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Systematic mapping of the literature: social innovation laboratories for the collaborative construction of knowledge from the perspective of open innovation

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ABSTRACT

The objective of this work is to determine the state of the art of social innovation laboratories for the collaborative construction of knowledge from the perspective of open innovation. It employs the methodology of the systematic mapping of the literature using the Science Direct, Springer Open and Google Scholar academic databases. The most significant findings include a tendency for social innovation laboratories using different technologies to socialize knowledge and the use of collaboration tools for the collaborative construction of knowledge. It has been found that the creation of citizen networks (open social networks, researcher networks or contributor networks) and interdisciplinary work groups is common. Experts in laboratories suggest participating in listening mode since they take into account the experience of those affected and non-experts. Therefore, social innovation labs are spaces that are open to proposals for designing a work plan involving a range of actors to prototype a proposal from the perspective of open innovation.

Categories and Subject Descriptors

K.3 Computers and education.
K.3.0 General.
K.3.1 Computer Uses in Education.
- Collaborative learning

General Terms

Educational environments, non-formal education, knowledge construction processes, collaborative work in virtual environments.

Keywords

Collaborative knowledge construction, social innovation laboratories, open innovation.

1. INTRODUCTION

This study examines three variables: social innovation laboratories, collaborative knowledge construction and open innovation. These variables have a close relationship since the laboratories are an emerging scenario where it is carried out the construction of knowledge from an interdisciplinary and collaborative work, with an approach of open innovation that allows the integration of different agencies and actors of the society to consolidate communities of practice in classroom environments and in mid by ICT.

For that reason, at present, educational environments are changing and increasingly used by various scenarios within and outside of the school. The dynamics of the new educational practices are carried out in formal and informal environments, which are enriched with the work of groups with people from different disciplines and that through constant interaction, work together to benefit from the results of such work as inputs to the society.

This article makes a journey by the results of the studies that have analyzed these variables from different perspectives. An overall finding is that the activities of the social innovation laboratories focus, use and rely on the user where there is a trend toward the models of open innovation. It was also found that in the present countries of Europe, North America and Latin America, already are integrated into the movement of open innovation and have created agencies that give value and accreditation to the laboratories that are incorporated and associated with the activities to be carried out locally, nationally and internationally, one of them is the European Network of Living Labs (ENoLL). Another aspect that you can recover from the findings is the motivation of the people who are concerned for the common good and the quality of life and for that reason have sought alternatives of attention to the challenges of society with groups of partners who conduct learning activities, training, research and the dissemination of information that is obtained with the experience.

Each context and its members enrich the new processes of construction of knowledge by means of collaborative work regulated by the participants with the guide of the teachers, tutors or mentors using the approach of the open innovation. At the end of the document, answers are given to questions that guide the mapping exercise of the literature, finding that they are diverse communities of practice, which does not focus on a single topic or scientific discipline, that its main mission is to meet the demands of society and benefit from the common science and the experience of those who participate in the emerging organizations: social innovation laboratories. In short, it is a document that provides information to the theme of the collaborative construction of knowledge with the approach of the open innovation that are carried out in the social innovation laboratories, but it is an approach to the state of the art that broadens the vision of the ecosystems of the common property and opens gap to continue studying the topic from different perspectives, with the aim of creating models for the assessment of the prototypes to determine its efficient and relevant application in the contexts citizens.

2. RESEARCH METHOD

Previous works

The systematic mapping of the literature in relation to citizen laboratories for the collaborative construction of knowledge from the perspective of open innovation, is a new technique. The reported studies that address the issue of citizen laboratories, document the experiences and share them on social networks and on their websites.

This research uses the mapping methodology since it is a way of concentrating relevant information on a particular topic and that reports the scope of investigations by classifying knowledge and the factors involved. This integration of the information is a valuable contribution to the topic to be investigated and also for finding gaps or spaces in the knowledge that not have been studied.

