Platform Urbanism for Sustainability

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Abstract. Digital transformation has brought about significant changes in nearly all aspects of urban life, including mobility, energy, economy, and governance. In recent years, many cities have pursued smart city initiatives in order to address emerging urbanization and sustainability issues. However, the existing top-down approaches to smart city initiatives have resulted in decreased citizen participation, which, in turn, can lead to decision-making processes that lack inclusivity, diversity, trust, and accountability. As such, there is a growing interest in the potential of digital platforms for enhancing citizen participation in sustainable urban planning and development. This paper delves into the concept of platform urbanism and examines the capabilities of urban digital platforms in facilitating co-creation and innovation for sustainable and livable cities. Furthermore, it provides a number of select case studies, in order to explore how digital platforms can enhance public participation and contribute to more democratic and inclusive urban planning processes. Finally, critical questions and considerations related to the use of urban platforms are highlighted, and corresponding conclusions and insights about the future of urban platforms are discussed.

Keywords: Digital Platforms · Platform Urbanism · Sustainable Urban Development · Citizen Engagement

1 Introduction

Over the last decades, as digital Information and Communication Technologies (ICTs) become more ubiquitous and permeate nearly all aspects of everyday life, cities are increasingly becoming the scene for techno-urban experimentation and transformation [1]. Furthermore, a growing number of cities have implemented policies and programmes intended to transform them into smart cities, in an attempt to tackle emerging issues of urbanization, and to achieve economic and environmental sustainability. Being a prominent urban digitalisation model, smart cities reconfigure urban space production and governance through data-driven systems and the increasing influence of IT corporations, as well [1]. Additionally, the phenomenon of platform urbanism, which refers to the integration of platform services and their underlying logic within "the fine-grain of cities" [2], is also gaining increasing attention. In general, even though the more specific characteristics of smart cities vary greatly, there is a common thread permeating most of them and that would be the reliance on ICTs and digital tools as their foundation.

This proliferation of digital tools and smart city applications, as well as the digital transition of urban societies, have created further opportunities for citizen participation and, consequently, a better chance of solving complex urban problems such as that of sustainability. Examples of this urban twin transition include, among others, cooperative, automated and connected multimodal mobility systems, as well as energy systems integration and management in order to lower emissions in the so-called circular city. Digital transformation has disrupted all urban domains from mobility to energy, economy, and governance, with different intensity each one. Digital tools play an increasingly important role in the traditional urban processes, such as urban planning, since they allow planners to make more informed decisions, by providing data, visualizations, and simulations that can help them understand complex urban systems better [3].

To this end, some of the most commonly used digital tools in urban planning include: (a) platforms with embedded Geographic Information System (GIS) tools that allow planners to comprehend the spatial patterns and relationships within urban areas, and make knowledge-based planning decisions; (b) Building Information Modelling (BIM) that facilitates the analysis of the potential impact of different planning decisions, and test the feasibility of different designs before they are built; (c) visualization tools that aim to support dialogue in urban planning by focusing on visual aspects and experiences of the environment [4]; (d) urban dashboards that consolidate urban information into a single view to efficiently monitor the performance of urban systems [5]; and (e) simulation models that help planners understand how different factors, such as transportation, demographics, and economic conditions, interact to shape the urban environment, and therefore, to identify potential problems and opportunities and make more informed decisions about how to respond to these challenges [6].

Nonetheless, most of these tools are used in the planning process following a rather top-down approach, where citizens are rarely included [7]. So far, urban planning is a domain in which digital technologies have not yet been utilized to their full potential so that they could also fully support, as well as incentivize, public participation. Recently, the focus is increasingly shifting on new opportunities that could enable the active participation of citizens, through digital platforms. These include, among others, platforms for crowdsourcing knowledge, as well as digital games that can change urban planning towards a more agile, data and user-driven direction, empowering citizens to share resources, collaborate and co-create solutions. MinStad, BlockByblock, CityLab010, VisitTheMayor, and NextCampus are a few examples of such platforms intended to create planning and design solutions; yet, their development is usually detached to the formal planning procedures and routines embedded in cities and regions.

As the effects of today's urban sustainability problems are increasing, the need to take various measures in order to address them is becoming more and more apparent. It is argued that the integration of digital technologies, and, especially, digital platforms in urban planning could facilitate the twin transition (i.e. green and digital transition). In addition, there is a growing interest in the roles of grassroots and digital social innovation in the transition to more sustainable cities and societies. While there is an abundance of literature on smart cities (e.g. [8–12]), this paper focuses on a more recent development of the smart city notion, that of platform urbanism (see Sect. 3 for definition), and explores

the use of digital platforms beyond the "platform-as-company" paradigm (which generates private value), but rather as open, participatory online spaces facilitating two-way interactions between city stakeholders.

