

Urban Living Labs as Instruments of Open Innovation: Examples of Sino–European Cooperation

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1. Introduction

This chapter analyses how urban living labs may be used as instruments of open innovation. The analysis is based on on-the-ground experiences with three urban living labs in China in the cities of Wuhan, Tianjin and Jingdezhen, in close interaction between local stakeholders and European and Chinese experts. These experiences were paired with desk research, local stakeholder workshops and Sino–European expert workshops in order to better understand the challenges that were identified in the urban living labs, and to explore pathways towards solving these challenges. Based on these methods, open innovation-based principles are discussed for urban living labs to function as meeting arenas to support communities' diversity, significance and connectedness, where participants can experiment with practical ideas and solutions towards a more cohesive, inclusive and sustainable every-day life.

This chapter builds on experiences from an EU-funded project TRANS-URBAN-EU-CHINA in which urban living labs represent physical locations in selected Chinese cities. TRANS-URBAN researchers involved in the project cooperate with local urban and regional authorities, developers, planners, citizens and other stakeholders. The living labs serve as testing grounds for the development and implementation of research results, created in the project to promote socially integrative cities (TRANS-URBAN-EU-CHINA 2019b).

2. Discussion of the Living Lab Case Studies as Instruments of Open Innovation

2.1. *About Open Innovation and Open Innovation 2.0*

Successful cocreation of knowledge and solutions between the public and private sectors, citizens and academia in living labs has the potential to generate social innovation, in which the stakeholders themselves help (re)shape their environment and trigger change (Moulaert 2013). Researchers can play a vital part as neutral, intermediary actors to curate this process, to activate multiple levels of stakeholders and decision makers into a sturdy long-term cooperation that tolerates political or

other staff shifts. As such, researchers can play “an entrepreneurial role” in urban living labs and society as a whole (Mazzucato 2013, p. 5).

In each of the three urban living labs, an Open Innovation 2.0 framework (Curley and Salmelin 2018) was implemented and adapted to local conditions, to frame the involvement and cocreation of the partners and key stakeholders in different sectors. Open Innovation 2.0 builds on the original open innovation framework as conceived by Chesbrough (2003). Open Innovation 2.0 promotes iterative, nonlinear innovation processes between multiple stakeholders from the public and private sectors, academia and civic society, in new and sometimes blurred roles, compared to the more linear exchange of ideas between individual companies in Chesbrough’s original framework. Ample use of brainstorming, group discussions and other collaboration techniques help the participants to align around a shared goal, despite their different backgrounds, cultures and motivations (Curley and Salmelin 2018).

All workshops were prepared through cooperation between European and Chinese partners with knowledge of the local stakeholders to ensure that the programme structure and content would be understandable and attractive for all participants. During all workshops, Chinese and European facilitators guided the participants in understanding the context of the workshops and challenges to be addressed, to interact and share information in discussions with Chinese and European peers and to interpret the responses that arose during the workshops in various settings.

During the living lab workshops performed in the three cities of this case study, the authors not only participated as knowledge experts and *curators* of the thematic content, but also tested a new role for researchers as *orchestrators* of cooperative innovation processes between the public and private sectors, civic representatives and other types of local stakeholders and international experts, thus setting up a quadruple helix open innovation setting of users, government, enterprises and technology providers (Roman et al. 2020). The role of *orchestrator*, fostering cross-fertilisation among participants, is typically emerging in quadruple helix cooperation (Curley and Salmelin 2018, p. 83) in the public sector, including universities; this type of role is able to be performed in an open, neutral manner (Mazzucato 2013).

2.2. Quadruple Helix Cooperation

A quadruple helix describes the cooperation between the public and private sectors, research and civil society in a knowledge society (Carayannis and Campbell 2009). While the *civil society* helix was originally described as media- and culture-based, with creative industries responsible for informing and engaging the public as passive recipients (Curley and Salmelin 2018), cocreation processes by and with citizens and their representatives are increasing in importance and frequency.

