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Digitally Supported Co-creation within Public Open Space Development Process: Experiences from the C3Places Project and Potential for Future Urban Practice

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ABSTRACT

This research aimed to explore information and communication technologies (ICT) types to support co-creation activities in public open spaces (POS) at different stages of the co-creation process. We conducted state-of-the-art research on the methods, best practices, obstacles and potential of ICT tools and co-creation activities to ease the interaction between stakeholders engaged in the process. Based on those findings, we proposed an ICT tools selection framework. Four living labs were analysed to better understand the practical side of digitally aided co-creation. We conclude by exposing challenges and suggest ways to move forward toward genuinely digitally supported co-creation of the POS.

KEYWORDS

Digital tools; roles of stakeholders; living labs; co-creation; public open space

Introduction

This paper reflects on some of the issues raised within the C3Places project supported by JPI Urban Europe, a project that seeks to use information and communication technologies (ICT) for the co-creation of inclusive public places. It is backgrounded by the contemporary circumstances where the growth of a city increases pressure on open spaces and their immediate surroundings, and where building up the land can have an adverse effect on citizens. This often results in citizens disagreeing with the planning decisions, especially if those were made with no or little involvement from the residents. Conversely, more attention has recently been paid to the development and design of such spaces to improve them according to the needs of modern residents. Involving people in the entire process of spatial development – from spatial and social analysis of the situation to the design, implementation, development and management of POS – is critical for achieving satisfying results. Citizens' input provides experts with the lay knowledge and locally adjusted solutions. Implementing those in the plans lead to the locals being satisfied with the fact that the government understands them, how they are linked to enhanced decision-making (Brown & Chin, 2013; Drzakiewicz *et al.*, 2015).

To facilitate the involvement of citizens in the urban planning process, urban planning researchers have focused on ways to increase interactions between experts and the public in the planning process, as well as to improve the methods and tools for facilitating the process. The latter is aligned with the proliferation of digital technologies, which have the

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potential to completely restructure the procedures, processes and practices of urban planning. The acceptance of such new technologies has especially been employed by large-scale planning projects and opposing initiatives. Researchers still point to the poor attention paid to the current and potential role of such technologies in the design and planning of the urban environment and regard them as a promising but at present not fully analysed approach (Graham & Marvin, 2002; Houghton, 2010; Münster *et al.*, 2017).

Using ICT is especially relevant for public open spaces (POS), which are an important part of urban systems as they allow and support equal human interactions and satisfy the social needs and wellbeing of the residents of the area. POS are therefore an important factor in urban justice, integration and social cohesion. Furthermore, POS have a long tradition of being proving grounds for the changing needs of citizens and their communities.

To illuminate the potential of ICT for urban planning with a special reference to public engagement in the development process of POS, this paper sets a two-fold aim which addresses the *who* and the *how* of the POS development process:

First, in relation to the actors in the urban development process – the *who*, it gives a critical overview of the engagement potential of ICT in the context of cocreating POS. second, it addresses the tools and methods – the *how* – by exploring ways in which ICT can support the interaction amongst actors and their co-creation activities beyond analogue participation or co-creation tools.

Based on a conceptual framework and empirically assessed living labs, the paper provides a critical observation of co-creation as a contemporary trend in the production of POS within urban planning processes. It concludes by exposing challenges that were experienced and suggests possible ways to move forward toward a genuinely co-creative approach with the support of ICT tools.

Theoretical Framework

Participation as a Process

Participation as an approach to involving citizens in different research and development activities has been widely discussed, promoted, analysed and scrutinized for decades (e.g. Andersen *et al.*, 2015; Arnstein, 1969; de Gramont, 2013; Neef, 2003; Sorensen & Sagaris, 2010). Through time, a whole range of analogue and digital tools and methodologies have been developed to support the involvement of citizens in the research processes to bridge the gap between research and practice. Those have been tested and are available on different platforms. Many of those are related to participatory data gathering as is citizen science (European Citizen Science Association (ECSA), 2020), citizens' observatories (CITI-SENSE, 2012), and crowdsourcing (The European Citizens Crowdsourcing (EUCROWD), 2016). Some also support research activities with a range of participatory research methods and techniques such as participatory action research, participatory video, digital storytelling theatre for development, photovoice and reality check approach (Participatory Research Methods, n.d.). Here, we attempt to interlink and incorporate into the co-creation approach some steps, methods and tools of the above-mentioned participatory approaches to establish a comprehensive development process of POS from its initial analytical steps to co-creation at the very final stages.

Co-creation to Elevate Public Engagement

Co-creation has been described as anything creative done collectively (Sanders & Stappers, 2008) and encompasses creative co-operation during the design process, service delivery and usage (Steen *et al.*, 2011). However, the form and content of a co-creation process are still under debate since there is no globally accepted method (Gordon *et al.*, 2011), especially regarding the question of how to align co-creation stages with the urban planning development process. There has been little literature that directly examines these two processes. Mostly, researchers have attempted to generally frame public participation in the urban planning process (see, for example, Hasler *et al.*, 2017; Fors *et al.*, 2015). Šuklje Erjavec and Ruchinskaya (2019) suggest an interrelation between the co-creation approach and open space development, calling their stages *to discover*, *debate*, *decide*, and *do*; the latter encompassing implementation, use, and management of a place. Goličnik Marušić and Šuklje Erjavec (*in press*) further developed a framework to also define specific co-creation process results for each co-creation stage, tasks of planning experts and users as the actors involved in the process. Based on their model, we further developed the activities and tasks for each co-creation stage (Figure 1), which are explained in continuation.

Type of Activities and Tasks of Actors

Discover

In this phase, activities performed mainly relate to:

Patterns of use: gathering information about the patterns of how people use a place to provide an overview of behaviours, activities and movements of people in POS;

Users' needs: collecting information on citizens' needs, wishes, preferences, complaints, and more;

Users' perception: collecting information on citizens' perceptions of the environment;

Spatial potential and problems: information on spatial potentials, problems, obstacles, etc.;

Using databases: spatial attributes and characteristics: information on spatial attributes and other characteristics; and

Budget: data on budgetary possibilities.