To this end, this paper aims to conduct an overview of collaborative urban (digital) platforms that facilitate the co-creation of innovative solutions for sustainable and livable cities. It is structured as follows: first, we provide a concise overview of citizen participation in urban planning and development, focusing on the various types of public participation in the context of planning and how participation relates to urban sustainability (Sect. 2). In Sect. 3, we present the theoretical framework of platform urbanism, as well as participatory urban platforms, alongside several examples of platforms. For these purposes, we conducted a systematic review in the pertinent academic and practitioner literature, using Scopus and ScienceDirect. We performed our search queries between December 2022 and February 2023, using keywords such as "citizen participation", "participatory urban planning", "platform urbanism", "platformization", etc. We then performed a manual selection based on publication date, type, and focus, and we analyzed interesting documents further, which led us to select 70 documents. Additionally, we conducted a thorough online search in order to find and examine digital platforms that were then categorized according to their attributes (Sect. 3). Afterwards, in Sect. 4, through the presentation of select case studies addressing the creation of urban open/green spaces, we explore the capabilities of digital platforms in enhancing public participation, the level of participation they currently support, and their role in facilitating more democratic and inclusive urban planning processes. Finally, corresponding conclusions, critical questions, and ideas about the future of urban platforms are discussed in Sect. 5.

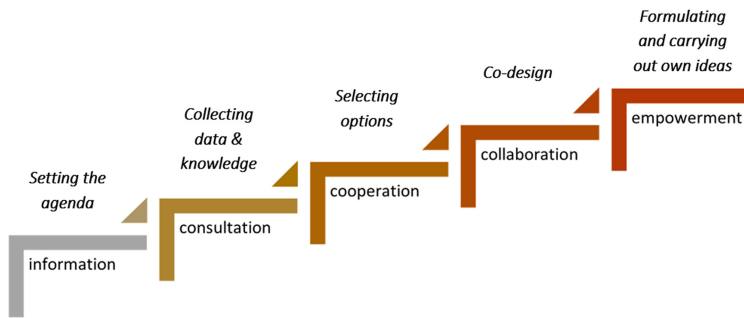## 2 Public Participation in Urban Planning and Development: An Overview

The city, a complex system of social, economic, and environmental forces at play, is a place viewed quite differently, by various stakeholders, from the individual to the collective level, based on their needs, values, and aspirations. Planning, as a process of shaping a city's future, cannot be achieved without conflict, and planners cannot be viewed as skilled technocrats with the expertise to produce 'good' plans, without involving the people for whom they are planning in the process [13]. This relationship between participation and planning might sound almost axiomatic in our days, as around the world "citizens push for substantive inclusion in decision making" [14] (p. 295). It is noteworthy, nonetheless, that public participation was hardly an issue during the early years of the planning profession, during which, as [15] points out, planners were considered a privileged elite, holders of superior knowledge, producing plans to be gratefully accepted by local officials and the public. It was in the 1960s and 1970s that the planning profession started to realize the deficiency of such an approach, especially in view of the racial and class conflicts in cities at that time. With ground-breaking work by liberal academics such as Paul Davidoff [25] and Sherry Arnstein [26], the planning profession started to acknowledge the importance of the engagement of the public in the decision-making process and of confronting the conflicts that different

planning choices evoke, for individuals and stakeholders [16]. In the realm of planning theory, public participation has been a crucial constituent in the communicative model, which emerged during the 1980s and 1990s [17]. Since then, the body of knowledge of what Healey [18] calls "collaborative planning" has been growing exponentially, a growth that coincided with a general turn in public policy, as government was replaced by governance [19].

Research on public participation in urban planning and development is today extensive and multifaceted. Any attempt to include the public brings to the fore "the more conflictual, structural factors that underpin city making" (p. 377) [20]. At the same time, however, participation is based upon and at the same time cultivates effective communication, empathy, and shared responsibility among citizens. If done appropriately, participatory processes can benefit conflict resolution, development of partnerships, transparency, and empowerment [21]. In relation to planning, in specific, participation is affected by the planning task, the nature of the planning environment and the decision-making system in which it takes place [19]. More and more it is acknowledged that efforts of scaling up the participation of residents and their associations in planning process have to take into account issues of inclusion of marginalized groups [22] of challenging localism and of formalization of participatory processes [14]. Last but not least, the concept of e-democracy and the use of ICT tools has been a driver of change in participation processes related to planning and development [23].