Cocreation is a process of shared value creation by end users and professionals (Prahalad and Ramaswamy 2004). Based on the principles of design thinking (Visser 2006), cocreation is increasingly used in urban transformation processes to promote social inclusion and develop better, more adapted solutions (Çalışkan 2012) that go beyond the scope any one organisation or type of stakeholder could achieve by itself (Curley and Salmelin 2018). A three-folded analytical framework proposed for open innovation in urban planning instructs how to ensure coinnovation in urban planning (Savini et al. 2017).

In the urban living labs, the range of stakeholders involved in the three case studies was broad, including municipal decision makers and administrators, other public institutions, citizens and citizen organisations, companies, and knowledge organisations, all with a stake in the development of the local community (TRANS-URBAN-EU-CHINA 2019b; TRANS-URBAN-EU-CHINA 2020). As organisers of the living labs, the authors clearly explained what the scope of the interaction would be, which roles the stakeholders and experts were expected to play and what kind of added value this could bring to the local area and its residents. With each individual set of local stakeholders and decision makers, an atmosphere of mutual trust and understanding was created prior to engaging them in the participatory activities of the living labs (Steen and van Bueren 2017).

2.3. Cocreated Shared Value

Overall, Arnstein (1969) categorises citizen involvement in three types of outcomes: nonparticipation, tokenism and citizen control. *Nonparticipation* methods typically aim to educate stakeholders or change their behaviours without involving them in the development of solutions or attempting to understand their real needs. *Tokenism* methods typically aim to inform or consult stakeholders unilaterally, with stakeholders having no realistic opportunity to participate in developing the solutions. *Citizen control* methods delegate more ownership to the stakeholders, either using cocreation methods and partnerships, or fully delegating responsibility for developing solutions to them.

In the urban living labs, the local stakeholders were able to obtain direct access to information as well as to contribute to creating evidence-based knowledge. Such efforts of ensuring the public participation on policy making have also been reflected in the reform of national law and regulation which makes sure that public involvement is mandatory (Ravazzi 2016). In this manner, the stakeholders contributed to collective transformation and decision processes that were based on a broad local knowledge and experience base, with solutions better adapted to local needs and priorities (Carstensen and Bason 2012). However, experience from the three case studies showed the challenge of dedicating sufficient time and resources to understanding local needs during the visits of the international experts to the living

labs. Dedicated workshops with local decision makers and stakeholders needed to balance expert-driven presentation of international best practices with data collection for the international cooperation, and, most importantly, with in-depth learning of local priorities.

A suite of analogue and digital methods and tools were created to help the organisers to create easy, understandable and rewarding cocreation formats depending on the type of outcome envisioned. These enabled the stakeholders to gain the confidence to participate in and take creative ownership of cocreation processes, to share their deep insights and experiences about local conditions, to better understand the vision of the other participants, to build key relationships with them and to identify new opportunities for cooperation.

2.4. *Virtual Community Building*

Cocreation processes between the local and international experts and stakeholders in the urban living labs helped identify and aligning interests, merge on-site local knowledge with international best practices and create new learning across geographical and cultural boundaries. In addition, they created valuable results by exposing day-to-day routines that hinder innovation, by contrasting business-as-usual practices of local and international experts and stakeholders.

One of the main challenges was for the European and Chinese experts to not be able to follow each living lab in real time, and hence it was challenging to build solid connections to the local stakeholder ecosystem. In order to remedy this and promote continuous communication, cooperation and learning between stakeholders and experts in between the on-site activities within the geographical location of the urban living lab, a virtual community was created.

A virtual *Community of Communities* platform (TRANS-URBAN-EU-CHINA 2018) was created as a tool for sharing knowledge and experiences among the participants of each urban living lab and across the living labs. The virtual platform reinforced the creation of ecosystems (Pasher et al. 2018) among the participants and promoted bottom-up knowledge shared by connecting different types of stakeholders across living labs, in English and Chinese. Stakeholder knowledge, best practices and lessons learnt were either added by the stakeholders themselves, or by the researchers that, as observers and facilitators of the living lab activities, often extracted different information than the directly engaged stakeholders.

The knowledge gained in the community of communities platform informed the content and format of future knowledge cafés and other living lab activities. To see that their contributions were actively being used engaged stakeholders with an additional incentive to interact and share their experiences.

