LIVING LAB FOR DIGITAL LITERACY AND ACTIVE AGEING. SYSTEMATIC LITERATURE REVIEW OF SCIENTIFIC PRODUCTION IN THE SOCIAL SCIENCES

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Abstract

The aim of this study is to know the state of the art of Living Labs in the field of Social Sciences. To this end, a Systematic Literature Review was carried out with the aim of answering the following research questions: a) what types of studies are carried out on Living Labs, b) what are the aims and objectives of the Living Lab analysed, c) what is its geographical context, d) the type of users it is aimed at and e) what are the characteristics shared by the different Living Labs analysed in the selected literature. After analysing the literature, the results show a predominance of both qualitative research and studies carried out in the European context, as well as heterogeneity in the objectives of the research analysed and coincidence in the characteristics of the Living Labs analysed. The conclusions point to the need to develop research on Living Labs in the field of Social Sciences and, specifically, from an educational perspective that promotes the technological inclusion of the elderly.

Keywords: innovation, Living Labs, elderly, technology

1 INTRODUCTION

The Social Studies of Science and Technology (STS) and of innovation management constitutes a field of study interested in the mutual relationships between social phenomena, the processes of generating scientific knowledge and the dynamics of technological production. In this context, the so-called Living Lab has been well received in the last decade.

Leminen and Westerlund [1] define Living Labs as physical or virtual environments where stakeholders form partnerships and collaborations for the co-creation of prototypes, validation and testing of new technologies, services, products and systems in everyday life contexts.

This kind of space constitutes a suitable environment for the dynamics of design and technological production, these ecosystems of co-creation are bound to the development of innovation and the participation of different types of social agents [2]. In short, these environments are characterized by following an open innovation paradigm and by the explicit participation of users, who participate in the process of research, innovation and development of technological products [3], [4].

In Europe there are about 400 Living Labs associated with the European Network of Living Labs (ENoLL). Some of these Living Labs have been gerontechnologically oriented, leading to the so-called Seniors Living Labs. After the analysis of different European Seniors Living Labs environments and registered in the ENoLL, Angelini et al. [5] conclude that most of these Living Labs carry out research and innovations around technologies aimed to improve the autonomy of the elderly, as well as providing support for different health conditions.

Therefore, it can be said that these communities seek to go beyond of digital literacy of the elderly, in such a way that these communities are involved as active agents in the process of designing and evaluating technologies for their better adaptation to other users; promoting and active aging through technological innovation within a context of social inclusion of the elderly [6]–[8].

Despite the development and emerging interest of this type of laboratory, there is still considerable lack of knowledge about its conceptualization and its implementation presents great heterogeneity. That is why, the objective of this work is to know the state of the art around Living Labs, focusing on Seniors Living Labs.

For this purpose, a Systematic Literature Review study is presented with the intention of answering the following research questions: a) types of studies that are carried out around the Living Lab, b) what are the objectives and purposes of the Living Lab analyzed, c) what is its geographical context, d) type of users it addresses and e) what are the characteristics shared by the different Living Labs analyzed in the selected literature.

2 METHODOLOGY

This research is based on the Systematic Literature Review (SLR) methodology, is also based on the study and analysis of publications and primary research and with the aim of responding to a series of questions of interest.

The objective of the SLR presented is to know the state of the art about on studies carried out around Living labs, specifically those aimed at the elderly group (Seniors Living Labs). To achieve this objective, the following research questions were posed:

- What kind of studies are developed in the research carried out on Living Labs?
- What are the objectives and purposes of these studies?
- In what geographical context are analyzed Living Labs developed?
- What type of users are targeted by the Living Labs analyzed?
- What are the main overlapping characteristics of these research and innovation environments presented in the studies?

The selection criteria for the refinement of the sample are summarized in those presented in Table 1. With respect to literature search strategies, This research was limited to databases that present a greater scientific impact in the area of social sciences: Web Of Science (WOS) and Scopus [9], [10]. The following algorithms were also established to search for information: "living AND lab AND technolog*", "living AND lab AND gerontechnolog*", "living AND lab AND senior*", "living AND lab AND elder*", "living AND lab AND age*", "living AND lab AND old* AND adult", "living AND lab AND old* AND people", "senior* AND lab", "senior* AND lab AND age*". Estos algoritmos se limitaron al título del recurso aplicando el filtro correspondiente.