In the 18th Workshop for Researchers in Computer Science in Argentina, held in April 2016, a proposal to create a line of research on living labs as open innovation ecosystems from the perspective of co-creation innovation. One of the objectives mentioned is to build state of the art concerning the subject matter, [57, 18 and 66]. A review was made of the history of living labs, explaining that the concept was developed at the end of the 1990s at MIT as a user-centric research methodology.

In 2006, the European Network of Living Labs (ENoLL) was created as a platform that aims to seek new open innovation models. This has led to the creation of laboratories in United States and Europe that seek the formation of interdisciplinary groups driven by research centers, universities or the Government to respond to the challenges of society [65 and 20], and citizen laboratories are created that have been called synonymous to living labs, but the former with an urban focus, and the latter focused on the ICT sector [57 and 50].

In Latin American countries, the promotion of citizen laboratories by companies, the Government and universities not has been the same as mentioned in the paragraph above. Their creation and promotion have been through non-governmental organizations, groups of activists or the same organized citizens [26]. The main focus of the laboratories in Latin America concentrates on responding to the needs and/or local and social problems from the perspective of those affected [60 and 41].

In the field of them TIC, users have offered feedback for the improvement of services, products, objects and artifacts. On its part, [25] a compilation was made of articles that speak of the different motivations of people as users that are integrated in open innovation and that manage to form part of the collaborative construction of knowledge [22 and 5]. Although the participation of users is part of non-formal education, the authors recover their role as an important part of the co-creation of knowledge.

So far, the literature review has not found evidence empirical of a systematic review or of mapping that contributes to e knowledge information about the state of the art of citizen laboratories as scenarios for the collaborative construction of knowledge from the perspective of open innovation.

Method

A systematic mapping of the literature is a method with scientific value to evaluate or interpret the information posted in relation to a topic and that is guided by means of a research question and its variables (concepts or constructs). The arguments that underlie this mapping are: summarize the form of treating a topic and find its benefits or limitations, determine the knowledge gaps to present a position about a new research undertaking and its methodology [35, 1 and 23].

In order to carry out the method of systematic mapping of the literature, it is important to complete the main steps which consist of: defining the research question, searching for the relevant literature, selecting relevant studies, classifying items as determined by the researcher and extracting the data to categorize them, analysing and presenting the results as part of the conclusions [14, 11 and 9].

Having the result of a wide range of research projects and tests carried out and related to a topic, allows the researcher to provide findings or general conclusions that facilitate the detection of the characteristics of a phenomenon and its contributions or the needs for intervention [42 and 67]. The author [37] asserts that there is possibility that investigations take a bias towards the presentation of the positive and not the negative; therefore, the researcher must have the ability to detect the true effects of this type of work [46].

Mapping has some drawbacks, in particular: the researcher spends too much time on reviewing the works that are in the databases and, also, might not be aware of more effective strategies for finding the information [61]. In addition, it is not easy to standardize the keywords found in documents and difficulties arise in the use of synonyms related to the concepts of the research question [51]. On the other hand, some databases lack an advanced search option, so filtering information is not agile [13 and 43]. These authors also suggest that establishing a series of strategies that clearly define the process to perform mapping systematically in order to achieve a solid, clear and well directed work [7 and 54].

When a systematic mapping of the literature is conducted, the documents found are divided into two: primary and secondary. Secondary documents are all the results of the search and the primary ones are those selected to be documented and to substantiate the most significant findings, conclusions and methods of the subject in question [52 and 34]. It is important to note that knowledge gaps are obtained largely through the in-depth analysis of the recommendations for future research [10 and 48].

Research questions

The main objective of this article is to determine the state of the art of social innovation laboratories for the collaborative construction of knowledge from the perspective of open innovation. It seeks to answer the following questions:

The main question is: What are the most common results of research related to social innovation laboratories in the process of the collaborative construction of knowledge from open innovation?

The specific questions are:

1. What are the concepts related to social innovation labs?
2. How does the collaborative construction of knowledge takes place?
3. What processes are involved in open innovation?