Debate

In the *Debate* phase, most important activities refer to:

Scenario development facilitation: facilitating the development of the predictions and scenarios to help identify parameters that may impact on people's use of a POS;

Actual implementation check: checking financial possibilities and calculations for the implementation and management of different scenarios as possible realisations;

Possible place layout check: recognizing or understanding place types and their attributes to support the debate about priorities and possibilities once/if implemented;

Possible place content and purpose check: recognizing ideas and suggestions shared by the public and other stakeholders about the purpose, vision, aims, possibilities, problems, preferences and priorities of a place once/if implemented.

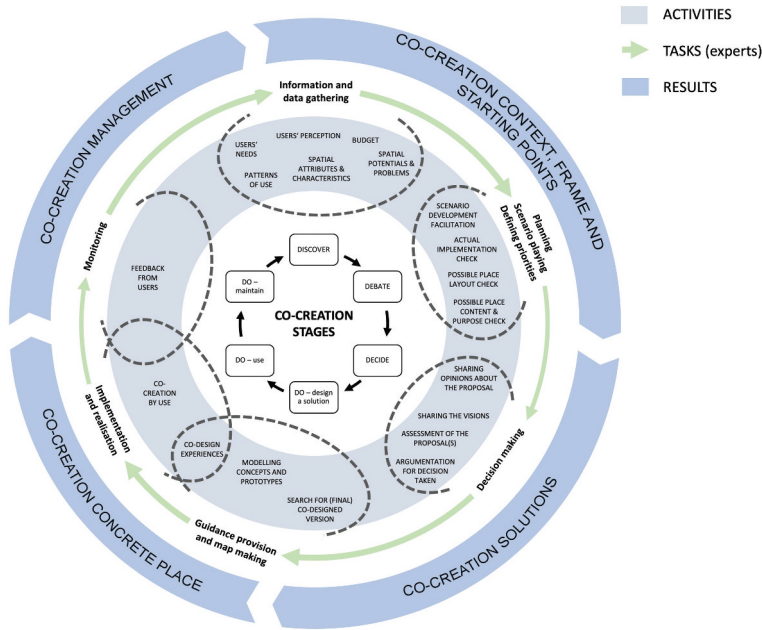


Figure 1. Co-creation stages, activities, tasks of actors and likely results within the POS development process (adapted after Goličnik Marušić and Šuklje Erjavec (in press) and Šuklje Erjavec and Ruchinskaya (2019)).

Decide

In this phase, the final decision is met, and the solutions are co-created. Main activities of this phase are:

- Sharing the visions: expressed comments and visions from diverse actors involved;
- Sharing opinions about the proposal(s): opinions about the proposal(s) based on results from the previous phase;
- Assessment of the proposal(s): appropriateness of the proposed solution(s) against selected criteria; and
- Argumentation for the decision taken: arguing and evaluation steps for decisions taken.

Do

The *Do* phase encompasses co-designing a solution, delivering and implementing a solution, including the actual design use as well as its maintenance as a (pre)condition for the long-term attractiveness and conduciveness for usage. In this phase, the activities may refer to:

- Search for (final) co-designed version: ways for searching for actual co-design solutions;
- Modelling concepts and prototypes: ways for and types of modelling concepts and virtual prototypes;
- Co-design experiences: co-design the site-specific experiences of various actors;
- Co-creation by use: ways of use and types of actual experiences in co-creation according to use; and
- Feedback from users: gathering feedback from users.

To facilitate the smoothness of a co-creative process, different kinds of participatory tools, methods and technologies have been developed, most of them aiming at being easy to use and available to users anywhere and anytime. Commonly, it is still urban planners who are designing and initiating the process, and so the selection of participatory tools mainly depends on them. However, with regard to digital technologies, different literature has argued that the discussion about and implementation of new technologies in contemporary urban planning and design are still limited and mostly developed in a form of participatory web platforms used for data collection and information sharing. These ICT tools are used less to involve different actors in a co-creation process (Dodgson & Gann, 2011; Falco & Kleinhans, 2018; Houghton *et al.*, 2014; Šuklje Erjavec & Ruchinskaya, 2019). Houghton *et al.* (2014) also found in their empirical research that the main reasons for the low incorporation of ICT in the planning process by urban planners were a lack of knowledge and skills, agency and time constraints. Conversely, Oksman *et al.* (2014) suggest that technological barriers to co-creative urban planning are diminishing, particularly at the local level. This produces new opportunities for public engagement. Facilitating and increasing participation through ICT may not decrease the workload. In fact, the amount, speed and diversity of information and ideas, coming from involved stakeholders may increase. Experts need to be prepared for this in the organisation of a co-creation process. However, ICT tools enable involvement of many more stakeholders and consequently make the process more inclusive and its results likely more relevant to the wider public. This is of importance when considering POS.

The Actors Involved

The actors, involved in the co-creation and the variety and relationships among them are of crucial importance for the success of the co-creation process. Despite the agreement in the academic literature that co-creation is a collective creative endeavour (Arnstein, 1969), we believe that the role of citizens and that of professionals differ. With regard to the roles of citizens, Goličnik Marušić and Šuklje Erjavec ([in press](#)) elaborate on three diverse roles of the citizens as co-implementers, co-designers, and co-initiators, of which, only the co-initiator is highly involved in various steps of the contemporary planning process. With regard to the roles of professionals, scholars use different terms to denote them, ranging from the role of initiator, metadesigner, negotiator, involver and enthusiast (see, e.g., Eggertsen Teder, 2019; Dewaele *et al.*, 2018). These roles might overlap with those identified in other literature as facilitator (e.g. Dewaele *et al.*, 2018) or a mediator (Goličnik Marušić & Šuklje Erjavec, [in press](#)). Different terms used might be a reason for the confusion and the uncomprehensive overview of roles. Nevertheless, it is clear that the co-creation process needs structure and clearly defined roles, yet it should also remain open to individual suggestions and approaches to enhance the creativity of all parties involved and facilitate constructive problem-solving. We elaborated on the roles in [Figure 2](#).