For this overview of this vast and interdisciplinary field, we will focus on three key aspects of how participation and planning can be viewed in tandem: first, the degree of citizens' participation in planning as an index of how democratic a city is; second, the various types and categorisations of public participation in the context of planning; and third, how participation relates to urban sustainability and resilience. According to the World Bank, participation is "a process through which stakeholders influence and share control over development initiatives and the decisions and resources which affect them" (p. xi) [24]. From this definition alone, it is clear that participation and distribution of power are closely linked. Arnstein [26] defines public participation as "the redistribution of power that enables the have-not citizens to be deliberately included in the future" (p. 216) [26]. She proposes a hierarchy of eight different forms of participation, in the well-known diagram called "a ladder of citizen participation". At the first, lowest rung of the ladder, she ranks 'manipulation', followed by 'therapy', 'informing', 'consultation', 'placation', 'partnership', 'delegate power' and 'citizen control' at the very top. Arnstein's ladder has been persistently reviewed and updated by other academics. [27] stresses that this categorisation fails to take into account that there is no single "point of decision" in a planning process. Instead, there are many stages during which contributions can come: from setting the agenda, defining problems, collecting information and analyzing it, identifying and selecting possible options, to formal decision, implementation and evaluation. Therefore, if the level of participation is only determined by the degree of power over "who makes the decision", it ignores the benefits of other forms of influencing the outcome, such as dialogue and information exchange, which can be instrumental in the informal policy-making arena [19], and a sound pillar of democratic society.

A host of studies attempt to propose a typology of public participation, which can be valuable in understanding the scope and assessing the available methodologies or participation techniques [28, 29]. [30] propose a comprehensive five-level scheme of "intensity of participation", which can be adapted for the scope of planning as a practice. At the lowest level there is 'information', which is one-directional and aims at public outreach. It provides the background necessary for setting the agenda and on raising awareness of the problem. One step up lies 'consultation' (still one-directional), which seeks the input of participants, their knowledge and data, through surveys, interviews, discussions. On the third step we find 'cooperation', which is bi-directional, and involves the participants in a dialogue with each other to formulate common approaches, define issues, and select from available options. One level up there is 'collaboration', in which the scope is to co-design and co-develop in equal terms (eye-to-eye), in a democratic context. And, finally, there is 'empowerment' which aims at assisting participants to formulate their own ideas and carry out their own projects. Figure 1 shows this five-level scheme.

Fig. 1. Diagram 1. Five levels of intensity of public participation in urban planning and development. Based on [30].

Participatory planning, as a process that involves thinking about the common future, is an important tool for achieving sustainability, in all aspects: economically, socially, and environmentally. Participation in urban planning and management is included in the 17 Sustainable Development Goals, as part of Goal 11, Sustainable Cities and Communities. Target 11.3 specifies that, by 2030, the goal is to "enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries" [31]. The engagement of citizens and communities may also contribute to improving urban governance and ensuring more resilient responses to complex urban problems [32]. Through information and citizen participation, communities can build their capacity for environmental management in terms of local sustainability, while also contributing to global sustainable development [33]. The complexity of global problems we face today call for coordinated action at the local level. In view of the climate crisis, which is a result of human actions and choices, expansion of participatory budgeting into climate change mitigation and adaptation [34] is an important driver towards a more sustainable and resilient future urban development.

3   Platform Urbanism and Participatory Urban Platforms

Having discussed public participation in urban planning and development, we move forward to an overview of commercial and community digital platforms and the ways they (can) support collaborative urban design processes. In general, digital platforms constitute virtual environments that enable the delivery of digital products, services, and experiences. Typically, they comprise a set of technologies and tools that support digital interactions and transactions. Additionally, they provide an open, participative infrastructure for these interactions and they set governance conditions, in order to facilitate matchmaking, as well as the exchange of goods, services, or social currency [35]. Leveraging advances in technology, such as cloud computing, big data analytics, and artificial intelligence (AI), digital platforms deliver more personalized, efficient, and effective services. Lastly, especially with the advent of Web 2.0, digital platforms have been increasingly providing new opportunities for innovation and the creation of new business models.

The widespread use of platforms in different domains and functions of the city (e.g. [36–40]) has given rise to the concept of 'platform urbanism', which – as one of the latest developments of the smart city – is focused on the integration of platforms into the design, management, and governance of urban spaces. More specifically, it refers to data-centered and digitally-enabled socio-technological assemblages, typically performed on a platform, rooted in the urban system, which facilitate the emergence of new social and material relationships including intermediations and transactions [41]. Technology is at the core of the urban ecosystem: it enables information richness, capable of revealing the complex natures of urban interactions, but also negotiates new tactics, new players, new governance models and new interfaces for everyday interaction [2]. The 'ecosystem approach' highlights the diversity of multiple actors (governance, individuals, technology providers, etc.) that interact and are coordinated through the platform but, also, their constant evolution and adaptation across time and space, since platforms are never fixed entities [42]. Although urban platforms constitute generic templates that can be applied across various geographical scales and multiple urban environments, platform urbanism is deeply spatially configured. As the authors in [41] mention, "platforms function across space but are rooted in place", as they are built in specific urban realities and involve connections between spatially specific nodes.