3. INCLUSION CRITERIA FOR THE LITERATURE SEARCH

This systematic mapping of the literature was conducted in June 2016, analyzing three databases: Science Direct, Springer Open and Google Scholar. The first two have been chosen for their availability in the ITESM digital library and the third because it is a search engine that allows you to retrieve open-access articles. The following keywords and some similar concepts were used (Table 1).

Table 1.
Research constructs and keywords

Laboratorios de innovación social	Construcción colaborativa del conocimiento	Innovación abierta
Innovation Labs	Collaborative Knowledge Building	Open Innovation
Social Labs ó Laboratorios sociales	Construcción de conocimiento compartido	
Social Innovation	Construction of	

Labs	Shared Knowledge	
Laboratorios de innovación		
Laboratorios ciudadanos ó citizen labs		

Note: Authors' own (The constructs are in Spanish and English, which is how the search was performed.)

The concepts were determined from a preliminary review of the literature that is related with the main variables of the study. Each variable is defined later on and justification is given for why such conceptualization is used.

The criteria used to carry to out a first filter were: include research articles published in databases and that contain refereed and indexed, open-access articles that were published between 2006 and the 2016, and with key words present in the title, the summary and/or the keywords of the chosen article, and the research is has been conducted in educational scenarios or with a focus on educational research.

4. VARIABLE CODING

The three constructs that will be analyzed in this research are: Social Innovation Laboratories (SIL); Collaborative Construction of Knowledge (CCK); Open Innovation (OI).

The databases used are: Science Direct (hereinafter ScD), Springer Open (hereinafter SpO) and Google Scholar (in Spanish Google Académico: GooA).

Characteristics of the databases

Science Direct is a database that offers more than 30 thousand resources, including popular science articles and books. Such resources have been reviewed from the ITESM Library since, as a Research Professor, the author of the article has unrestricted access to them. This site makes it possible to conduct an advanced search to view articles published in open-access journals, and specify the timeframe, key words in abstracts, titles. This text only mentions the filters used in this mapping.

Springer Open possesses open-access publications. It was also accessed from the ITESM Library account. The official website mentions that it covers more than 160 journals in all areas of science. Its search engine is very simple, i.e., there is no advanced search, but users can request a filter for the keywords that appear only in the title of the article.

The last database used for mapping the literature was Google Academic, where academic articles that are the product of scientific research can be found. This site also has an advanced search option to specify the keywords that you want to find in the body or the title of the article, as well as the dates of publication of the required work.

All three databases offer open access digital resources and have articles in Spanish and English. With the help of Boolean operators, the searches are specified according to the needs of the researcher.

5. ANALYSIS PROCEDURE

The document analysis was performed according to the content analysis methodology:

Stage 1: Review of previous work.

Stage 2: Design of the research question.

Stage 3: Choice of databases as sources of information.

Stage 4: Definition of the key words that may be related to the constructs of the research.

Stage 5: Reading the articles: overview, methodology, results.

Stage 6: Selection according to the context, factors and results.

Stage 7: Concentration on a Word table with categories.

Stage 8: Definition of each of the constructs.

Stage 9: Response to specific questions.

Stage 10: Answer to the research question as part of the conclusions of the study.

6. RESULTS: ANALYSIS OF THE CHARACTERISTICS OF THE PRIMARY STUDIES

On conducting the search in the three aforementioned databases, a total of 548 documents was found, from which a first choice was made and 311 were left, because articles addressing the topics of enterprises, industries or markets that are not related to educational research were excluded. Afterwards, the articles found in the three databases were compared and the articles repeated in the different searches were eliminated, thus obtaining 263, in which we mainly analyzed: the overview, the introduction, methodology and instruments, context, results and conclusions.

Classification of articles

The articles from the final selection were divided by constructs; Table 2 presents the totals obtained.

Table 2.