The importance of a virtual tool such as the *Community of Communities* was confirmed during the COVID-19 pandemic, when all living lab activities acutely

needed to be shifted to virtual interaction, often from home offices. For instance, one of the Urban Living Labs (ULLs) were based in Wuhan, where the COVID-19 outbreak was detected first, and data collection activities planned there in the spring of 2020 had to be postponed and carried out digitally. Virtual communication abruptly became the main form of interaction and the cooperation between local stakeholders and international experts became a useful source of information and learning regarding socially inclusive urban environments between China and Europe.

2.5. Support by Data Science Algorithms

“Environmental quality, the quality of public spaces and the quality of life contribute to the well-being of the population. Strengthening a sense of community and fostering a sense of place as well as preserving cultural heritage shape the city’s in- and outward-bound image” (TRANS-URBAN-EU-CHINA 2019a). Therefore, a collection of data science algorithms were developed in order to determine the correlations of air pollution with transportation, industry and daily activities for all urban living labs. The results of this analysis supported evidence-based governmental decision-making with respect to transportation, industry, and air pollution.)

The results of the big data analytics of the contributing factors were presented with respect to air pollution and transport based on multiple data sources for urban living labs. Various impact factors were taken into account during the analyses: monthly and real-time air quality data and concentrations of gaseous pollutants and fine particles (AQI (Air Quality Index) measured by NO₂, O₃, SO₂, CO, PM_{2.5}, PM₁₀), derived from the platform for AQI Intelligent Management. The monthly air quality data for the urban living labs ranged from December 2013 to April 2020.

The annual transportation data ranging from 2013 to 2019 were collected from the national and local statistical yearbooks. Furthermore, the locations of industrial Points of Interest (PoIs) of construction, machinery and electronics, chemical and metallurgy, mining and factories, as well as shopping areas in the Urban Living Labs, were derived from AMap. Real-time traffic data were obtained from AMap for the same period as the real-time air quality data.

The analysis methods included big data analytics for nonconventional data and were concentrated on:

- visualisation of some data to determine the variations of real-world data over time;
- correlation analysis to determine the interdependencies between data;
- nonparametric tests to determine similarity and class membership of city-specific environmental data.

The use of the nonparametric tests allowed for the analysis of a group of cities with similar characteristics—i.e., with the same distributions of the values of public

transport construction indicators, instead of individual cities. This result led to improved analytical efficiency, as cities can be classified according to the public transport construction indicators, and only a representative of each class needs to be analysed in-depth.

In addition, deep learning neural network technologies were applied in order to develop a Back Propagation Neural Network (BPNN) model for Air Quality Index (AQI) prediction in cities. It delivered satisfactory predictions of the AQI based on a data set of road properties, traffic and weather data.

These data analyses constituted a top-down evidence-based framework for testing, monitoring, benchmarking and assessing impacts of the urban transition in China. This analytic approach was complemented by the online system platform creating a *Community of Communities* where the city residents are planned to contribute bottom-up to planned changes in the cities.

3. Three Chinese Urban Living Labs as Case Studies

In the case studies described and analysed in this chapter, living labs were initiated to enable cooperation between Chinese and European partners of the TRANS-URBAN-EU-CHINA project, as well as local decision makers and stakeholders such as urban authorities, real estate developers, public service providers and citizens. In the living labs, an attempt to cocreate new knowledge was carried out and tested in the local context to improve and mature it before dissemination to a global audience.

3.1. A Literature Study of Urban Living Lab Methodologies in China and Europe

In order to define the scope of the living labs in these case studies, a literature study was performed on Chinese and European living labs, followed by two expert workshops with Chinese and European experts to align expectations and experiences from both geographic areas and cultures.

An urban living lab is a spatial arena, or set of spatial arenas, in which stakeholders from the public and private sectors, research and civil society cooperate to develop, test and validate innovative solutions, processes and services (GUST 2017; Steen and van Bueren 2017). European living labs aiming to promote low carbon and sustainable cities and use a wide variety of targets, methods, actors and partnerships (Molinari 2011; Voytenko et al. 2016).