Digitally Supported Co-Creation

ICT has the ability to empower the self-organisation of citizens and mobilize them, which is most obvious in the implementation of citizen-led mass events such as demonstrations, riots, and more. Being aware of these powerful effects of ICT, it is becoming extremely

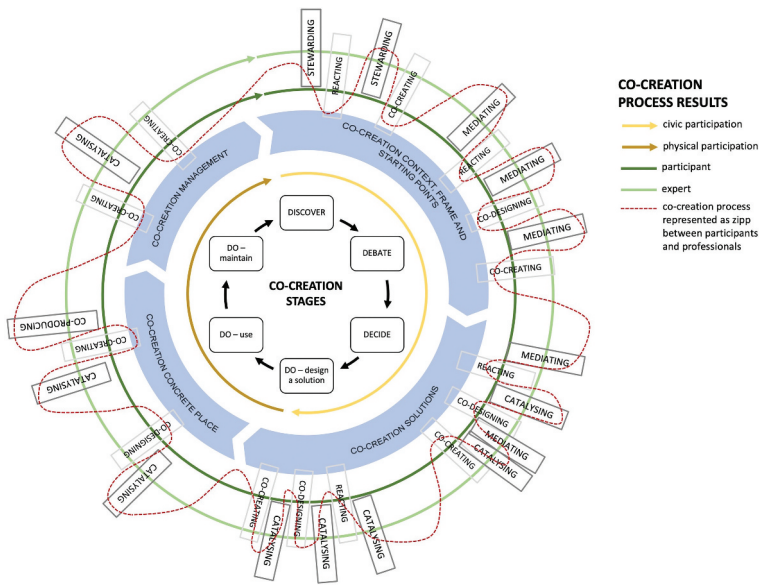


Figure 2. Roles of actors in the co-creation within the POS development process (adapted after Goličnik Marušič and Šuklje Erjavec (in press)).

popular for governments to try and use digital media for promoting citizens' self-organisation and engagement in urban development (Kleinhans *et al.*, 2015). As a consequence, the number of place-based technology initiatives is raising through initiatives that are both top-down and bottom-up. Despite ubiquitous ICT accessibility and general positivity towards digitally supported engagement, there is still little empirically proved knowledge of the benefits (Kleinhans *et al.*, 2015). One reason for this may be the gaps in communication between the actors involved (Sanders & Stappers, 2008). Their different backgrounds and skills can create boundaries and to overcome them, new approaches are needed. To facilitate the structuring of the co-creation process and define the roles of the actors even better, we investigated the type, degree and form of interaction. Based on the literature (Arnstein, 1969; Hanzl, 2007; Manzini, 2015; Münster *et al.*, 2017), we constructed parameters for each aspect, which are briefly discussed.

Type of Interaction

The types of interaction can differ according to several parameters including reach, scalability, participant interaction, participant characteristics and flexibility. Reach refers to the time (when) and, space (where), interaction can take place. This can be home, public place, transit space, the venue where the event takes place, online space, etc., and the time is defined accordingly. Scalability defines the number of participants to be reached. In general, the methodology which has been tested in practice recommends starting with a large number of end-users, continuing in smaller working groups and, at the final stages of the process, involving a larger number of people again (Münster *et al.*, 2017). Along with scalability, participant interaction is defined. Manzini (2015) maps participant involvement and interaction quality by defining the degree of collaborative

involvement. This indicates the level to which the participants are involved in the collaboration with others, and it can span from doing everything alone to doing everything together. Accordingly, participant interaction can, for example, be individually, in pairs, in small groups or large groups. Participant characteristics, such as background (e.g. culture and education), skills (specifies whether the engagement requires any pre-training) and position (stakeholder representative, demographically representative, open to everyone, specific individuals, etc.) are also to be considered. Finally, flexibility denotes the ability of the tool to be adjusted according to participants' characteristics and scalability, i.e. to engage a wide and relevant enough range of stakeholders in an equal way by paying attention to their different skills and motivations for engagement.

Degree and Form of Interaction

We defined the degree of interaction as the level of citizens' participation in the co-creation process, which ranges from passive to active participation, and whether it can be digitally supported or not. The degree of interaction has been discussed by different authors many times over the past decades (see e.g. Arnstein, 1969; IAP2, 2018; Manzini, 2015; Münster *et al.*, 2017) and the general belief is that facilitated by the use of ICT, a switch has been made from one-way communication (informing the public) to emphasising a dialogue and the co-production of content. However, some research shows that digitally supported communication has remained confined to one-way sharing of information from governments to the public and that a real two-way digitally supported communication between residents, governments and policymakers is still limited. This might be due to poorly developed strategies focused on organisational responsibilities and technology as a problem solver rather than on the needs of citizens' empowerment. Kleinhans *et al.* (2015) offer a review of communication strategies and argue that wider engagement can only happen if a virtual connection is projected to the real space through concrete actions supported by the use of both online and offline tools.

Based on the reviewed literature, we can assume that, at the moment, ICT tools in the co-creation process do not yet fully facilitate advanced two-way communication where all actors work together in the decision-making. To improve that, we believe that it is important to better understand how the stages of communication differ according to the stages of co-creation and which types of communication channels are needed. We outline our understanding of the degree of interaction in [Figure 3](#).

The form of interaction relates to the methods and tools used in the co-creation process, of which we focused on the digital ones. There exists a wide variety of methods and tools to gather different kinds and amounts of data, and the availability of appropriate tools is important for the users to express themselves (Sanders & Stappers, 2008). At present, governments hold on a few easy-to-implement – usually non-digital – methods such as low-level workshops, city walks or distributing information leaflets (Münster *et al.*, 2017). The use of digitally supported methods is rare, although research has shown that citizens are more likely to engage with planners via digital tools such as social media, online pictures and maps than via conventional methods (Evans-Cowley & Hollander, 2010). Furthermore, there exists little information on the alignment of relevant methods and tools with a specific co-creation stage. To utilize these tools and improve the planning process, however, it is important to understand their significance in co-creation activities.

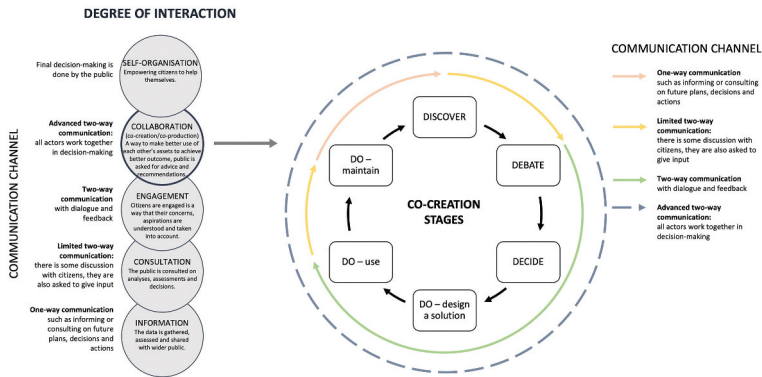


Figure 3. Degree of interaction in the engagement process and applied to the co-creation process.

