

# The Living Lab Approach and the Challenges of Urban Mobility within a Moroccan Context: The Mediating Role of Open Innovation

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**Abstract**— Sustainable urban mobility has become a central concern that requires adapting demographic constraints to environmental imperatives and financial realities. In this sense, Morocco has adopted several strategies over the past decade that have not translated into a general improvement in the means, modes and practices of mobility in urban areas. To face these challenges, the Living Lab approach, as an open innovation, seems to be an approach to new perspectives for sustainable urban mobility. Thus, this contribution aims to analyze the link between the Living Lab and urban mobility while identifying the mediating role of open innovation in this relationship. The results reveal the contribution of the LL approach, which is based on user empowerment, openness to stakeholders and co-creation, in the development of sustainable urban mobility. They also demonstrate the incoming open innovation that is based on user integration, membership of networks and collaborative research, which reinforces the contribution of the LL approach to sustainable urban mobility.

**Keywords**— *Living Lab, Co-creation, Open Innovation, Sustainable Urban Mobility.*

## I. INTRODUCTION

Today's globalized world and the many underlying challenges make it imperative to design new and more sustainable approaches to creating, living, moving, collaborating and sharing. The contrast between natural resource scarcity and abundance is gradually losing much of its ability to explain disparities in productivity and growth between countries. Faced with these changes, the need to reinvent and renew academic discourses and actions in the field has become a necessity to face the challenges of the future at the global level. In this sense,

new collective approaches have emerged around the world, emphasizing the need to combine both scientific and experimental knowledge.

In a local dimension, several approaches and actions manifest themselves through several configurations of territorial innovation where knowledge generates new resources by giving rise to creative territories (Glon & Pecqueur, 2016). A first wave of initiatives has contributed to the emergence of governance models seeking to bring together knowledge-generating institutions (laboratories, universities), companies, public bodies and representatives of civil society, with the aim of designing innovative solutions and their valorization at the territorial level (Klein & Pecqueur, 2017). It is in this sense that formulas such as local productive systems (SPL), innovative environments and clusters emerged towards the end of the 20th century, either through public authorities, through local initiatives or via hybrid approaches coupling these two levels (Benko & Lipietz, 2000).

New formulas will make it possible to go further in this rapprochement between innovation and knowledge economy. They build on existing experiences and create new approaches by involving research institutions, public authorities, users and other stakeholders whose function and representation vary from case to case. (Lehmann & al, 2015).

In this contribution, we propose to approach one of these experiences, that of the "Living Lab", an emerging approach to innovation, which is arousing renewed interest. In terms of collective innovations, the Living Lab (LL) concept is a form of open innovation whose scale continues to grow worldwide. This approach is characterized by an early and active involvement of users in the innovation process and by experimentation under realistic conditions.

A LL can thus be defined as a place of open innovation that shapes new forms of collaboration between territorial actors in order to design solutions to problems experienced by citizens (Dubé & al, 2014).

It allows the development of an innovation network focused on a public-private partnership (PPP) and the creation of an ecosystem to reconcile the divergent interests of the different actors of a territory.

Moreover, the LL may not explain a territorial aspect. Indeed, at a time when some refer to formulas where service providers and users collaborate in specific areas, others participate in the improvement of certain tools by mobilizing a community of interest. But many have a clear, even explicit, territorial configuration. In this sense, they refer to practices and modalities related to sustainable territorial development, of which urban mobility is one of the cornerstones.

Ensuring sustainable and intelligent urban mobility, while preserving economic, social and environmental balances, is the complex challenge from which the notion of "sustainable urban mobility" has emerged. The latter presents itself as a mobilizing notion given its ability to address concerns relating to innovation and development, and design alternative solutions to be explored in order to achieve a balance between economic, environmental and social issues, particularly in urban areas. However, the multiplicity of actors, policies and strategies that revolve around sustainable urban mobility action approaches have created difficulties in understanding and appropriating it (Uster & Valcke, 2014).

In this context, the territorial registration of the LL should serve as a reference for the actors of a mobility territory to design innovative solutions by offering places of experimentation to examine, test and validate these solutions. The LL is therefore intended to be a space for experimentation of common projects, for which an approach to evaluate socio-economic, environmental and societal effects will be deployed (Mück & al, 2019).

In Morocco, the LL approach has such significant potential and presents such attractive opportunities that it would be regrettable not to take advantage of it. The country has several advantages to position itself as a major player in this field thanks in particular to a network of associations, a dynamic private sector and a public administration in the process of modernization. In addition, in the current economic, social and technological context, the stakeholders of a territory claim a need for change to which these innovative approaches can be a solution.

