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Enabling citizen participation with the planning support system: Empirical evidence from crowdsourcing greenway planning

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Abstract: Urban greenways are closely related to public interests, such as outdoor recreation, environmental quality, and public health; thus, public participation is regarded as one of the key strategies for effective greenway planning. The recent development of the communicative Planning Support Systems (PSS), which are GIS-based platforms for supporting planning tasks, has provided new opportunities for the public to give feedback, communicate with decision-makers, and contribute to optimal greenway planning outcomes. This research explores the enabling factors of PSS exemplified by the Wuhan Crowdsourcing Planning Platform, which was first experimented with the municipal greenway planning program. Through in-depth interviews and platform information, we find that the user-friendliness of the platform, the awareness-raising and mobilization of citizens, and the process management are the three most important factors that enable the acceptance and application of the platform.

Keywords: urban greenway; planning support system; user-friendliness; mobilization; process management

1. Introduction

While the theoretical debate in urban planning had shifted from a top-down approach to collaborative planning (Innes and Booher 2018), many challenges persist in public-involvement processes. Collaborative planning emphasizes extensive engagement and communication among stakeholders, which could be very time-consuming and expensive. Arnstein (1969) lamented that given all the challenges, public participation may remain an empty ritual and do not result in real efficacy. In a digital era, the participatory process can be facilitated by planning support systems (PSS), namely a GIS-based platform to facilitate planning tasks such as information sharing, communication, and analysis in planning processes (Vonk, Geertman, and Schot 2005). A digital PSS allows distant contacts and online participatory process management (Hanzl 2007).

Nevertheless, PSS as a new product is in the process of experimenting for many local governments (Hanzl 2007, Brabham 2009). Both technical and managerial strategies are required before such platforms can play important roles in planning. PSS, including the crowdsourcing platforms, have recently been applied in greenway planning in the Chinese context. Digital participation is in line with the transition of Chinese urban planning from a top-down approach to a more participatory approach. Early greenways in Chinese cities were planned more for ecological protection of agro-production or city beautification, with little concern for human uses (Yu, Li, and Li 2006). Greenways were usually developed along with river systems, transportation corridors, or even farmland for wind protection. In this sense, a top-down approach to greenway planning in a short period could be effective under a centralized administration, even with limited public involvement (*ibid.*). Nevertheless, this approach proves less efficient with the speed-up of the urbanization process. With the urban population increasing from 15% before 1980 to 64% by 2020, land use in cities intensifies, and urban greenspaces including greenways are supposed to provide more recreational functions, such as cycling and hiking. This entails to understand the needs and

preferences of citizens in greenway planning. The recent development of PSS thus provides new platforms for citizen engagement.

This research examines PSS-based greenway planning in the city of Wuhan, China, and attempts to understand what kind of factors influence the successful application of a PSS. Wuhan aims to provide citizens with accessible, inclusive, and ecological greenways. In traditional planning, given the regulatory or technical constraints, the planning agency usually informs citizens of the official decision regarding the plans or asks for public opinions at the final stage. Communication is usually one-way and official responses to public comments are not ensured. Citizens have limited capacity to influence the final decision, and may not support the plans. The Wuhan Natural Resource and Planning Bureau (“Bureau”) was not satisfied with the results of the traditional planning, and experimented with a new PSS, the Wuhan Crowdsourcing Planning Platform, which is also the first of its kind in the nation, towards better planning outcomes.

2. Literature review on planning support systems

PSS provides new digital forums for public participation and stakeholder communication in urban planning. However, there have been some bottlenecks that impede the widespread application. Vonk, Geertman, and Schot (2005) find that the lack of awareness and experience of PSS, as well as the low recognition of their value and benefits within the planning community, prevent PSS’ extensive adoption in planning practices. It entails efforts to disseminate more profound information and knowledge about the availability and functionality of PSS to stakeholders. Based on existing literature, we focus on three key factors enabling the application of PSS, including the technical, the awareness, and the management aspects.