Based on the selected literature (Hasler *et al.*, 2017; Šuklje Erjavec & Ruchinskaya, 2019; Šuklje Erjavec & Žlender, *in press*), we systemized methods and ICT tool types for the stages of co-creation to support the facilitation of activities and tasks in the co-creation process executed by all involved (Figure 4).

We addressed separately the interaction among actors and the interaction between the POS and the actors. As shown in Figure 4, the methods and tools for interaction among actors and the data gathered are abundant in the initial stages of co-creation while less so in the design execution and management stages of the *do* phase. Clearly, co-creation puts much emphasis on the process rather than on the output, which is a reminder for experts to let go of their expectations of the result to some extent and focus instead on the positive contribution of the process. On the contrary, ICT tool types for interaction among actors and POS are plentiful in the *do - use* phase, indicating ample possibilities

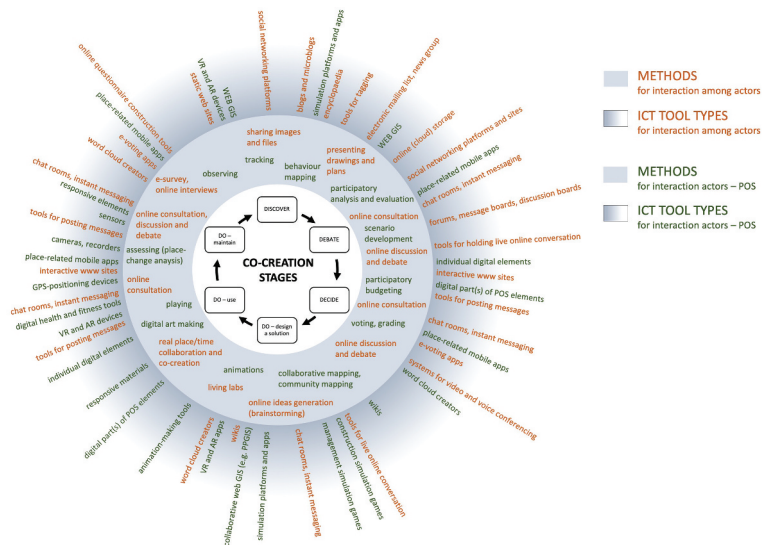


Figure 4. Form of interaction: The most common methods and possible ICT tool types to facilitate co-creation among actors and between actors and the POS.

offered by digital technologies to change our interaction with public spaces. This difference indicates lacking information and knowledge regarding fitting ICT tools for certain co-creation stages. Undoubtedly, the potential exists to develop those in the near future.

Finally, we believe that stronger empirical evidence is needed to understand what works, what does not and why not, what are the roles of actors and how they are included. Accordingly, backgrounded with the reasonings discussed in this section and illustrated in [Figure 1–4](#), we assessed four living labs to test the operational possibilities and qualities of the co-creation approach.

Research Methods

In this research, a living lab was taken as a milieu to examine the implementation of ICT in co-creation in the field of urban planning, addressing the provision of inclusive public places in four European cities: Ghent (Belgium), Lisbon (Portugal), Vilnius (Lithuania) and Milan (Italy). Living labs were part of the C3Places project (C3Places – using ICT for co-creation of inclusive public places, n.d.), which launched in May 2017 and aimed at developing strategies and tools to increase the quality of POS through ICT by influencing positive co-creation and social cohesion effects.

The goal of the implementing living labs was to better understand and present the characteristics of different stages of the POS co-creation process. Each living lab responded to the chosen context and closely addressed only a selected part of the process since, timewise and organisational-wise, more than that would greatly exceed the project frame. During the project development, it became clear that there are still too many practical obstacles on various levels and sides of involved parties to develop and execute a comprehensive POS co-creation living lab. Equally, practical usage and implementation of digital tools revealed to be much more demanding than anticipated. However, under such circumstances, pilot cases were implemented, and some valuable insights were pointed out. Details of the living labs relevant to this study are listed in [Table 1](#).

Ghent Living Lab. This lab addressed issues of interactively augmented soundscapes and their potential to improve the sonic environment in noise-polluted parks. The case study area was a corner part of the Zuidpark in Ghent, located in the De Krook area. The Zuidpark is an elongated rectangular park with a rather open character, fully surrounded by busy roads and thus exposed to high levels of road traffic noise. The park use is more or less limited to people walking their dogs, jogging or cutting through the park. This presented an opportunity to introduce technology into the park and explore how it could change the use, experience and perceived quality of the space in the currently rather uninteresting park, both visually (open green space surrounded by shrubs and trees) and acoustically (traffic noise). To research the possibility of improving the sonic environment, the research team developed an interactive soundscape augmentation with natural sounds. Using a smartphone application (app), they recruited users who were allowed to mix eight different pre-recorded natural sounds, which were played back by a hidden loudspeaker until their personally optimized soundscape had been composed. These preferred soundscapes were then evaluated by other participants. For more, see [Van Renterghem et al. \(2020\)](#).

Table 1. The living labs.