Total articles obtained by each database

Database/ Constructs	ScD	SpO	GooA	Total

The literature mapping found that social innovation laboratories make it possible to open a space to tentative and the experimental matters. Each lab calls for diverse projects that address the problems or challenges of a specific society or context. The platforms or spaces in which the work is carried out facilitate collaboration between participants and inspire and respond to the possibilities of ICT as a means to socialize, build and develop teaching and learning processes that include and require different knowledge [28].

The laboratories highlight the fact that error is part of the learning process, since it is the means to achieve the production, exchange and dissemination of information, now with the support of both digital and print media. After teamwork, collective voluntary associations that can be consolidated as citizen community networks commonly emerge [4]. It is also possible to build learning communities where exchange and discussion are inputs for laboratories to develop products that are prototypes. These can be an object, an action, a service, an institution, networking, etc. [40]. The idea that the product is a prototype, opens up the possibility of other people participating in the modification of the same, reflecting on changes and providing new solutions to the challenges of the context.

Alternatives to teaching and learning environments use the common laboratory methodological strategies, but a social innovation lab experiments with responding to the local and social problems of a context through networking. The most common model is through the development of participation and discussion workshops, taking into account the point of view of the communities [19].

For the work of the laboratory to be determined as an educational action, it should be noted that they use prior disciplinary knowledge to solve a problem. In this sense, school and society are linked, so it can be said that citizen laboratories are an extension of the services of the university, the school or the institution that is involved with the affected parties for resolving the challenges they face [29].

The trend of laboratories is strongly aligned with the users' needs. For this reason, the work should be observed from an open perspective, related to collaboration spaces and the diversity of disciplines that allow greater coverage of social problems. This is why laboratories currently achieve a greater coverage than a research and development institution, since members of the schools have a greater emphasis on a single specialty [24].

In the citizen laboratory, networking allows responses that are rich in application diversity, in less time. The dynamic organization capacity permits collaborative work [58]. However, despite finding advantages, there might be communication difficulties if the participants do not have a language common, since in a laboratory interdisciplinary work is the norm, combining experiences and competences.

Laboratories are learning communities that achieve their prototypes through the various communities formed within society. One can say that laboratories are a network of construction, exchange and dissemination of knowledge through synergies for coexistence and interaction between different actors [56]. That innovation is considered the social dimension of the laboratory, and here is where we can speak mainly of two moments: 1) Organization of demand that includes assessment, design and projects; (2) Organization of the offering where the application, the intervention, its implementation, its evaluation and the reorganization of the prototype are executed [6].

Laboratories have been called a virtual entity to access knowledge, where the use of ICT to communicate and create common spaces for information consultation [16] are a constant for the interaction of the participants as innovation strategies in educational processes. Such scenarios, also called urban, are put into practice to facilitate testing products and services on a platform in the real world.

One of the main objectives main of laboratories is to find challenges, needs and demands of those less favored in order to promote the effective performance of the population. These interaction spaces manage to educate responsible, socially committed citizens to develop intellectual skills and human, spiritual and relational abilities [30] that impact decision making in a particular context and the aim is to give you priority to addressing the demands of that context. In laboratories, mainly in Spain, everyday activities that have managed to modify public policies have been documented.

It has been highlighted that laboratories are made up of several actors and create solid, coherent and dynamic environments that exploit individualities. Experiments do not end, but are prototyped and modified throughout their existence: they evolve. Their design is participatory through open innovation in real contexts. They use as tools interdisciplinary activities from the experience of the participants as processes of change and response to the problems of the context [12].

2. How is the collaborative construction of knowledge implemented?

The collaborative construction of knowledge is implemented in scenarios where participants manage to appropriate and accept innovation. Being able to modify the traditional forms of teaching and the learning is also important, taking into consideration that they will have to be adapted to the needs of the context [55]. Here the student becomes the means by which knowledge will be built, i.e. processes are no longer focused on the student, but have surpassed borders since learning that involves the community is being sought.