Urban platforms can be defined as digital software and hardware-based interfaces that: (a) allow multiple users to interact; (b) support transactions being carried out in real time or near-real time; (c) are focused on the analysis, manipulation and (often-times) monetisation of digital data; and (d) affect the way urban life is conducted [43]. Examples of platform urbanism include smart city initiatives, for example, the Chinese CityBrain AI platform for urban planning and management [43]; corporate platforms, such as property rental and ride-sharing/-hailing platform services; and platform-based systems for urban governance and decision-making, where citizens can access and inform governance-related information and decisions. Overall, smart cities and platform urbanism can be considered complementary approaches to urban planning and management. Smart cities typically use technology such as sensors, Internet of Things (IoT) devices, and big data analytics to gather and process information about city operations, in order

to improve decision-making and optimize resource allocation, whereas platform urbanism is more focused towards utilizing digital platforms to support collaboration between city stakeholders. It is also proposed that while smart city initiatives are mainly focused on optimizing oversight of city systems through state procured "solutions," platform urbanism aims to transform the operations of city services that are usually geared to consumers or the market [44].

As already mentioned, smart city initiatives most often follow top-down approaches, with critical questions related to the role of citizens and the ownership of public and private data, arising. Indeed, researchers are increasingly pointing out the potential drawbacks of such approaches; for example, according to [45], citizens are frequently excluded from being meaningfully involved in the design, use, or appropriation of civic technologies, even though they are their main beneficiaries. Often, the "black-box" technology of smart cities reinforces a "a status-quo" where citizens remain outsiders [46]. In addition, it is also argued that smart city projects typically consist of only government, knowledge production and industry actors, often overlooking the role of citizens as equally important agents, and not only as "end-users" [47]. Furthermore, when citizens are only expected to contribute data to companies developing smart city solutions, they are transformed from participants to the *objects of control* of the strategies developed by smart city technologies [48]. On the other hand, citizens themselves are gradually becoming more informed and participatory on their own initiative; they claim democratic representation in policy making and governance and they generate innovative ideas [49]. In addition, they often demand direct participation as co-designers and active decision makers in urban development projects [50].

Ongoing discourse and scientific research have introduced new concepts regarding the active participation of citizens in spatial planning, policy-making, and service development. Such concepts include grassroots and open innovation, co-design and co-creation, and crowdsourcing, among others [49]. As mentioned in [51], under the umbrella term of "bottom-up urbanism", citizens all around the world carry out activities that can be considered as drivers for urban innovation; for example, "they revive an unused building into a community cinema, or organize street festivals". As cities around the world are facing a wide range of pressing challenges, such as climate change, public health in the face of the COVID-19 pandemic, socio-economic disparities, and aging infrastructure that has to accommodate growing populations, there is a need for more integrated, flexible, and adaptive urban planning strategies. Urban citizen projects, which are initiatives led or co-created by citizens in order to shape the design of their urban environments and create more livable, equitable, and sustainable cities, can be important tools for engaging communities and fostering innovation. Examples of such projects include: (a) parklets: small park-like public spaces built by communities to serve as gathering places; (b) community gardens: public spaces where people can engage in urban agriculture, created and maintained by communities; (c) placemaking projects: the creation, redesign or revitalization of public spaces so that they are attractive and usable for the community; and (d) pop-up projects: temporary initiatives that transform public spaces and promote community engagement. Such projects also play an important role in the sustainable development of cities, given the fact that urban open spaces

improve quality of life by offering multiple social, ecological, spatial, economic and health benefits [52].