Table 1. Selection and exclusion criteria

Inclusion criteria	Exclusion criteria
1. Full text availability	1. Availability only of the abstract
2. Publications open and available for consultation	2. Restricted access to the resource
3. Publication time period: last 10 years (2010-2020)	3. Publication time period: literature published outside the established range
4. Language: Spanish and/or English	4. Language: other than Spanish and/or English
5. Studies sample: older people	5. Study simple: nonparticipation of older people
6. Literature review or meta-analysis paper	6. Duplicated documents

Note: this criterion was not applied in those articles in which a literature review or meta-analysis was carried out
Source. Author's own creation

A two-phase process was carried out for the final selection of the articles. The first one consisted of applying inclusion and exclusion established criteria. The second one, was based on the exploratory reading assessing the relevance of the content presented in the different articles
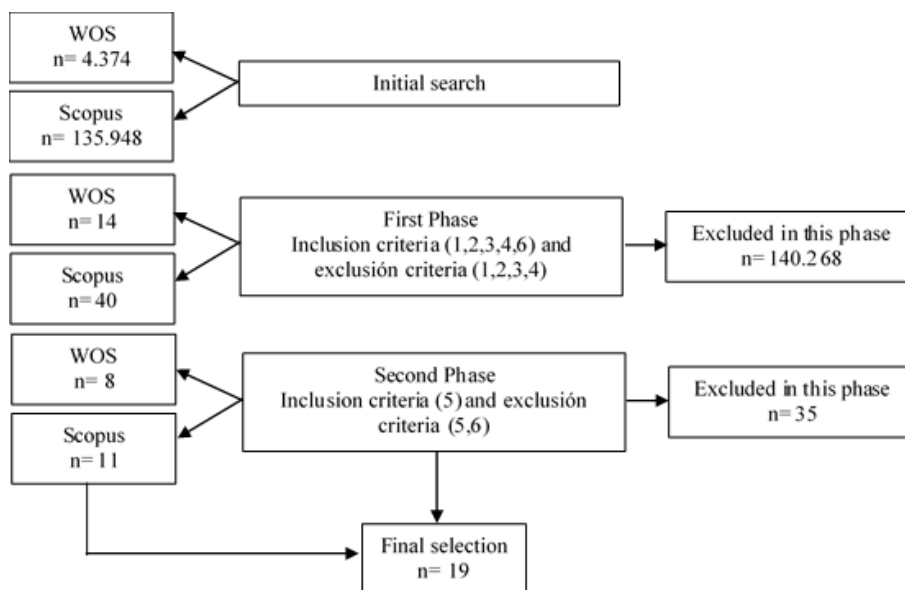
Figure 1. Literature selection process

Finally, regarding the analysis and extraction of the information, an in-depth reading of the articles already selected was carried out.

3   RESULTS

The results obtained after the analysis of the selected literature in which different studies and research on the Living Labs are presented can be seen in Table 2 in summary form.

Table 2. Presentation of the results

Author/s (publication year)	Type of study conducted	Living Lab context	Living Lab users
Alaoui y Lewkowicz [11]	Mixed (questionnaires and interviews)	Europe (France)	Elderly
Angelini et al. [5]	Qualitative (literature review)	Europe (Different countries)	Elderly and environment
Blain et al. [12]	Qualitative (experience description	Europe (France)	Elderly
Callari et al. [13]	Qualitative (semi-structured interviews	Europe (United Kingdom)	Elderly
Callari et al. [14]	Qualitative (semi-structured interviews)	Europe (United Kingdom)	Elderly
Calyam et al. [15]	Qualitative (experience description)	United States	Elderly
Kang et al. [16]	Qualitative (experience description	Asia (Taiwan)	Elderly
Konstantinidis et al. [17]	Mixed (resource evaluation and interviews)	Greece	Elderly
Marone et al. [18]	Qualitative (semi-structured interview and case study)	Europe (Italy)	Elderly
Noublanche et al. [19]	Qualitative (description of an experience)	Europe (France)	Elderly
Noublanche et al. [20]	Qualitative (description of an experience)	Europe (France)	Elderly
Riva-Mossman et al. [8]	Qualitative (description of an experience)	Europe (Switzerland)	Elderly
Rumeau et al. [21]	Cualitativo (entrevistas y grupos focales)	Europe (France)	Elderly
Van Den Kieboom et al. [22]	Cualitativo (entrevistas y grupos focales)	Europe (Netherlands)	Elderly