Urban living labs may include a wide range of topics, including social cohesion and innovation, urban governance, urban and rural renewal, cultural heritage, water management, e-participation, circular economy, mobility management and stakeholder involvement (JPI Urban Europe 2017). The cross-cutting cooperation between different types of stakeholders and sectors, embedded in a real urban environment, enables them to find solutions that are economically viable, scientifically

valid and well-adapted to the priorities and needs of the local stakeholders (Chron er et al. 2019; Voytenko et al. 2016).

The European Network of Living Labs (ENoLL), founded in 2006, features nearly 450 living labs, in which open innovation, cocreation and citizen engagement are key elements. ENoLL defines living labs as “user-centred, open innovation ecosystems based on a systematic user co-creation approach, integrating research and innovation processes in real life communities and settings” (ENoLL 2020). Similarly, the Joint Programming Initiative Urban Europe defines urban living labs as innovation for a “employing working methods to integrate people into the entire development process as users and co-creators to explore, examine, experiment, test and evaluate new ideas, scenarios, processes, systems, concepts and creative solutions in complex and everyday contexts” (JPI Urban Europe 2015). The URB@Exp (Scholl et al. 2017) and SubUrbanLab (2016) projects in Europe summarise success factors for urban living labs, including a transdisciplinary approach, participatory processes from the early phases onwards, a clear distribution of roles and responsibilities, adaptation to local conditions, and explicit mechanisms for learning and knowledge exchange both within and outside of the living lab.

In China, prominent examples include the China Housing Lab (ENoLL 2020), a living lab and dissemination and innovation centre embedded within the China Industry Technology Innovation Strategic Alliance for Housing (CITISAH). The living lab facilitates long-term partnerships between companies, research/design institutes and universities as members, employing a user-centred approach to create innovation for the housing industry. A second example is the Beijing City Lab (Beijing City Lab 2020), a cross-disciplinary research network studying the quality of living environments in Beijing to provide evidence-based decision support. While the Beijing City lab includes many of the characteristics embedded in a European living lab, it does not encompass citizen engagement. A third example is the China Future City Lab (MIT CFC 2020), an urban research and innovation programme hosted by MIT that facilitates and creates start-up teams, comparative studies and test sites for urban innovations and policy experiments.

While urban living labs have been used in the United States and Europe for many years, in China they are a more recent phenomenon. There are also several differences between European and Chinese approaches, with citizen engagement and cocreation for the time being mainly taking place in Europe. However, recent examples of urban living lab-like activities in Wenjiang (POLITO 2019) and Wuhan (UN-Habitat 2018) show that citizen engagement approaches such as community planning and place making are becoming more widespread in Chinese settings as well.

3.2. Sino–European Expert Workshops to Fine-Tune the Urban Living Lab Scope

Based on the initial results of the literature study, the urban living lab as a concept has been tested both in Europe and China. Especially in Europe the research focus and practice on ULLs are active; however, there are some different understandings of the concept and operation mechanisms between China and Europe. As summarised above, two expert workshops were conducted with European and Chinese participants, one in Europe and one in China. During these workshops, a design thinking methodology (Brown 2009) was used to understand the expectations and experiences of the invited experts regarding urban living labs. The participants were asked to discuss best-case and worst-case scenarios of urban living labs in order to develop a common understanding of what would entail an appropriate scope, criteria and framework conditions for the selection and implementation of Chinese urban living labs in cooperation with a European–Chinese expert team.

The following core ingredients were identified for successful urban living labs within the scope of European–Chinese cooperation: prior contacts and cooperation with key local actors, in particular local government; a firm anchored in local context and existing value chains, in particular actors with prior experiences of urban transformation; opportunities to engage local stakeholders and stakeholder ecosystems, facilitate dialogue, build trust and credibility, support mutual understanding, gain public and government support, and secure involvement of local universities or research organisations (TRANS-URBAN-EU-CHINA 2019b). Storytelling was discussed as an essential ingredient for the development of the urban living labs, using narratives to connect with local stakeholders, help them make sense of the context, gain their trust and have them share their experiences (Davidson 2017).