In cases where urban platforms are concerned, the trend towards applying participatory design processes is growing, as cities seek to harness the collective wisdom of their citizens. Based on the pertinent literature, we categorized digital platforms that support participatory urban planning and decision-making in the following broad areas:

- Urban crowdsourcing platforms: Digital platforms that engage citizens in the planning and design of their cities, based on crowdsourcing, which constitutes a *distributed online problem-solving process that requires the participation of the crowd for the accomplishment of specific tasks* [39]. For example, there are urban design crowdsourcing platforms (e.g. Neighborland, Commonplace, Streetmix) and crowdfunding platforms (e.g. Spacehive, Voor je Buurt, Ioby). Citizens can gather and contribute data, e.g. by identifying city areas that need improvement, they can provide feedback, suggestions, and ideas on urban design projects, or support initiatives by investing in the urban projects that matter most to them.
- Urban data platforms: Digital platforms that gather, process, and visualize big data about city activities, such as mobility and transportation patterns, energy usage, air quality, and waste management, to inform urban decision-making. These can be urban analytics platforms, city dashboards, and city data portals. Examples include CitySense, Ride Report, Urban Footprint, and Urban Open Platform.
- Collaborative governance platforms: Digital platforms that support collaboration and decision-making between city stakeholders, such as participatory budgeting and citizen engagement platforms, where citizens can discuss and co-create urban initiatives, as well as directly participate in budget allocation decisions by voting on proposed projects (e.g. CitizenLab, Décider pour Paris, Decide Madrid, Decidim Barcelona); and smart city governance portals, which are online platforms that provide citizens with access to information and data about their cities (e.g. Open Data Barcelona, London Datastore, Helsinki Region Infoshare).

4 Presentation of Related Case Studies

In what follows, we present in more detail a few examples of digital platforms from the categories mentioned in Sect. 2, which are used as tools for: (a) informing stakeholders and increasing public awareness on various issues, and (b) engaging citizens and communities in co-creating more livable and sustainable cities. Afterwards, we suggest how they support the five levels of intensity of public participation in urban planning and development, as described in Sect. 2.

4.1 Urban Crowdsourcing Platforms

So far, crowdsourcing platforms have already been used in many diverse areas, from business projects to non-profit initiatives, and it has also been suggested that they could motivate and facilitate citizen participation in urban projects [39]. Indeed, there are many noteworthy examples of crowdopinion, crowdfunding, crowdcasting, and open innovation platforms. In this section we focus on two case studies harnessing the collective

intelligence of the crowd for eliciting citizens' perspectives on important urban issues, as well as devising innovative solutions.

Spacehive[1]: a community fundraising platform in the UK and Ireland. It works by allowing individuals, groups, and organizations to create a page about their project on the Spacehive website, set a fundraising goal, and invite the community to contribute funds. Projects can be related to various categories, including public spaces, community centers, and parks. If the fundraising goal is met, the project can move forward, and the funds are released to the project's creator. According to its website, Spacehive has helped crowdfund over 2,000 ideas and raised nearly £30 million to support local projects, which include climate change initiatives, new public places to improve mental and physical health, and spaces for young people. The platform has a partner network that includes councils, foundations and businesses that assist in funding projects that local communities want, so that they can reach their fundraising goals faster, and mitigates the risks and rewards that come with crowdfunding public projects by having publicly accessible projects and the involvement of public officials [53]. One important benefit of Spacehive is that smaller organizations (e.g. local initiatives, charitable projects) with limited budgets also gain access to significant marketing and networking possibilities [54]. Furthermore, on a crowdsourcing platform such as Spacehive, citizens and communities are given the opportunity to express their local viewpoint and propose projects which they believe that would benefit their neighborhoods, something that, in accordance with [55], can lead to citizen empowerment, by enabling the crowd to contribute to the definition of the problem and complement top-down urban governance.

Some examples of projects funded on Spacehive include the following: the Thames Head Energy, a community energy initiative aiming at helping residents reduce their energy costs and carbon footprint, and ultimately achieving NetZero, while raising money for the community[2]; the Peckham Coal Line, a community-led project to reconnect Peckham's neighborhoods with a new linear park, connecting communities, opening up business possibilities and creating new green space[3]; as well as an initiative to raise the money for a new, more environmentally friendly wind turbine for the Kielder Observatory[4].

Block by Block[5]: The Block by Block project is a partnership between the United Nations Human Settlements Programme (UN-Habitat) and the video game company Mojang (creator of the computer game Minecraft), and Microsoft (corporate parent of Mojang), aiming at integrating Minecraft into public space planning to get community members more involved. The idea of using digital games for developing community engagement has gained attention in the last decades, and "serious" games that aim to provide an engaging environment combined with pedagogical principles have emerged [56]. However, these tools are usually limited in their use in space and time and tailored for specific urban contexts [56]. On the other hand, the Minecraft platform provides an endless virtual world that players can appropriate according to their imagination. Further,

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[1] https://www.spacehive.com/

[2] https://www.spacehive.com/thames-head-energy-community-project

[3] https://www.spacehive.com/peckhamcoalline

[4] https://www.spacehive.com/kielder-observatory-wind-turbine

[5] https://www.blockbyblock.org/

being a very efficient and cost-effective way to visualize a three-dimensional space, in a format designed for rapid iteration and idea-sharing, it allows people to visualize and create models of their local environments, allowing for more effective and inclusive urban planning.