Vaziri et al. [23]	Mixed (questionnaires and interviews	Europe (Germany and Spain) and Australia (Sydney)	Elderly
Verbeek et al. [24]	Qualitative (description of an experience)	Europe (Netherlands)	Elderly and environment
Verloo et al. [25]	Qualitative (literature review)	Europe (Switzerland)	Elderly
Wu et al. [26]	Mixed (standardized questionnaires and semi-structured interviews)	Europe (France)	Elderly
Zerwas y Von Kortzfleish [27]	Qualitative (literature review)	Europe (Different countries)	Elderly

Source. Author's own creation

Regarding the geographical context in which the Living Labs ecosystems are developed, it can be observed that most of the research is carried out in the European area. Likewise, based on the data previously presented, it can be said that, in most of these investigations, a qualitative research was carried out. The 15 qualitative studies reflect the presentation and description of the experiences of Seniors Living Labs, 5 of these studies present the evaluation instruments used in the development of these environments, 7 are limited to the presentation and description of experiences of Seniors Living Labs and 3 are based on literature reviews.

In regard to mixed research, in the Senior Living Labs analyzed, standardized questionnaires were carried out for the assessment of the technological resources used and/or designed by users in those environments. These questionnaires aimed to assess aspects such as: acceptance and usability technology level, ease and performance of resources and technological tools.

Regarding the objectives developed, after the analysis of the nineteen selected studies, different objectives were identified in the development of the Living Labs, this heterogeneity can be observed in Table 3.

Table 3. Objectives of the analyzed research

Author/s (publication year)	Objectives
Alaoui y Lewkowicz [11]	To introduce the data collected in the development of the Living Lab called FoSIBLE. The objective of this project is to promote social interactions to increase the well-being and self-esteem of older people through the use, from their homes, of communication and exchange tools through television
Angelini et al. [5]	To introduce the transdisciplinary methodologies needed to design a Living Lab for the elderly and discuss the role of technologies in the co-creation of products through the participation of the elderly. An analysis of 28 European Living Labs Seniors registered in the ENoLL was carried out
Blain et al. [12]	To introduce the Living Lab called Falls-MACVIA-LR. The goal of this is to prevent falls of older people
Callari et al. [13]	The objective of this research is to explore the needs, expectances and motivations that older people have with regard to participating in research developed in a Living Lab environment. The study was conducted under the Data Drive Research and Innovation (DDRI) Programme of the University of Coventry
Callari et al. [14]	(I) To understand the experiences of all stakeholders involved in the participation of the Living Lab linked to Data Drive Research and Innovation (DDRI), as well as the ethical issues related to such participation. (II) To propose an ethical framework to guide the development and communication of future Living Lab projects
Calyam et al. [15]	To introduce the design of a system called ElderCare-as-a-SmartService (ECaaS) designed to continuously assess the health of older people, focusing on physical training and physiotherapy aspects remotely
Kang et al. [16]	To introduce the experience carried out in the Living Lab of Suan-Lien, established by the Center of Innovation and Synergy for Intelligent Home and Living Technology (INSIGHT) of the University of Taiwan
Konstantinidis et al. [17]	To show the evolution of the exergaming platform called webFitForAll (wFFA). This platform is intended for the exercise of the elderly and the maintenance and advancement of their healthy physical condition and well-being