It is therefore in this precise context that our research work is inscribed, which aims to characterize the concept of the Living Lab, through its capacity for open innovation, in the Moroccan case by crystallizing reflections on its contribution to the development of sustainable urban mobility.

The literature review carried out in the first part and the lessons learned from our empirical research carried out in the second part of this contribution allowed us to provide some answers in relation to our research object which revolves around the contribution of the Living Lab approach, through its capacity for open innovation in the development of sustainable urban mobility.

Therefore, the principal research questions of the current study are as follows: what about open innovation through the Living Lab approach in Morocco? what are the main challenges of urban mobility in Morocco? And how could the Living Lab approach, through its capacity for open innovation, contribute to the development of sustainable urban mobility in the Moroccan context?

To address these research questions, the present paper is structured into four parts: the first part presents a state of the art of the Living Lab approach in its territorial design. In the second part, the methodological approach followed is described.

Next, the results are reported and discussions are outlined in the third part. In the last part, the main conclusions and the study implications are outlined, as well as some recommendations for further research.

## II. CONCEPTUAL FRAMEWORK AND RESEARCH MODEL

### A. *The Living Lab, a Space for Open Innovation*

Within the scope of "open innovation", we are now witnessing the advent of tools, concepts, approaches and organisational forms that envisage a greater role for users in responding to the multiplicity and complexity of their needs (Genoud & Moeckli, 2010). In this respect, OI spaces are currently enjoying considerable growth worldwide. These are spaces initiated by territorial actors with the aim of co-creating and applying appropriate solutions to the problems of their territories within physical places that fall outside both the public and private spheres. In this contribution, we focus in particular on Living Labs as collaborative design approaches. This phenomenon began in the late 1990s in the United States, at the Massachusetts Institute of Technology (MIT), and spread to Europe with the inauguration of European Network of Living Labs (ENoLL) in 2006, the Living Lab is an approach that offers suggestions, solutions and recommendations from the users themselves. It brings together heterogeneous actors in a hybrid space, bringing research out of the laboratories and giving the public a stake in scientific protocols and innovation processes.

### B. *The Open Innovation Approach: a Solution to the Challenges of Urban Mobility*

Urban mobility is currently undergoing radical change, particularly with the advent of new approaches that are considerably changing the way we operate in urban areas. In recent years, we have seen the emergence of a number of local initiatives which use digital tools and networks of

players to solve local problems, particularly those relating to mobility via new travel practices and new modes of transportation. These initiatives, which are part of the open innovation framework, are helping to meet new regional challenges, particularly in terms of mobility. This movement, of openness and recourse to actors of different categories for the production of services usually supported by the public to enrich the urban experience of displacement, is akin to a "back-officisation" of production of public services that must be compensated for (Denis & Pontille, 2010). By encouraging co-design within a group of people, open innovation is an invitation to rediscover the city and reappropriate the mobility environment.

The open innovation process, through its ability to build networks of local players as part of a public-private-citizen partnership, encourages the emergence of as much knowledge, ideas and solutions as possible to meet the challenges of urban mobility. By making users co-authors of the solutions to their own mobility needs, open innovation broadens "everyday democracy". According to Crozet & Lopez-Ruiz (2011), technical improvements alone are not enough to develop effective mobility policies; the rest must be based on changing people's travel practices. The challenge of changing people's mobility habits now seems to be inextricably linked to a gradual transition to sustainable urban mobility.

The use of open innovation is therefore a means of guiding and modifying certain mobility habits associated in particular with the intensive use of private cars. It is also a way of compensating for the failings of transportation systems by building collective intelligence. In short, urban mobility calls for conceptual structuring and the identification of new areas of questioning which, with open innovation approaches, are opening up for all local actors.

### *C. The Living Lab is at the Service of Urban Mobility*

Addressing the social need to enable mobility and accessibility for all, without disrupting economic and environmental balances, is the complex challenge that urban mobility faces. This challenge prompts the exploration of alternative solutions to strike a balance between economic, environmental, and social concerns. It revolves, among other things, around the development of soft modes of transportation and their coexistence with other modes, as well as the use of shared mobility (car-sharing, carpooling, and self-service vehicles), defined as the "third mode" of transportation. However, the multiplicity of actors, strategies, and initiatives that have emerged around sustainable mobility actions has complicated its clear understanding and adoption (Uster & Valcke, 2014). In this context, Mobility Learning Labs (LLs) emerge as suitable environments for the development of sustainable and intelligent mobility, as their characteristics can foster sustainable mobility practices and the development of intelligent transportation systems.