Based on these criteria, potential living labs were identified: Tianjin, Wuhan, Jingdezhen, Xiong’An and Wenjiang. Three of these case studies will be discussed and analysed in this chapter, to showcase the diversity of approaches and learnings available from the cases: Wuhan, Tianjin and Jingdezhen. For a more detailed description of engagement activities within the urban living labs, please refer to TRANS-URBAN-EU-CHINA (2020).

3.3. Case Study 1: Wuhan

The Wuhan urban living lab was created based on the cooperation of four complementary local stakeholder organisations: Wuhan University, the Wuhan Urban Spatial Planning Research Center (WLSP), the UN-Habitat China office and local project developer *Shui on land*. Each of these four organisations had long-standing cooperative agreements with at least one or more of the authors of this chapter; additionally, WLSP and UN-Habitat had prior cooperation (since 2016).

Hence, a basis of trust, cooperation and communication had already been established prior to creating the living lab.

The basis for the cooperation was created during the UN-Habitat placemaking week in December 2018, an international event for experts, students and local stakeholders, with the quality of the local Wuhan urban environment at the core. During meetings, study visits and workshops with the four stakeholder organisations, Chinese and European experts presented the vision and aims of creating socially inclusive cities, and the local stakeholders identified the most urgent local needs. The key priority identified, was to create transformation pathways for a rapidly growing city, both in terms of upgrading urban heritage areas and integration of surrounding rural communities in the expanding urban environment. This priority area included three key elements for more socially integrative urban environments: making the city more attractive for young people, the need to provide quality public spaces in dense urban areas and rising inequality among residents.

These challenges formed the scope of a series of interaction activities with the four core local stakeholders and their cooperation partners. European and Chinese researchers within these topics organised the activities and participated together with local stakeholders to form a bridge between science and practice. The interaction activities included stakeholder workshops, knowledge cafés (Elliott et al. 2005; Pasher and Ronen 2011), the above-mentioned placemaking week (UN-Habitat 2018), summer schools, secondments of Wuhan experts to Europe, study visits, expert interviews, a web workshop on data science and communities and similar activities (TRANS-URBAN-EU-CHINA 2020).

This suite of participatory methods offered the local stakeholders a platform for exchanging ideas with Chinese and international experts, and generated ideas on how to solve particular challenges building on local resources and international best practices.

3.4. Case Study 2: Tianjin

The Tianjin living lab was created using a top-down approach (Leminen 2013), using the local authorities as an entry point. During a series of introductory meetings and site visits between Chinese and European experts with the local decision makers of the Tianjin free trade zone, the latter expressed their intention to upgrade the area to become a mixed-use and more socially inclusive area, a transition to be performed in cooperation with the planning authorities of Tianjin. With the local authorities, the Tianjin free trade zone was selected as a dedicated area for the living lab, and priorities were set for increasing the social inclusiveness of this area. The key challenge to be addressed in the living lab is transforming the area from a pure work environment into a more mixed-use, liveable urban area to create a multifunctional public space (Jacobs [1961] 1993).

Based on this goal, a political decision was made to launch the living lab in a public ceremony during a high-level Sino–European event, and to broadcast to the local media. A dedicated local office space was transformed into living lab offices, called the “EU-China Research and Innovation Laboratory”.

After the launch, a suite of workshops and knowledge cafés were organised in which the local workforce and residents were invited to identify the key challenges in the local area and were presented with international and Chinese best practices. Based on these presentations, concrete opportunities for improving the urban fabric and facilities in the living lab were discussed.

3.5. Case Study 3: Jingdezhen

Similar to the Tianjin living lab, the Jingdezhen living lab was created using a top-down approach in cooperation with local authorities. After a series of introductory meetings, a cooperation agreement was signed in the presence of high-level decision makers, consolidating the intention to cooperate on developing a smart city platform with cultural heritage at the core. A seminar and study visit were organised in which Chinese and European experts presented international best practices for socially inclusive cities. Under the guidance of the local decision makers, the visiting Chinese and European experts visited the heritage sites that define Jingdezhen’s identity (the city is known as the “Porcelain Capital” due to its longstanding tradition of porcelain production), as well as the surrounding areas that will be embedded within the upcoming expansion of the city. Some of the visited heritage areas were the Imperial Kiln Sites and Jingdezhen Ceramic Industry Heritage Museum.