The creation of stages as a way of systematizing the CCK process, of has been proposed: involving task design, group organization, task development and self-assessment. Collaboration largely depends on the type of tasks and the forms of interaction between participants. The facilitator plays an important role in collaboration, since he/she designs the environment, creates and monitors the activities, organizes the work and channels individualities to form real collaboration groups [69].

In this environment of the use of ICT and where globalization comes into play, all the members of society should be involved in the construction and dissemination of knowledge. They must be committed to being informed in their context as the objective is a democratic, inclusive society. All the efforts that involve cultural production processes are based on digital media and the use of Internet [21].

In the scenarios referred to in the preceding paragraph, different discursive strategies and forms of the use of language also emerge. When we talk of contextualized learning and real challenges are used, each community has a form of understanding the meanings, as well as its rules of interaction and forms of expressing its knowledge. Authors such as [53] have suggested that communities should use the following phases: share and compare, discover and explore, negotiate meanings, co-construct and use knowledge, as processes that make collaborative knowledge construction visible.

In this process of creating innovative educational spaces a parenthesis must be opened since it has been found that daily practices lead to the fragmentation and division of the work in which nobody collaborates, but only brings together work completed individually. In other cases, information is accumulated without being analysed and discussed by the participants, leaving aside the processes mentioned in previous paragraphs. Finally, authors like [49] point out that in order to implement the collaborative construction of knowledge, there is no need nor is it essential, to have a formal education structure, which allows the input of communities of practice and affected communities, a term used in the field of social innovation labs.

3. Which processes engage in open innovation?

Based on the concept of open innovation that is rooted in business activities linked to areas of research and development, where it is promoted by external actors, the author [15] defines open innovation as a paradigm that assumes that the company can and should use external and internal ideas and processes, which are internal and external to the market, and thereby, companies seek to advance their technology.

In spite of this, the business world endeavors to prevent information leaks, since patents, copyrights, etc. are discussed. Currently, in education, society demands access to knowledge for everyone. For this reason, open innovation seeks the collective understanding of patterns in social systems that generate challenges to solve, design and implement solutions affecting these social systems [2].

The concept of open innovation in education is a process of collaborative and interdisciplinary work that creates alliances-to the inside and to the outside-between different institutions or teachers, in order to share the information that will be used to improve the knowledge production mechanisms. This leads schools to the growth and development of their capacities for serving the student community [36]. Creative ideas and innovative solutions are key factors for the achievement of institutional goals.

A disadvantage found in processes that involve open innovation is that it is considered to be an isolated program without a budget and without the guarantee of continuity and, therefore, it is thought that the results of these innovations cannot be evaluated in the long term. On the other hand, [47] says that open innovation is concerned with contemporary social intervention projects that use ICT and open up collaboration channels between different actors. A common topic to be investigated in these laboratories is the gap between the government's social programs and people's needs.

Another process regarding open innovation is that public and private corporations are linked from the inside out and vice versa. The creation and development of collaboration activities are aspects that consolidate the dynamic of corporations, always leading to horizontal development - according each one's purposes- and obtaining vertical benefits: services, products, activities, etc. are improved. This serves to capitalize on innovations and enhance their competitive advantages in the market, generating equal opportunities and equitable distribution of the resources invested [38].

In this collective process of decision making and of building collaboration ties, a particular strength lies in the interdisciplinary networks that arise through the construction of inter-agency networks that give strength to all those that are incorporated. They include formal and informal activities between emerging institutions or organisms since, along with the government, carry out collaborative work with different groups, to consider being open to society as a whole [31]. This collaborative process is an innovation to respond to a problem that develops interaction among those involved as a form of evolution. Innovation is not the point of arrival, but the means to transform society.

Open innovation can be observed as a competitive advantage that impacts the reduction of I+D costs, allows evolution, dynamism and improves knowledge management by means of the strategic use of organizational capabilities. It is also a mechanism that helps to identify skills, competencies and generate the resources that stimulate them. The authors [8] mention that open innovation is a success factor, i.e., an organizational management factor that is addressed effectively with the purpose of increasing the odds of success to develop better products and services since they match the user's needs.