The Ghent Public Space Living Lab	
Objectives	Demonstrate the effects of digital technologies for making POS more attractive; Demonstrate interactive co-creation through digital technology; Demonstrate assessment methods based on new technology.
Knowledge sought	Masking potential of the augmented natural soundscapes; Possibilities of using ICT to improve sonic environment in noise polluted green areas; Common factors in the co-created soundscapes that allow to explore preferences of certain user groups; Intensity of use of the platform; Quality of the users' experience of the soundscape generation system.
Actors involved	On-site visitors (no socio-demographic restrictions).
Data collection methods*	Long-term continuous SPL measurements of the existing environmental sound as a research reference, using internet-based meter (D); Sound mixing via a mobile application (D); Survey (D); Observation by the researcher (T).
Lisbon Alvalade Living Lab	
Objectives	To analyse the sociability and spatial practices of students and their connection with ICT devices; To shed light on teenagers' appropriation of POS; To evaluate spatial resources, values and opportunities, linking the local knowledge with existing practices; To develop, test and gain experiences on digital research tools and methods, esp. innovative co-creation ones, tailored to the context of teenagers; To provide recommendations in designing strategies and policies to develop teenagers'-oriented POS in Alvalade.
Knowledge sought	Identifying features and user-friendliness of the POS in Alvalade; Elucidating teenagers' practices and behaviours in POS; Testing the potential of digital co-creation with teenagers through thematic workshops; Gaining local knowledge.
Actors involved	School pupils (teenagers between 13 and 17 years old) involved in co-creation workshops; On-site visitors (teenagers).
Data collection methods*	Mapping of public spaces (T); Field observations (T); Literature review (D + T); Exploratory informal interviews with teenagers (T); Semi-structured interviews with two civil engineers, one landscape architect and one architect from the Parish Council (T); Five co-creative workshops to formulate and justify design solutions for the POS in front of the school. They included a site visit, questionnaire, and group work with the use of digital tools such as Padlet, image bank, PowerPoint and Google Maps (D + T).
The Vilnius Aukštamiestis Living Lab	
Objectives	To explore how digitally enabled is functioning of Loftas, with a special focus on seniors' social group; To complete document analysis and social media observation for description of case conditions, context and create qualitative and quantitative research instruments; To explore characteristics of cyber open spaces from social, technological, and urban design perspectives by interviewing stakeholders; To generalize the scientific results on behaviour of seniors as a user group in focus.
Knowledge sought	Digital sources of knowledge about community, activities, events.
Actors involved	Residents and their communities; Owners of business and cultural spots; Municipality and related governmental units.
Data collection methods*	Document analysis and social media observation of selected websites, social media (Facebook and Youtube) and blogs (D + T); Five stakeholder semi-structured interviews (T); Questionnaire survey of senior citizens who participated in Loftas events (T).
The Milan Living Lab	
Objectives	Demonstrate the effect of digital technologies for making public space inclusive, interactive and co-created; Improve the liveability of the area, namely the quality of life inside the University; Develop assessment methods based on new technology and data analysis.

(Continued)

Table 1. (Continued).

Knowledge sought	Possibility to involve people by means of a web app, sharing information related to POI located in POS.
Actors involved	Students; Teachers; Other workers of the University; Citizens of Milan freely accessing the area.
Data collection methods*	QR codes + the web app featuring shared bulletin board for posting requests or offers (rooms, roommates, books, joint study, etc.), pictures sharing, public and private chat; publication of local events with the possibility to join, information about the POI (D).

*D = digital, T = traditional

Lisbon Alvalade Living Lab. This lab addressed teenagers' relationship with the local public space in front of their school. It was developed in the Alvalade neighbourhood in Lisbon, which was designed in the 1940s and composed of eight housing unit cells around a central core of several schools and a large green space, Alvalade Woods. The neighbourhood has a good mix of uses (housing, retail, and services), traffic hierarchy, and green spaces. The case living lab study was a wider area of arrival and entry to the Secondary School Padre António Vieira and its students (mostly teenagers around age 17). The aim was to better understand students' behaviours, needs, and expectations regarding the POS as well as the spatial challenges and restrictions on their use of the area. Five thematic workshops were held with the teenagers at the secondary school in Alvalade involving two classes (49 students). This lab strived to promote interactive and stimulating activities, allowing the students to freely express their suggestions and solutions. In the final workshop, the students drew a proposal to transform the area. In parallel, several other methods such as field observation and interviews were conducted. Another partner in this living lab was the Parish Council of Alvalade, which provided insights on urban policy, management and maintenance. In addition, it was planned that an app would be employed to contact, engage and track teenagers but due to technical issues, it was not finalised in time to be used within the living lab.

Vilnius Aukštamiestis Living Lab. This lab addressed existing cultural services for a presently excluded community and expanded knowledge on how cyberspace may foster the function of public spaces. It was focused on the Naujamiestis district of Vilnius. Aukštamiestis, a part of this district, is currently undergoing a transformation from a former industrial area to a cultural hub providing spaces and opportunities for creative people to implement their ideas. The living lab focused on Loftas Art Factory as a main cooperating community in the area. Loftas is located in a former factory which combines open and covered spaces for which it has become popular for year-round events such as concerts, parties, visual arts, cinema, theatre dance experiments and conferences. It is mostly visited by representatives of creative industries and the younger population of Vilnius. The aim of the living lab was to study digital means (mostly social media such as Facebook) to better include other inhabitants of the area such as seniors, the disabled, families, and others who have different interests, needs and motivations. However, the research team uncovered technological and societal difficulties related to the lack of publicly available and reliable information. The living lab explored the dynamics of the

Loftas as a service for the community and expanded the knowledge on how digitally supported open spaces function, focusing on the senior's community.

Milan Living Lab. This lab addressed the measurement of open space liveability through a web application. The living lab was located in the Città Studi area in the so-called educational sector surrounding the science departments of the University of Milan. Città Studi is rich in tree-lined avenues and green spaces, offers many services for students and is well connected with public transportation as well as bike paths. Part of the area is a publicly accessible and very attractive university botanical garden. Within this living lab, the research team placed quick response (QR) codes near different points of interest (POI). Scanning the QR codes connect visitors with a dedicated web application through which, after registering, useful information on the corresponding POI can be accessed (see Table 1 for details). It also offers several social features. The purpose of the installation was to draw users to the POI where they could co-create a community that uses and provides information and, by creating opportunities for interaction, begins to communicate.

Analysis and Results

The four living labs differed in location, spatial and urban composition, the scale addressed, the actors involved, interaction among them and between them and the POS, the use of ICT as well as in a phase of co-creation process they are placed in (Figure 5). The Lisbon case is characteristic of the *discover* or the *debate* phase of the co-creation. Interestingly, the Vilnius case can be interpreted as the case in a shift of entering a new loop of the process, as it can be classified at the stage in which – after the final *maintenance* stage of the *do* phase – new challenges arise and a new loop of the *discover* phase appears. Both the Milan and Ghent living labs are characteristic of the *do* phase, with Ghent being in the *design a solution* stage while Milan is in *use*, a later stage of the *do* phase. Due to great differences among these labs, they are assessed separately but through the same protocol, based on the developed conceptual framework addressing the process of co-creation, the actors involved, interaction among them, and ways in which ICT tools were used in the process.