Together with invited decision makers from city and regional authorities, the most promising local challenges were identified and discussed, all contributing to a balance between culture, environment and economy. Similar to Wuhan, the city identified upgrading of its heritage centre and controlled expansion into a rural area as core topics for cooperation. A location for the living lab headquarters was dedicated by the local authorities in the heritage area. A series of cooperation activities were defined, including on-site engagement activities with local stakeholders as well as regular Sino–European events to link local learnings to international practices. A fact-finding mission was planned to be held by European and Chinese experts, combined with field studies by students, in preparation of an international expert event the year after.

Nevertheless, due to a political shift, the living lab activities were no longer prioritised by the local authorities and the cooperation activities were cancelled. Despite its customisation to local needs and priorities, the living lab was not sufficiently anchored across several municipal decision makers and entities, making it vulnerable to political changes. Unfortunately, this left the living lab dormant despite promising ideas and the initial enthusiasm. There are several potential ways

this can be explained. One relates to the typical method of governance at Jingdezhen Municipality, a strict top-down administration system, which directly challenged the open innovation approach taken. Another issue relates to trust and a failure to assess the types of anchorage that project participants had in the municipality. Swift political changes strongly affect decision making in China, and ultimately the ULL project was not deemed interesting or relevant enough to the local government. This implies that the cocreation process initiated with local stakeholders was not robust enough to allow for iterations that would be beneficial to establish a stronger anchorage. As such, this case illuminates the fact that any form of uncertainty, be it political, time-related or resource-related, cannot be controlled and a degree of preparedness is necessary to not be taken by surprise.

4. Conclusions and Recommendations

The experiences from the three urban living labs as presented here, combined with literature studies and Sino–European expert workshops, foreground two particularly central aspects relating to societal transformation. On the one hand, a successful long-term urban living lab needs to include technical, spatial, social, economic, regulatory and other aspects in order to be able to identify and address complex urban challenges. On the other hand, an urban living lab will only be successful if properly embedded in a local innovation ecosystem of professional and citizen stakeholders, to give them the confidence and capacity to reshape their environments, to ensure that their everyday knowledge is used and shared optimally and, in short, to boost capacity for transformation at the local level.

The experiences gathered over a three-year long practice on ULL cases in Chinese cities as described here also reflect some differences between Europe and China in how the ULL concept is perceived. Clearly, the Chinese cases presented here show a larger flexibility to the concept, which implies that more time is needed in order to form a common understanding. This also implies that the initial ULL idea might be adapted as part and parcel of the alignment process. In promoting ULL activities in China, recognition and endowment from the local authority is crucial, and the ULL activities need to align with the policy and urban development strategy. This suggests that identifying the key local ambitions and activities before engaging in ULL initiatives is useful. However, the effectiveness of ULL activities depends on creating a wide, diversified and iterative involvement with local stakeholders, which can boost the open innovation and guide to a pathway of socially inclusive cities. Using a bottom-up approach will engage local stakeholders but might lack political anchoring to produce actual impacts on the local environment. Using a top-down approach, on the other hand, will have political anchoring but will ultimately require intensive cooperation with local stakeholders in order to develop an actionable programme relevant to local realities. Nevertheless, as the case of Jingdezhen showed, top-level

priorities can change quickly, and a top-down approach does not guarantee that ULL activities will be carried out.

As a recommendation for future research, there are several questions relating to the level of flexibility and improvisation in dealing with local ULL efforts in a Chinese context that would be interesting to study closer. Could, for instance, ULLs gain a better understanding of the type of flexible and experimental governance very often witnessed in Chinese policy making? Are there ways of facilitating studies that would lead to both a local benefit and a more systematic way of studying the form of “directed improvisation” identified by Ang (2016)? Answers to such questions would also allow for a more dynamic engagement with the ways in which local policy makers respond to and adapt to urban development issues that ultimately impact open innovation processes in more integrative cities.

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