The LL approach, based, among other things, on actor networks and user communities, implements a mechanism of interpersonal influence that can impact mobility behaviors. This influence encourages the exploration of new practices, modes, and routes. It plays on the symbolic representation of modes of transportation and the legitimacy of their use (Alter, 2002). As a result, the LL approach opens up a multitude of avenues, offering potential solutions to address the current key challenges of mobility policies. These challenges range from transitioning from a solo car-dominant mobility to a multimodal mobility to addressing issues of equality in mobility and access to a territory's resources, to reconciling mobility and urbanity (Louvet, Rocci & Le Bris, 2013). By deeply engaging with communities of practices and interests, the LL approach delivers mobility information and advice that is better suited to influence user behaviors (Rocci, 2008).

The LL approach can, therefore, be considered as a tool for renewing mobility policies as it allows for diversifying sources of knowledge, capable of transcending the traditional boundaries of supply-focused mobility policies, reaching the user more closely, and influencing their practices. Furthermore, open innovation prompts a reevaluation of mobility policies by challenging the scope of public mobility action, its prerogatives, objectives, and areas of concern (Louvet, Rocci & Le Bris, 2013).

Furthermore, the LL approach encourages a shift from an approach to mobility policies for the user to an approach "by" the user. (Lichtenthaler, & Ernst, 2007). To maintain a clear understanding of open innovation mechanisms in society and to be able to influence them, either slowing them down or promoting them, public action must not overlook the need to understand the levels of acceptance and adoption for each new device, the pace of its deployment, the barriers and drivers that affect its integration into practices, and the fine-grained transformation of practices it generates, user by user.

Local authorities, economic actors, associations, and users all acknowledge the need to optimize the current mobility system, which is predominantly dominated by individual cars, albeit with differing perspectives. New forms of mobility are emerging, and they require better coordination, greater interoperability between various modes of transportation, and efficient information systems. Through their planning, implementation, evaluation, and strategic development processes, Mobility Learning Labs (LLs) can be used for the planning of these new forms of urban mobility (Mück, Helf, & Lindenau, 2019). The principle of LLs is to leverage expertise and bring together stakeholders within a territory around shared mobility projects and goals, such as streamlining and organizing daily travel, fostering the development and replication of innovative products and services, and promoting alternative, accessible mobility for all.

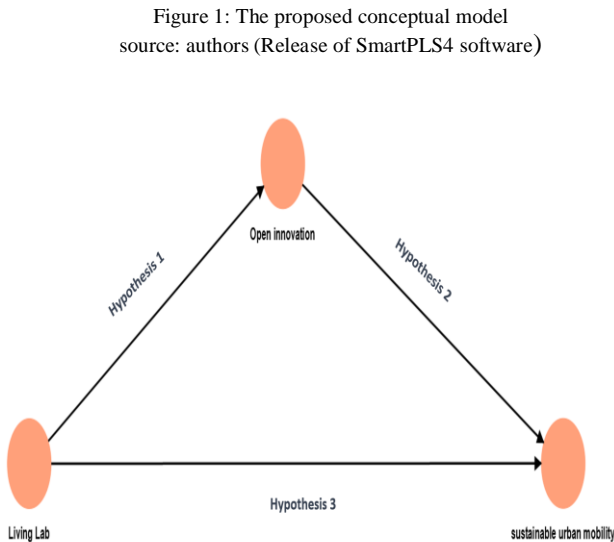
Furthermore, the territorial anchoring of LLs should serve as a point of reference for local mobility actors to incubate innovation projects by providing real-world

testing grounds for these innovations. LLs are intended to be places for experimenting with incubated projects, for which a methodology for evaluating their socioeconomic, environmental, and societal impacts will be applied (Uster & Valcke, 2014).

Living Labs (LLs) also allow for testing measures related to mobility in various contextual situations. They identify the parameters and factors that influence the performance and acceptance of these measures, including density, the availability of transportation options, the sociodemographic composition of a neighborhood, its location within the city, commuter and traffic flows, the pedestrian potential of the area, the quality of public space, and other factors (Mück & al, 2019).

In conclusion, we can ascertain that the LL approach serves as a platform for the development of innovation projects dedicated to sustainable mobility. To achieve this, LL provides a conducive environment, connecting existing stakeholders and mapping out their expertise (industrial, academic, institutional), offering them access to a neutral space for exchange and education. Furthermore, LL positions itself as the creator of an ecosystem to catalyze collective dynamics around intelligent and sustainable mobility, serving as an intermediary for local actors.