So far, the Block by Block Foundation has funded and activated dozens of public space projects in more than 35 countries around the world. The foundation's committee members evaluate proposed projects based on a range of detailed criteria addressing financial sustainability, partner capacity, and suitability for Minecraft, as well as project design, accessibility, economic impact, etc., and they select a wide range of projects incorporating diverse themes such as gender equality, climate change, accessibility, cultural heritage, social inclusion, etc. After, using GIS and satellite data, as well as photographs of the proposed work area, the workshop facilitators create models in-game that workshop participants can edit as they please [57].

For instance, the Municipality of Pristina was one of the first sites in Europe selected by UN-Habitat to test the Block by Block Methodology for upgrading public space[6]. The initial project focused on revitalizing a former green market in one of Pristina's largest neighborhoods and creating a multifunctional public space. The site's temporary market structures had been removed, leaving an abandoned, concrete-covered space that was rarely used by the community's 4,000 residents. More than 70 Pristina residents participated in a Block by Block Workshop to redesign the former marketplace. After initial discussions on urban design and the importance of public space, the participants formed small teams to model different solutions and co-create the final designs on a multiplayer Minecraft server. The final concept featured a range of facilities addressing the needs of various groups, including gardens, comfortable resting places, a playground, and a skatepark. The 17 team proposals and the final concept were used as the basis for detailed architectural designs.

Several other projects have been implemented across the globe, including the use of Minecraft to crowdsource ideas for the redesign of Plaza Tlaxcoaque in Mexico City, in which 7,429 young people participated and 1,438 ideas were submitted[7]; a workshop in which residents designed a park in Jianghan district, one of the most populous industrial regions in Wuhan, China[8]; and a three-day workshop involving 50 resident youth in the design of a community garden in Wadi al-Joz, East Jerusalem, Palestine[9].

4.2 Urban Data Platforms

Urban data platforms crowdsource data and provide insights into various aspects of urban life, such as transportation, housing, environment, energy usage, air quality, and more, in order to inform decision-making around urban planning and policy. A common way to showcase this data is with city dashboards, which provide access to data visualizations from public or private service providers, relevant to a city's performance against selected indicators [2].

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[6] https://www.blockbyblock.org/projects/kosovo

[7] https://www.blockbyblock.org/projects/mexico

[8] https://www.blockbyblock.org/projects/wuhan

[9] https://www.blockbyblock.org/projects/palestine

There are many urban data platforms, which typically collect, process, and analyze big data from a variety of sources to provide insights into urban systems. An example of such platform would be UrbanSim[10], an open source platform supporting land use, transportation, and environmental planning and analysis. It integrates a range of data sources allowing users to customize models and parameters to match local conditions. UrbanSim has been used to model and simulate urban development patterns, assess the impact of proposed policies, generate forecasts for future scenarios, as well as engage the local communities by making models more tangible. It has been applied to cities and regions around the world, including cities in the United States, Europe, Asia, and Australia. Another urban data platform is UrbanFootprint[11], a proprietary web-based urban planning software that helps city officials, developers, and designers make informed decisions about the built environment. The platform provides data-driven insights and visualizations for urban design, land use planning, transportation, and sustainability. Users can access a variety of data sets, including demographic, economic, and environmental data, to help inform their decisions. The platform also provides collaborative tools for sharing and analyzing data, making it a useful resource for public engagement and community involvement in the planning process.

Regarding any urban data platform research projects, an earlier example would be the 'CityDashboard'[12] platform, which was developed by the CASA research lab at the University College London (UCL). It aggregates simple spatial data for cities around the UK and then displays this data on a dashboard and a map. Lastly, the Urban Open Platform (UoP) is a research initiative originating from the European Innovation Partnership on Smart Cities and Communities (EIP SCC). It comprises a collection of smart city services that communicate internally and externally with harmonized APIs, using open standards and widely used technologies and software, which make it easy to develop and integrate with. Its aim is to support not only data acquisition but also various types of data processing: data is aggregated, processed, manipulated and extended within the city context. The platform was validated with 10 real-life urban use cases in two European capital cities, Helsinki and Tallinn [58].

4.3 Collaborative Governance Platforms

Digital platforms for urban democracy facilitate citizens in: (a) expressing their opinions about developments, plans and policies to city authorities, (b) debating urban issues, and, (c) taking part in participatory city budgeting [59]. It is argued that these platforms have been introduced and advanced within a discourse which contrasts the notion of the smart city, by promoting open-source, commons-based democratic approaches instead of using closed and proprietary software services for e-participation [59]. Two prominent examples of such platforms are Decide Madrid and Decidim Barcelona, which are described in more detail in what follows.