Ghent Living Lab. This lab encompassed the *design a solution* stage of the *do* phase since on-site visitors were co-creating the POS by experiencing an augmented soundscape co-creation. The interaction between actors and the POS was facilitated via a mobile app but realized on the spot, temporarily changing the soundscape of the place and consequently its characteristics and quality. This influenced the experience of the co-creator and other visitors, and provided useful information on the possible future use of ICT in the co-creation of the place in real time.

To collect all necessary reference data, researchers continuously recorded the existing sound environment of the area with a sound pressure level (SPL) internet-based meter mounted to the façade of the adjacent maintenance building. The area of the installation was selected to fit all the necessary aspects: a corner of the park that is spatially attractive but exposed to traffic noise, had the possibility to hide a loudspeaker, and accessibility to electricity and internet connection. Although this lab provided a technically

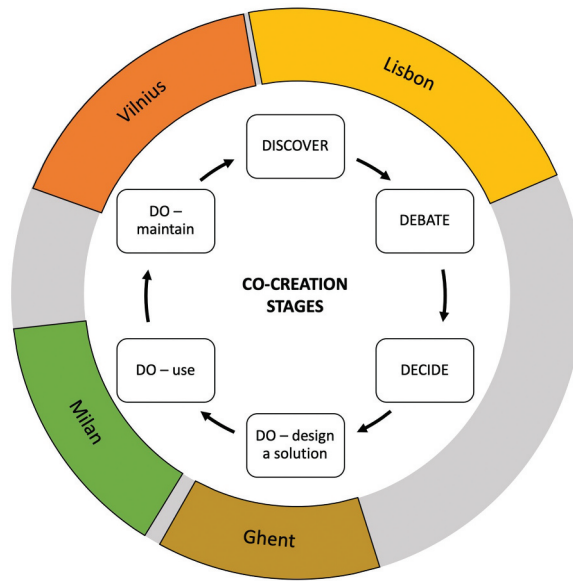


Figure 5. The examined living labs in relation to the stages of a co-creation process.

sophisticated, innovative and attractive co-creation opportunity, the research team faced difficulties in persuading the public and regular park visitors to come to the case study area and to install and use the app on their smartphone (facing questions of security and mobile data use). Hence, on-site recruiting was necessary to engage participants. Since the app was designed for Android operating system only, the recruiter tried to overcome this obstacle by providing tablets available to iPhone and other operating system users, and to visitors who did not have their smartphone with them or did not own one.

The users and researchers were not in direct contact, but users' experience-based information such as their choice of sounds, experimenting with the effects of soundscape on hearing traffic noise, self-reported enjoyment, and the number of volume changes during the soundscape composition provided researchers with valuable input. Furthermore, the researchers were able to compare the augmented soundscape co-creation results with the real-time sound environment of the area, which was continuously assessed. The researchers collected users' basic demographic data through the app registration system, which helped them to interpret the engagement and preferences of the users. Researchers in this co-creation process play a sort of catalyst role and could interpret and evaluate provided solutions.

Lisbon Living Lab. In co-creating the context with teenagers, the researchers detected that there were difficulties with identifying and expressing teenagers' needs regarding the POS. They appeared to use the POS only to a minor extent, and they prefer private and indoor spaces such as shopping malls, and POS close to their homes. Further findings elucidated a lack of motivation for co-creation on the side of the teenagers as they were aware that co-creation of POS is a long process, and they would not benefit from the

transformations proposed. That led to it being difficult to motivate them to participate. Further details on the findings can be found in Smaniotto Costa *et al.* (2020).

This living lab produced valuable data on the behaviours and activities of teenagers at a POS, but also regarding their needs, wishes, preferences and perceptions of the environment. In addition, data on spatial attributes and other characteristics of the Alvalade POS were collected. Regarding the intended use of ICT tools to support co-creation activities, the team encountered several unpredicted obstacles and problems such as the app not being developed well enough to be ready for wider use, the school was not supportive in providing a Wi-Fi connection due to regulations and teenagers were unwilling to use their smartphones due to data usage and battery drainage. To overcome these problems, the research team adapted the living lab approach and used more traditional tools for the co-creation activities. To make the process at least partly digital, the team provided several tablets and a free Wi-Fi connection for the duration of the living lab workshops, but this was not enough to foster true digital co-creation, as a tablet enables a maximum of two persons working together in that way. Additionally, software support and participants' skill of using it also became an issue. Under such circumstances, the use of traditional tools such as printed maps, sticky notes and coloured pens proved to be more effective and, above all, more cohesive for the participants.

The assessment of the living lab for both co-creation phases (*discover* and *debate*) resulted in direct interaction, i.e. on-site meetings in small groups. Accordingly, there was little digital interaction among actors. Interaction between actors and the POS was supported by the presentation of paper drawings and plans and digitally on screens through Google Maps and using and sharing text and images via PowerPoint. In the *discover* phase, further elaboration resulted in assigning tags to images in the Padlet database, whereas in the *debate* phase, the generation of ideas was achieved by online voting and note taking, also using Padlet. This phase clarified the preferences of teenagers for place types and attributes, helped to define priorities and elaborated on the design ideas and suggestions. The role that experts played was predominantly as stewards and initiators as they developed the living lab idea and approach, and they guided the participants through the process with the guiding questions and supportive information such as examples of good practices. In such a process, participants mostly took acting and re-acting roles. Thus, rather than providing a final solution, the main contribution of the workshops resulted in an increase in knowledge, an understanding of issues, the raising of awareness and the development of creative thinking of the participants. To achieve a solution, a much longer time range and different ICT tools will be needed along with a budget for those. Also, additional knowledge and skills of participants and experts will be needed. There is a range of further challenges which shall be addressed in the future to find an effective and matching combination of ICT tools to use in the co-creation of place-related processes.

Vilnius Living Lab. Here, the monitoring of seniors' activity in a digital world showed their low participation and consequently a lack of information on activities and events in which they would participate. This points to the problem of relying on social media for spreading information whilst excluding groups who do not use such media. Different ICT tools should be chosen for interaction with those actors. The interviews

with the municipality and cultural spaces representatives indicated that different ways of information sharing were not possible due to lack of finances, the volunteering nature of managing the community and the lack of knowledge on how to use alternative (digital) tools.