Through the examination of existing literature, we constructed the conceptual research framework in the following manner (figure 1):



### III. METHODOLOGY

In the following sections, we present the methodology deployed to operate and measure the latent variables in our research model, as well as the data collection and analysis tools. the explanatory variable in our model 'Living Lab' is measured by three second-order latent variables: empowerment, openness, and co-creation. These three variables will be measured using items on a 5-point Likert scale. The intermediate variable of our open innovation model is measured by three variables: user integration, collaborative research and development, and network

membership. These three variables will be assessed using items on a 5-point Likert scale. The dependent variable in our model sustainable urban mobility will be assessed by five items on a 5-point Likert scale.

The questionnaire of the current study is designed around two sections. The first section serves to gather information regarding the participants' characteristics, whereas the second section included Twenty-six questions (items) measuring the nine latent variables of the developed conceptual model. We developed our questionnaire based on the formulated hypotheses and through the operation capacity of the variables in our conceptual model. To avoid bias, ensure a proper understanding of the questionnaire, and assess the time required for responses, we conducted a pre-test of the questionnaire with ten participants. During this test, respondents were asked to read the introduction and complete the questionnaire.

Furthermore, given the limited target population of our study (we identified a total of 12 Living Labs, with 8 focusing on urban mobility themes), we opted for complete coverage. We conducted our survey by administering a questionnaire encompassing our various constructs to eleven representatives from each Living Lab addressing urban mobility topics, totaling 132 distributed questionnaires. The response rate was approximately 75%, with 99 responses received.

### IV. TESTING HYPOTHESES

Based on the foregoing, we conclude that the conditions of validity and reliability of the research model, that of the variables and their items, and of measurement scales have been met. The measurement scales are reliable and homogeneous, convergent and with discriminant validity. The overall quality of the structural model have also been verified. Therefore, the testing of research hypotheses and the research model can be carried out. In this regard, we evaluated the structural coefficients, "path coefficients," between the latent variables of the model to examine their levels of significance, indicating the nature and strength of their theoretically supposed relationships.

#### **H1: The Living Lab approach promotes the conception of open innovations**

This hypothesis assumes a positive impact exerted by the characteristics of the Living Lab approach (empowerment, openness, and co-creation) on open innovation practices (user integration, collaborative research, and network participation). The correlation between the two variables is positive, equal to ( $\beta = 0.949$ ), exceeding 0.20 and indicating a significant correlation. Additionally, the t-value is 56.186, surpassing 1.96, implying a significant relationship between the two variables. Therefore, our hypothesis is validated.

#### **H2: Open innovation practices promote the emergence of sustainable urban mobility solutions**

This hypothesis assumes a positive impact exerted by open innovation practices (user integration, collaborative research, and network participation) on the establishment of sustainable urban mobility. The correlation between the two variables is positive, equal to ( $\beta = 0.488$ ), exceeding 0.20, indicating a significant correlation. Moreover, the t-value is 5.872, surpassing 1.96, implying a significant relationship between the two variables. Consequently, our hypothesis is validated.

### **H3: The Living Lab approach promotes the conception of sustainable urban mobility solutions**

This hypothesis assumes a positive impact exerted by the characteristics of the Living Lab approach (empowerment, openness, and co-creation) on the establishment of sustainable urban mobility. The correlation between the two variables is positive, equal to ( $\beta = 0.514$ ), exceeding 0.20, indicating a significant correlation. Additionally, the t-value is 6.165, surpassing 1.96, implying a significant relationship between the two variables. Therefore, our hypothesis is validated.

## **V. GENERAL DISCUSSION AND RESEARCH IMPLICATIONS**

The empirical research in this work was conducted using a quantitative method, providing insights into the research question. The results emerging from the analyses overall validate the formulated hypotheses. In this general discussion, we demonstrate that despite its novelty within a Moroccan context, the Living Lab approach maintains a relevant association with sustainable urban mobility.

### **A. The Living Lab Approach within a Moroccan Context: An Emerging Approach**

In Morocco, until now, no enumeration of Living Labs has been conducted or was available. The context thus constitutes one of the main contributions of this work. Therefore, we opted for a mapping approach that involves identifying initiatives explicitly bearing the designation "Living Lab," without seeking to compare practices and discourses. Thus, on a "declarative" basis, an initial mapping was developed by identifying initiatives that display, draw inspiration from, or claim the Living Lab definition. As we conducted our research, we observed that the label "LL" was not frequently used or prominently featured in all cases. Some initiatives do not explicitly carry the "LL" designation without significant differences from other identified LLs. We can hypothesize that the absence of the label may stem from a lack of awareness of the term or a choice not to affiliate or align under this banner. The late emergence of the Living Lab concept in Morocco tends to reinforce the idea that the concept did not make enough sense for all organizations to embrace it. Additionally, we must consider structures that employ LL approaches/methodologies while proclaiming that they are not, such as certain research laboratories or start-ups.