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[10] https://www.urbansim.com/
[11] https://urbanfootprint.com/
[12] https://citydashboard.org/

Decide Madrid[13]: Decide Madrid is a collaborative governance platform launched in 2015 by the Madrid City Council in order to engage the public in decision-making. Built on the "Consul" open source software, it aims at ensuring the transparency of government proceedings and to increase public participation in council decision-making and spending processes. Currently, Consul is being used by over 130 institutions in 33 countries, mostly cities and regions [59].

The citizens of Madrid can engage with the local government through the platform, in the following ways:

- Participatory budgeting – citizens can make spending proposals for city projects
- Proposals – citizens can shape government actions by directly proposing and supporting ideas for new legislation
- Consultations – citizens can vote on council proceedings
- Debate – citizens can deliberate on various issues so that the local government has access to the public opinion

An important aspect of the platform is the support for local participatory budgeting: citizens can submit proposals (which are analyzed by city council officials), support by voting the proposals they like (both for city-wide projects and for district-level projects), and vote on final projects after they are presented with estimated costs and overall budgets. According to [59], the first budget in 2016 opened €60 million to citizen proposals; it attracted 5,184 proposals, on which 22,389 participants cast 168,111 votes. Further evaluation and voting led to 206 selected projects that were funded, including tree-planting in the city, facilities for recycling, green routes interconnecting the city, etc. Another successful Decide Madrid project was the remodeling of the city's Plaza de España in 2017, in which 26,961 citizens actively participated by making and voting on proposals[14]. The winning project, named "Welcome Mother Nature, Goodbye Mr. Ford" was voted by more than 52% of the participants[15]. The main focus of the winning proposal was to prioritize cyclists and pedestrians, reduce car traffic around the square by diverting it underground, and increase greenery, by planting over 1200 new trees. The remodeled square also includes children's playgrounds, a park for the elderly and routes to view the archaeological finds that have come to light during the work.

Decidim Barcelona[16]: Similar to Decide Madrid, Decidim Barcelona is a collaborative governance platform built on open source software. It launched in 2016 aiming at elaborating Barcelona's municipal strategic plan, which defines objectives and actions to be carried out by the local government during the current legislature, with the participation of the citizens [60]. Using the platform citizens can (among others):

- Consult the open participatory processes
- Take part in debates (make new proposals, debate/comment on existing proposals, support or share through social media)

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[13] https://decide.madrid.es/

[14] https://involve.org.uk/resources/case-studies/decide-madrid

[15] https://decide.madrid.es/proceso/plaza-espana-resultados

[16] https://www.decidim.barcelona/

- Track proposals (those that began on the platform and those generated at face-to-face meetings)

According to [61], the platform increased the transparency of information leading to better accountability and result monitoring, and also managed to incentivize citizens to collaborate around key issues. There has also been an increase in participation and proposal deliberation towards the municipal strategic plan of Barcelona [61]. During a two-month process of co-production, more than 40,000 citizens discussed and supported proposals made by the government, and also made their own proposals for the strategic city plan [60]. The Decidim Barcelona platform has been used to crowdsource citizen proposals and opinions on a number of projects[17], such as the design of the new green area in Bon Pastor's "Cases Barates", the development of the Action Plan for the Parc de Montjuïc, the development of the strategic plan for the city's coastal areas, etc.

As already mentioned, urban platforms are developed as generic "socio-technical assemblage templates", with the capability of using them across different local contexts [41]. As with Decide Madrid, several other platforms were also built on the Decidim open-source platform for participatory democracy used by Decidim Barcelona. An example is OmaStadi[18], a participatory platform in Helsinki, Finland, which allows residents to propose and vote on ideas for urban development and improvement. The first round of the OmaStadi project was piloted between 2018–2020 by the city of Helsinki, as part of its efforts to increase citizen participation and engagement in decision-making processes related to urban planning and development. The platform was open to all residents of Helsinki as it was designed to make the city's decision-making processes more transparent and accessible to the public. The evaluation results of the project were rather positive, as it emphasized direct participation and online democracy [62]. According to the Omastadi website, the platform has been used to crowdsource over 6,000 ideas from citizens and has been successful in promoting collaboration and participation in the planning process. The city government has also been supportive of the platform and has incorporated citizen ideas into the urban planning process. The implemented projects range from using renewable energy sources for illuminating parks and streets, to planting more trees and flowers in the city, and adding more benches, lamps, and bins to prevent littering.