Marone et al. [18]	(I) To identify the needs of the elderly in order to maintain their participation in a Living Lab for the design of technologies for neurorehabilitation. (II) To create a means to share methods of planning specific activities in order to respond to the emerging needs presented by this collective, thus collaborating in the production of technological innovation for health
Noublanche et al. [19]	To present the Living Lab called Angers Living Lab in Gériatrie Hospitalière (ALLEGRO). The objectives of this Living Lab are to improve the living environment of the elderly and to compensate for the loss of independence
Noublanche et al. [20]	To present the Living Lab called Angers Living Lab in Gériatrie Hospitalière (ALLEGRO). The objectives of this Living Lab are to improve the living environment of the elderly and to compensate for the loss of independence
Riva-Mossman et al. [8]	To analyze the development of an interdisciplinary and interprofessional research project in the configuration of a Senior Living Lab for the care of the elderly and the promotion of active aging, with the participation of different faculties of the University of Arts and Applied Sciences of Western Switzerland
Rumeau et al. [21]	To describe the experience of a Senior Living Lab held in France. The objective of the Living Lab was to identify technological tools and services that could improve the housing residents service in rural context, thus optimizing the daily activities of the elderly
Van Den Kieboom et al. [22]	(I) To explore in a longitudinal way the changing needs of people with dementia and their informal caregivers. (II) To develop and evaluate co-created innovations in real life situations. The study is developed in the Innovate Dementia 2.0 Living Lab (Netherlands)
Vaziri et al. [23]	To analyze the co-creation process of an exercise called iStoppFalls aimed at preventing falls in the elderly
Verbeek et al. [24]	To analyze the Living Lab in Ageing and Long-Term Care founded in the Netherlands in 1998. The objective of this analysis is to describe the objective of this innovation environment and explain the key mechanisms in the collaborative work between different groups
Verloo et al. [25]	To conduct a bibliographic review to contextualize and know the state of the art of the Senior Living Labs intended for older people who have problems related to dementia
Wu et al. [26]	To evaluate and observe the acceptance of robots by older people that allow them to maintain an independent lifestyle and improve their well-being. This evaluation was conducted at the LUSAGE Gerontechnology Living Lab (France)
Zerwas y Von Kortzfleish [27]	To provide a conceptual framework for analyzing and discussing the potential of Living Labs in overcoming the problems related to the use of technologies by the elderly

Source. Author's own creation

In regard to the characteristics, the analysis of the selected articles has allowed to identify and extract a series of common characteristics of these Living Labs.

These characteristics are specified in the fact that Living Labs are configured as real open innovation environments aimed at the construction and exchange of knowledge, as well as the co-creation of products and design of services in a collaborative way [8], [14], [16], [18], [25], [26].

Among these characteristics, it is important to highlight the importance of interaction between the different actors involved in these environments, as well as the relevance in the establishment of networks of collaboration between users, researchers, producers, among others [5], [8], [13], [14], [16]–[18], [24], [26].

The involvement of all these agents, together with the information they provided, will guarantee to improve the benefits in functionality, in the ease of use and suitability of the products and services towards the end-users, in these cases, the elderly and even their families, improving their quality of life [5], [16], [18], [26].

Finally, these studies mention the relevance in the acceptance and adoption of technologies by end-users, ensuring their adaptation to the needs, interests and capacities of the elderly [5], [11], [16], [18], [26].

A reference to the usefulness of technologies in the health and care fields (telemedicine and tele-assistance) is also made, as well as to products related to home automation [5], [8], [12], [13], [15], [18]–[20], [23], [24].

4 CONCLUSIONS

In conclusion, from the nineteen analyzed papers, we can stablish a brief profile of the current Living Labs.

- On the one hand, the majority of these ecosystems are located in Europe. This result supports previous studies, such as those carried out by McPhee et al. [28], or Hossain et al [29], which conclude in this same direction.

- Second, these Living Lab do not respond to the same model, but they show a great heterogeneity in their objectives and approaches Burbridge [30] and Hossain et al. [29].

- Nonetheless, we can find some coincidences in terms of the basic characteristics on which its design is based, in the sense that they focus mainly on projects related to the co-creation and evaluation of products and services aimed at health care in specific diseases, home automation and/or aimed at the development of autonomy in the elderly.

- According to what Veeckman et al. [31] called The Living Lab Triangle, it can be observed three pillars on which the design of all Living Lab must be based: basic components of the Living Lab environment, basic components of the Living Lab approach and result of innovation. This feature is consistent with the characteristics reflected in other research on these living environments of innovation [1], [2], [21], [25], [29], [31]–[33]

Finally, it is necessary to highlight new lines of research in order to know better the designs and implementation of the Living Labs and Seniors Labs, and how this type of environment helps to improve the inclusion and active participation of certain social and age groups.

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