This mapping, even if incomplete, proves to be a necessary foundation for establishing landmarks regarding

the orientations of each structure and developing an initial typology of organizations. This step is typically the conclusion of a study process, but in our case, we opted for the reverse approach: starting with a basic classification of Living Labs based on major themes and institutional anchoring, and then proposing a quantitative step targeting Living Labs of interest in themes related to urban mobility. The initial typology relies on formal and easily collectible elements without having investigated all concrete organizations.

We have thus compiled a directory of Living Labs of interest to urban mobility themes. Furthermore, this exploratory study has allowed us to establish reference points, introduce new areas of inquiry, and measure the gap between the perceived image of Living Labs and their internal activities. This prospecting phase was crucial in choosing the methodology for our confirmatory quantitative study and defining the conditions for analyzing a coherent corpus of Living Labs addressing urban mobility themes: the sample, approach, immersion techniques, data collection processes and tools, etc. The exploratory research also determined which entities were active, as some Living Labs could be classified as "phantom" entities. The challenge was therefore to be able to target "active" organizations that offer minimal activity.

### **B. The Combination of the Living Lab Approach and Open Innovation: a bridge to sustainable urban mobility**

The results of our confirmatory quantitative study support the importance of the convergence between the concepts of Living Lab and open innovation in rethinking mobility practices in urban environments. The positive spiral generated by the association of these concepts considers the subject's aspirations and gives meaning to their actions. This open innovation approach contributes to the establishment of sustainable solutions for urban mobility.

These results attest, first and foremost, to the positive impact of the Living Lab approach on open innovation within a Moroccan context. They reveal the specifics of this relationship through the integration of users into the innovation process at the forefront alongside other stakeholders. The development of co-creation practices in a partnership governance approach also strengthens the relationship between the Living Lab approach and open innovation. It facilitates the flattening of hierarchical obstacles that hinder coordination and consultation between actors in a territory.

The combination of the Living Lab approach and open innovation promotes the development of sustainable urban mobility. The integration of users as key actors and the openness to other stakeholders in the territory establishes a sustainable relationship based on co-creation of solutions that can improve citizens' daily lives. The convergence of these concepts promotes the development of sustainable urban mobility and reveals the essential role of the user in its construction.

### C. The implications of the research

At the conclusion of this work, we affirm that the improvement of mobility practices and behaviors constitutes a major concern of the Living Lab (LL) approach in its territorial conception. Today, we witness a growing number of LLs focusing on themes related to mobility. The results of the quantitative approach have confirmed the positive impact of the Living Lab approach on sustainable urban mobility within a Moroccan context, demonstrated through its capacity for open innovation.

In this context, we identified two orientations within LLs dedicated to urban mobility that were the subject of our investigation. Firstly, those relying on initiatives encouraging soft mobility practices (walking, cycling, public transport...) and minimizing the use of individual cars (carpooling, car-sharing, etc.). Secondly, those leveraging technological innovations promoting intelligent mobility, particularly through the use of digital applications on smartphones. The contribution of the LL approach to improving mobility practices is evident through the encouragement of soft modes of transportation, the promotion of shared mobility platforms, and the use of intelligent transportation systems. By leveraging open innovation practices such as collaborative research and networking, local actors work towards co-creating solutions that facilitate urban mobility practices for citizens.

From a theoretical perspective, this work expands the field of open innovation by adding a territorial dimension. It also enriches the concept of Living Labs by specifying its contribution to the development of sustainable urban mobility.

From a methodological standpoint, this research provides several contributions. The first contribution lies in the choice of a post-positivist position to address our research problem. This positioning involved a research approach that employed two research methods. It's important to note that, in the absence of theoretical works that would have allowed for a more in-depth exploration of the concepts in our model, we opted for a hybrid qualitative and quantitative approach. Throughout our journey, we borrowed from grounded theory the idea that the discovery of theoretical perspectives emerges from reality as situated in the field. The second methodological contribution is related to the use of the Partial Least Squares (PLS) approach. This method has gained prominence in management science research and is a robust technique for testing research models. Furthermore, this research has contributed to the development of new measurement instruments that can be used by researchers and managers in various disciplines. Indeed, we

constructed several measurement scales to address the research problem at hand.

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