So far, we have presented a number of cases where participatory urban platforms have been used along with formal planning procedures and routines embedded in cities. We argue that these platforms hold significant potential for engaging citizens and communities in co-creating more livable and sustainable cities, by providing feedback on urban design projects, supporting various initiatives, or even proposing their own solutions; thus, they should not only be viewed as ecosystems of value extraction but also as tools with a great potential for connectivity, exchange of knowledge, and for raising awareness on important issues. Additionally, acting as generic templates, they can be (re)used in multiple urban contexts and environments (as in the case of the Consul software) and be iteratively improved.

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[17] https://ajuntament.barcelona.cat/digital/en/digital-empowerment/democracy-and-digital-rights/decidim-barcelona

[18] https://omastadi.hel.fi/

However, the level of citizen engagement varies according to the platform's architecture and capabilities, as well as the level of integration of the platform into the formal planning procedure. Concerning the levels of public participation in urban planning, as described in Sect. 2, we suggest that urban data platforms, such as urban analytics platforms, city dashboards, and city data portals, correspond to the lowest level ("information" level), providing one-directional information aiming at public outreach, or at the "consultation" level, as they gather big data in order to inform policies and to increase public awareness and engagement with urban data. Participatory governance platforms that support collaboration between city stakeholders can be categorized in the third level ("cooperation" level), as this level involves the participants (e.g. citizens and city authorities) in a dialogue with each other in order to define issues, formulate approaches and decide on solutions, or, in certain cases, in the "collaboration" level, as all involved stakeholders co-create solutions in equal terms, following democratic processes. Crowdsourcing platforms, such as Spacehive, where citizens identify local problems, propose their own ideas on urban design projects, or support initiatives by investing in urban projects, can be placed in the "collaboration" level. Finally, concerning the last level of participation, ("empowerment" level), we believe that initiatives such as Block by Block could have the potential to support participants in formulating their own ideas and projects. Nonetheless, we argue that the empowerment level in the urban platform context would mean that citizens themselves can self-organize in order to develop open, neutral, and transparent urban technologies, or appropriate technological tools to meet their needs, by following genuine bottom-up approaches [1].

5   Conclusions

In this paper, we argued that the introduction of digital technologies in urban planning processes and the use of digital platforms under the platform urbanism framework could facilitate the twin transition of urban areas. This can be done by dealing with three main drawbacks of urban planning; first, urban planning is an urban policy domain that is relatively rigid, embedded in the institutions of each area. This creates obstacles to the development of scalable solutions, leaving room only for softer retrofitting solutions, sometimes with the addition of a digital layer. Second, although citizen participation in urban planning has been discussed for quite a while, it has not been practiced. As shown in our analysis, digital platforms are mostly used for relatively simple activities and functions, such as information-exchange, consultation, cooperation, etc. and much less for more complex ones such as co-design. Third, there is a significant time lag between urban planning formulation and implementation.

However, green transformation and response to environmental crises urge us to view urban planning as a mission-oriented strategy, that allows the participation of different actors, enables bottom-up experimentation and seeks societal transformation. The emergent complex and co-generative dynamics between platforms and the urban space can lead to the transformation of place- and space-based social worlds and provides a great opportunity to renegotiate the "urban" and to shape new visions of the city. Platform urbanism is characterized by dynamic networks involving different actors [41] which are hybrid and ephemeral; they can appear out of nowhere when there is a specific

need but can also withdraw when the demand has fallen. We also believe that platform urbanism could be a useful framework for shaping urban planning towards the goals of the New European Bauhaus Initiative, an EU launched, creative and transdisciplinary movement that aims to connect the European Green Deal with the living spaces based on mission-oriented innovation, participation and creative contestation [63].

Furthermore, we explored the role of participatory urban platforms in effectively disseminating knowledge, engaging citizens, and raising public awareness. Even though these platforms contribute significantly in bringing people together, they are still challenged by various issues and critical questions. For instance, an important issue, also common in smart city initiatives, is participation bias and the platform's accessibility and inclusivity with regard to the digital skills of users [64]. Also, the discussion regarding platform urbanism often revolves around the notion of the *platform-as-a-company*, which generates private value from coordinating different networked actors [65]. As profit-driven, commercial platforms mediate main activities of daily life, many concerns regarding the politics and accountability of these socio-technical systems, arise [66]. Based on the findings of this paper, we argue that participatory urban platforms can support and engage citizens in co-creating more fair, livable, and sustainable cities. Nonetheless, there is a need for further research into the platform technology and attributes (e.g. openness, transparency) that can lead to citizen empowerment, as well as into frameworks and methodologies that could facilitate the successful incorporation of such platforms in bottom-up, citizen-led initiatives, and, subsequently, connect these to effective urban policy.

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