This living lab raised the importance of monitoring and thus the challenge of co-creation management. The *maintain* stage of the *do* phase is relatively new in the concept of co-creation since opportunities for co-creation are mostly seen in the initial stages of the process. However, we stress the integral concept of co-creation and thus take a chance with this study to promote the involvement of users in the co-creation stage in which places are already in use. Users' integration is seen as extremely valuable, although the practice shows quite a few obstacles, including users' low willingness and insufficient skills to participate. Further challenges are focused on searching for principles of effective co-creation once a place is already being used.

Milan Living Lab. This lab encompassed the *use* stage of the *do* phase in which users do not physically transform any POS but co-organize its use and activities and gain and share information about them. The technology used in this lab had the ability to draw users into the space and consequently foster different activities and encourage socialisation, but also to facilitate online interaction. However, the team encountered a lack of interest to use the proposed web application.

This living lab raised questions about the necessity of the application which aims to navigate and organize the users in a place, especially when the users are familiar with the place or the place is clearly designed and easy to orient and navigate through. Specific user groups, e.g. the visually impaired or other vulnerable groups may be more interested in such a tool. However, the data gathered in this living lab did not show any such preference. Furthermore, many other ICT tools were already publicly available, attractive and commonly used for socializing, engaging and supporting people to self-organize for shared use of a place. To address such co-creation activity, a different approach and a different set of ICT tools would likely be needed.

Discussion

The heterogeneity of the four living labs analysed provided different insights into the possibilities and limitations of ICT methods and tools used for interaction among actors and between actors and the POS in various stages of the co-creation process.

Whilst the soundscape augmentation application proved to be a good example of using ICT to improve POS, the **Ghent Living Lab** struggled with recruiting users for various reasons, as pointed out earlier. This raises a question of the suitability of the type of ICT tools used as well as missing steps in the co-creation process related to the expertise of the public communication where different types of ICT tools can play an important part. We argue that a physical, spatial part of the installation could have provided a visible attraction for involvement in the co-creation of a sonic environment. To attract and engage the park visitors, placed-located ICT tools (see Šuklje Erjavec & Žlender, *in press*, for an overview) such as digital public displays, interactive screens and more could be used. Such tools are more noticeable, legible and accessible, since they do not require personal possession of an ICT device and would include also the fraction of

the population with sight problems. Furthermore, as in co-creation, the collaborative involvement is crucial in terms of the strength of social ties and relational intensity (i.e. the reasons for participants to get involved) (Eggertsen Teder, 2019) while instant interaction among participants, for example, for group sound mixing, could add another dimension to co-creation of the POS.

The most important lessons learned from the **Lisbon Living Lab** were that a clear message and expectations are a requirement for the success of a co-creation. It is important to know what is going to happen and why, the structure and timing of co-creation and the expected results, in which format and configuration along with clear benefits for participants. Without these clear expectations, different approaches to co-creation in the same process may be required to allow flexibility and overcome any limitations or problems but may also enable teenagers to engage in different ways according to their personalities. In line with this, working with teenagers showed that participants should be allowed to freely choose which digital tools they preferred instead of imposing specific ones. The tools should be carefully selected and tested beforehand so that they facilitate the process well and do not disrupt the general workflow. Some previous studies have shown that teenagers are particularly attracted to different portable ICT tools such as personal augmented reality and virtual reality devices, and GPS-positioning devices, which have the potential to establish a relationship with space (e.g. Šuklje Erjavec & Žlender, *in press*). Employing such ICT tools would most likely advance interaction with teenagers and produce rich data. In addition, bringing together two actors – the teenagers and the Parish Council representatives – could add another dimension to the co-creation process since it would allow for teenagers' needs to be heard on one hand and teenagers would perhaps feel the importance of their needs being treated more seriously, on the other hand. Remotely accessible ICT tools such as social networking platforms, tools for tagging, instant messaging and similar (Šuklje Erjavec & Žlender, *in press*) could further facilitate interaction among players when physical contact due to time or space restrictions is not possible.

The **Vilnius Living Lab** showed that the digital inclusiveness of seniors is poor, and its increase should be stimulated by face-to-face activities. There are several ways to ensure the comprehensiveness and continuation of strong inclusion. For example, this could be done based on a paid or voluntary administrative position to work with a community, through support for learning to improve digital literacy among senior citizens, interactive digital learning platforms, or by using the full potential of tools that already employ. Facebook, for example, is the main ICT tool of the community and provides different possibilities of interaction. The community perceives it as secure and privacy assuring technology, which provides possibilities for data collection (aggregation) and data access, sharing and creating knowledge, and decision-making). Indeed, enhancing two-way interaction between the users and the experts, which did not happen in this lab, would enable an understanding of users' needs and wishes but also their digital literacy, which would pave the way for selecting tools and measures for their digital inclusion. Still, we need to be aware that although the rise of people's skills and accessibility of ICT tools is almost inevitable, users will continue to have different preferences, needs, values, motivations and skills when using new technologies.

The ICT tool used in the **Milan Living Lab** enabled a variety of actions such as posting impressions about the POS, sharing photos and having public and private conversations. With regard to the latter, there was very low activity detected and it can be assumed that

a great amount of social networks available is actually a barrier to the use of the proposed web application since the users do not see any benefits in using another local social network in addition to the existing and established ones. Motivating people to use a new tool in a world full of digital stimuli requires maximum effort in promoting the initiative, making clear its meaning and value. To achieve this, however, substantial physical and financial resources are needed. On the other hand, different types of ICT tools that are more place-related could be much more attractive and supportive to users for finding new ways of socializing and experiencing the POS and could open new possibilities to improve the liveability and inclusiveness of the area.

The literature review and the examination of four cases provided enough information for a critical overview of the *who* and the *how* of the POS development process and how digital technologies can enhance the co-creation process of POS development. For the further discussion, we expose several challenges regarding the users of ICT tools in co-creation activities, which were shown by the results, and lessons learned from them.