In that sense, knowledge from outside and inside the institution is used intentionally as a set of advantageous practices. Also, it has been detected that it depends on of the collaboration chains that work from the open innovation approach to attain creation, interpretation, and research. For this reason, [45] claim that the institution or institutions benefit from the new, have business opportunities and can use processes from other institutions that are open to innovation.

9. CONCLUSIONS

The results common to research related to social innovation laboratories in the process of the collaborative construction of knowledge from the perspective of open innovation find that they are active teaching methods that allow the active and experiential participation of the participants. Also, group work spaces are built with the support of a facilitator. The main values that participants require are autonomy, hard work and willingness, which in themselves are the pillars of success in the new societies centered on collaboration and support for the vulnerable [3].

Another common factor found, is that the collaborative knowledge construction process uses a guide-mentor to monitor the teaching process and attention in the learning process, which also happens in social innovation laboratories. In these scenarios, the knowledge construction process should be systematized, even if it takes place in non-formal education situations, since the laboratories are emerging spaces in which non-formal education is combined with formal education processes. In this sense, the authors [68] suggest and claim that the expert's control should be gradual, descending at each moment (day-work day-project) to achieve the development of each novice participant's personal skills to generate open innovation. With this process, non-experts are expected to become experts and motivate other individuals to participate in social, learning, virtual and/or practical communities in a collaborative interaction with debate and reflection to respond to social challenges social in an innovative way.

Moreover, collaborative knowledge construction processes seek to involve all citizens (in some cases, the affected community or the student community, depending on the context) to carry out not only the building, but also the dissemination of knowledge for the benefit of those communities. For their part, [17] found that the integration of communities to work in groups is a feature in the current dynamics of collaboration for educational purposes or for purposes of social response to companies looking for ways to carry out teaching-learning processes, which is where the prospect of open innovation and social innovation laboratories emerge as an alternative response.

The previous paragraph emphasises the dissemination of knowledge, while the mapping of the literature revealed that discursive strategies are carried out using: the creation of texts, review and the co-creation of writings to be socialized in open spaces for knowledge production and dissemination. In that sense, all the tasks of the laboratories are supported by means of a synergistic interaction so that preparation is collective and that all the participants' voices are captured in the end product [32]. Therefore, it can be specified that laboratories use asynchronous or synchronous collaborative writing tools as a means to build knowledge through the integration of the information to which it has access or the information retrieved from the experience in the co-creation of a response to a problem social driven by open, collaborative innovation.

It has been found that in social innovation laboratories, perceived as spaces in which teaching processes are conducted, the facilitators (mentors, collaborators, experts) need the content to be contextualized and the participants to achieve participation and build significant knowledge. This model is in the process of collaborative knowledge construction, since all the participants have contact with real-life situations where they apply the knowledge that they have acquired throughout their life. Therefore, it is worth analyzing the interventions of the facilitator or mentor as actions that promote the collaborative construction of knowledge [62].

The participation of the people in learning communities through social innovation laboratories, comprises specific tasks that take into account prior knowledge and, with the help of mentors, attain the implementation and creation of new knowledge. The practical activities for the collaborative construction of knowledge are performed in groups integrated by different disciplines that meet for what [63] have called the customization of the learning content by participating in real challenges.

In the documents reviewed, a tendency can be observed for social innovation laboratories related to the use of ICT and the Internet to socialize knowledge and of collaboration tools for the collaborative construction of knowledge [27]. It has also been found that the creation of social networks (researcher networks or contributor networks) and interdisciplinary work groups create listening spaces where the experts take into account the affected, the non-experts. Therefore, social innovation laboratories are spaces that are open to proposals to design a work plan that involves a series of actors to prototype a proposal from the perspective of open innovation.

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