares prominence with the community: The collection was transformed, enriched, and made public by the library users who attended the installation. From the Library Living Lab and through Twitter, the unpublished poems were revalued thanks to a process of collective action. In addition, the project explored the use of Twitter as an open repository of this collaborative editing experience.

In *3D Capitals*, citizens do not play the role of data collectors, sample suppliers, or testers of a prototype's effectiveness: The library users who participated in this project were cocreating agents from the very beginning, from the first phase of prototype codesign. *3D Capitals* is not just a collaboration between the library and other citizen agents to carry out a digital humanities project. In *3D Capitals*, the community reappropriates the local cultural heritage and places it in the library so that the public library becomes an enabler of citizen science and an agent of innovation in the citizen ecosystem.

The case studies also reveal a public library that, since 2015, has successfully integrated a living lab, a sociotechnical infrastructure for innovation. How is it possible for a single library to organize simultaneously activities as diverse as book clubs, music concerts, craft workshops, and projects such as *@Brossalnedit* or *3D Capitals*? Rethinking the public library as a "boundary organization" could contribute to a better understanding of this phenomenon. "Like boundary objects, boundary organizations can accommodate the varying interests of parties by providing a mechanism that reinforces convergent interests while allowing divergent ones to persist" (O'Mahony and Bechky 2008, 426).

The public library is a flexible infrastructure that allows the coexistence of what Lave and Wenger (1991) called different communities of practice. The two case examples showed that library users interested in cultural heritage, enthusiastic literature readers, as well as techno-geeks wishing to learn photogrammetry techniques, converged around the same project and in the same place. All these communities of practice, each one with different aspirations and interests, each one with its own specificity, joined together in projects offered by the library and launched from the Library Living Lab.

At the same time, the library is a stable infrastructure, as mentioned in the first paragraph of this paper. It is precisely this stability that bridges the boundaries between these different communities of practice and allows them to carry out common goals. When members of intersecting social worlds are placed together to carry on a common goal, issues may arise, along with problems and concerns that are potentially conflicting and on which it is not always possible to reach consensus. It is in this idea of cooperation between different communities of practice where the concept of the boundary object (Star and Griesemer 1989) expands: In the absence of consensus, boundary organizations make collaboration possible by enrolling different actors (Latour 1987) on the basis of their convergent interests.

Facing the legitimately divergent positions of the different social worlds, boundary organizations do not promote practices oriented towards imposing a certain representation or to coercing minority positions, nor to silencing non-hegemonic voices. Within boundary organizations, divergent interests coexist, dissidence inhabits the space, and disagreement occurs. Indeed, it is precisely such

heterogeneity that enables the emergence of collaborative practices among the communities that converge there.

Rethinking public libraries as boundary organizations means assuming this dissension: a) it means that different communities of practice can be involved in the same project; b) it means that these projects, as in the case of *@Brossalndedit*, blur the boundaries between the physical and the virtual library, between the physical and the digitalized collections, while maintaining consistency; and c) it means that, as in the case of *3D Capitals*, intersection spaces between collective action, individual creation, and public cultural heritage can be built.

Understanding public libraries as boundary organizations allows us to better comprehend why living labs have become the innovation framework for the entire network of libraries of the province of Barcelona because public libraries are both flexible and stable enough to integrate sociotechnical infrastructures such as living labs, which also means integrating citizen innovation practices into libraries through technology and collective experimentation.

Conclusions

We started this paper by asking what public libraries are becoming in a changing and uncertain global context where the digital is increasingly present in our daily lives and it seems that citizen engagement holds a prominent place in the debate. We have examined two experiences that show how a public library can become a strategic agent in promoting citizen participation in the community it serves. In the shift towards building communities from public libraries at a time of intense digital transformation, living labs are sociotechnical infrastructures that give an answer to this challenge.

Firstly, this is because the public library, as the boundary organization that it is, perfectly integrates an infrastructure such as the Library Living Lab. The public library facilitates that different communities of practice come together in the Library Living Lab to experiment collectively and build new knowledge through collaborative practices of innovation. The public library integrates these dynamics because it is an infrastructure used to coexist with diversity (of users, of activities, of management tools) because it offers a meeting point for innovation without requiring the different agents (the divergent communities) to abandon their own original practices and because it is an infrastructure that has always been in transformation, "in the making". The *BiblioLab* program provides solid signs that the innovation model developed in the Library Living Lab can go beyond a local community and be scaled up as the innovation model for the 227 public libraries of the Barcelona Province Library Network.

Secondly, the integration of the Library Living Lab within the public library transforms the library. In the Library Living Lab, innovation is produced in a certain way with a multistakeholder participation scheme, which takes the Quadruple Helix innovation

model as a reference and uses living lab methodologies. The community is placed at the center of the innovation process, which has a collective dimension from the beginning since it is a process open to citizens, and citizen involvement is actively encouraged. This approach to innovation has an impact on the library itself: It transforms it. The library becomes a place where it is no longer only possible to access, retrieve, and disseminate knowledge, but it is also a place to create and share knowledge collectively. The two examples illustrate this: from the Library Living Lab, at *@Brossalnedit*, the community cocreated new narratives from a digitized collection, and at *3D Capitals*, the codesign of a prototype made it possible to digitalize cultural heritage and symbolically bring it back to the community.

Finally, in these transformation processes in which public libraries are immersed, the Library Living Lab is an encountering space for communities to meet technologies. Public libraries have always been relevant agents in the processes of digital transformation, and having a living lab within a public library multiplies this potential since technology transfer, innovation, and user-centered approaches are the basis of living labs activities. Living lab methodologies provide new and still unexplored perspectives, given that the community itself is at the center of the process. The community defines its own challenges, makes decisions, and builds its own technological solutions. The living lab is a place to experience these solutions. Through the Library Living Lab, the public library becomes an enabler of this whole process.

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