The first challenge seems to be recruiting enough users. In all four living labs, limited participation led to low motivation and/or a lack of skills to use the offered tool. This challenge has been stressed before (Münster *et al.*, 2017), but until now, no universal solution has been found for how to activate and engage people to participate. Based on our analysis, we can emphasize that the role of the facilitator – usually an expert group combining professionals with expertise of communication and spatial design to enable good public communication and provide motivation strategy – is crucial to increase the number of users, as clearly illustrated in the Ghent Living Lab. Münster *et al.* (2017) also report a lack of information on the process, barriers in culture, understanding or accessibility as potential reasons for few users, but none of these barriers were detected in the assessed living labs. Previous studies (Eggertsen Teder, 2019; Dewaele *et al.*, 2018) highlighted the role of facilitator as crucial for involving other actors in the co-creation process from the very beginning, motivating them to participate and contribute and keeping the spirits up during the process. This may be difficult when only remotely accessible ICT tools, such as social networking sites, blogs or chat rooms are used in the process (see Šuklje Erjavec & Žlender, *in press*, for a review). Our findings suggest building interaction among actors in parallel with the interaction between actors and the POS, and supporting online activities with actions in real space, where additional possibly on-site digital tools are installed and/or offline tools are used to support the process. Also, it is important to understand that ICT tools may be more useful during some stages of co-creation than in others, depending on whether the interaction among actors or interaction between actors and the POS is to be achieved. Sometimes, people still need to connect in person to effect change, as illustrated in the Lisbon Living Lab, where in-person and online experiences complemented each other in discussing problems and forming solutions for the development of the POS by teenagers.

The second challenge refers to the use of ICT tools for *all* users. The ICT tools used in all four living labs were designed to be accessible to a great diversity of users, which is commonly desired in a POS development process, as in this way, valuable experiences and creativity of non-professionals and utilization of wider knowledge basis are achieved. However, since all the assessed living labs, except for the Ghent, one were targeted to a specific user group, the ICT tools' ability to fit any user group came into question. In Vilnius, for example, Facebook was not used much by the seniors, and consequently was

not the best choice for the purpose. Similarly, the social networking web application used in the Milan Living Lab did not attract students, which was the main target group, despite students being the user group of social media networks (Pew Research Center, 2019). The chosen app did not offer enough added value and benefits for it to be attractive to participants. Accordingly, to secure a co-creative and productive process and to build interaction among actors and interaction between actors and the POS, the activities and tools used should be specifically chosen or designed for each relevant user group and according to specific stages of co-creation. Furthermore, to be able to activate a large number of participants, further empirical evidence is needed to understand what works, what does not and why. Following this, the roles and skills of experts needed in activating people and defining how they are included could also stand to be more clearly defined.

The third challenge refers to the knowledge of the ICT tools and the co-creation stages and activities. Based on the observations from the four living labs, we are confident that the co-creation process – if considered as integrative as possible – is a demanding process for both, user-participants and experts. A general framework and the roles played are recognised as operative; however, for each situation, the process needs to be carefully adjusted as it may depend on multi-variables such as the availability of an ICT tool, familiarity with the tool, users' motivation, experts' availability, and more. However, the observations also show that ICT as an advanced enabler of users' interest and willingness to participate cannot be taken for granted. To use ICT effectively as an added value to the process, a thorough understanding of different types of ICT tools and their possible roles in the co-creation process is needed together with good skills of all involved to use them.

Finally, when deciding why and how to use ICT tools within the co-creation process, it is important to consider the advantage of time flexibility digital involvement provides. This offers the opportunity for participants to select the appropriate time for themselves when to engage. One must bear in mind also people's daily routines and their right not to participate, as they may simply not have time for it. This perhaps pushes the experts into an even more responsible position in which they may try to gather as much knowledge about users' needs, preferences and expectations from the co-creation processes as possible. By incorporating such knowledge into the initial ideas, the perceptions and the concepts from professionals and participants can come together as closely as possible during the initial stage of the process. However, respecting professional knowledge and expertise to address quality aspects of living still remains crucial in the process, which can be greatly improved with the empirical and experiences-based knowledge about users. Accordingly, in the co-creation process, the adjustments shall reflect the lessons learnt:

- (1) the need to have a thorough understanding of and relevant skills for choosing the right ICT tool;
- (2) consideration of using a combination of online and offline tools;
- (3) a consideration that ICT tools are not necessarily better than offline tools in all stages of co-creation;
- (4) consideration of adaptability, referring to specific tools for specific user groups;
- (5) the need for a strong communication and motivation strategy during each step of the co-creation process to attract participants;

- (6) definition of suitable and rational timing of the involvement of different actors in the co-creation process to balance overburdening and loss of interest with well-communicated outcomes and quality solutions; and
- (7) co-creation is an interdisciplinary approach integrating different professions and expertise regardless of the main focus and aims.

Conclusion

These days, co-creation activities are favoured in the planning-development processes and are hoped to have a great impact on the development of an inclusive and quality POS. However, process-wise as well as motivation-wise (mostly referring to users' willingness to participate) to achieve the highest user-satisfaction, these activities should be planned in a flexible way, combining a variety of offline and online methods and tools, adjusted to stages of co-creation and specific user groups. Such activities can provide solid ground for design evidence during the early stages of the POS development process and enable its continuing development with positive public input and acceptance. In such a way, the process becomes smart instead of the often rigid and linear workflow, common in urban design practices of the past.

Finally, it should be noted that ICT methods and tools are not a magical solution to increased interest and participation of the public in the POS development process. They are still just a tool, and since they have not been yet explored and tested to the extent that traditional tools have, they should be used with precaution, as an alternative and to supplement the traditional tools rather than as their substitute – especially in crucial steps of the process. More research is needed to understand better which types of tools align with a certain user group, certain types of activities and a certain stage of co-creation. In general, young people are interested in new technological approaches but perhaps not so in the topic explored. Therefore, it remains challenging to find a method to activate them to participate and influence their living environment. Older people, conversely, are perhaps passionate about the topic, but the exclusive use of digital tools could put them off from taking part. In our view, a soft introduction of ICT into the POS development process and keeping a good balance between digital and traditional tools is still key to a successful planning process and quality outcomes. However, by better understanding the possibilities and potential-added value of digital tools, they will certainly enable greater inclusivity, adaptability, flexibility and responsiveness in future processes.

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