The technical aspect

A PSS is usually based on GIS and integrates many applications such as Sketchbook Pro or Google Streetview (Pelzer et al. 2014). To support citizen participation, organizers must clarify the exact scope of the proposed development, make all necessary data available, and detail the requirement of planning calls (Brabham 2009). They need to define the problem clearly, which would form the basis of a participatory call. Organizers must also clearly stipulate the uploading format of the public’s solutions. A specific set of guidelines for written comments, or a clear template for participants to work within, would be ideal. If the city wants to see where citizens want the parks or how they desire the shapes of roads, a simple base template could be offered. While these issues may seem rather trivial in nature, negligence in any aspect may cause inconvenience in platform use and decrease users’ interest in this new technology. PSS should be user-friendly, i.e. they are easy to be used by laymen and thereby allowing to engage of a large number of citizens in the participatory process (Lin and Benneker 2021).

The awareness and mobilization aspect

In a top-down approach, the government is sometimes unconscious or unwilling to include the public in decision-making (Arnstein 1969). However, in other cases, the public is hesitant to engage in public affairs. The public may be intimidated by the official authority, legal jargon, and the possible futility. For instance, the presence of interest groups representing some facets of the public interests may discourage the public’s engagement with charts and maps, and the provision

of local knowledge (Hibbard and Lurie 2000). People may not be interested or not want to engage, because they lack time, feel underrepresented, or delegation through voting is enough to guarantee their needs. They may worry that they will not have an actual influence on decision-making and policymakers (Brabham 2009). Without real engagement, they simply accept the decision and support the agency's proposal. The U.S. planning agencies had to rely on nonprofit community organizations, especially community development corporations, to facilitate resident participation (Arnstein 1969).

Internet-based PPS are new to many people, the planning agencies need to inform the public about the availability and the advantages of digital participation. Ideally, all citizens, regardless of their sociopolitical status or education, would have the opportunity to participate, so long as they have access to the internet. Through online platforms, participants can keep anonymous if they prefer (Brabham 2009). This can greatly minimize the negative impact of pitfalls in a traditional way of public participation. The public will realize that when their voices are spread online, they can hinder other powerful stakeholders' discursive dominance; online communication can also reduce the above-mentioned disadvantages that surfaced in in-person public meetings (Campbell and Marshall 2000).

The project management aspect

Strategic management is another important factor to engage the public. The planning process includes several stages, such as problem/stakeholder identification, organization, education, negotiation/resolution, and implementation (Innes and Booher 2018). For different stages, different managerial strategies are needed. For example, a questionnaire survey may be used to understand the problem at the assessment stage, co-design may be applied at the negotiation stage, and an evaluation survey may become necessary to learn about the experience or lessons from the projects. While the process is based on the online platform, new strategies are required to marketize the new application. Brabham (2009) suggests that aggressive public plans should be carried out before launching any crowdsourcing project. For instance, it is important to draw an initial rush of users to the crowdsourcing platform to get the online community started. For a new platform, managers may even consider feeding the project in interest with existing solutions that appear to have been submitted by users and include staged comments on bulletin boards (Brabham 2009). From the users' side, planning professionals will evaluate a PSS's usability, namely how the platform may satisfy their professional's demands (Zhang et al. 2019); while the public is concerned about its usefulness, namely how this platform may meet the public's demands (Vonk, Geertman, and Schot 2005). Therefore, both professionals and the public will consider to use it only when they see its value.

3. Methodology and data collection

In 2015, Wuhan initiated the East Lake Greenway Development Program, which was developed in four phases with a total length of 102 km. Upon completion, the six-meter-wide greenway, winding along the lakeshore of the 33-hectare East Lake, becomes one of the most popular city landmarks (Fig. 1). The number of greenway visitors increased from 94,000 to over 10 million in just two years, leading to substantial job creation and local economic development. In 2016, the Wuhan greenway program was listed as the UN-Habitat demonstration project for China's urban public space improvement. Wuhan greenway program features extensive public participation

through the new crowdsourcing planning platform.

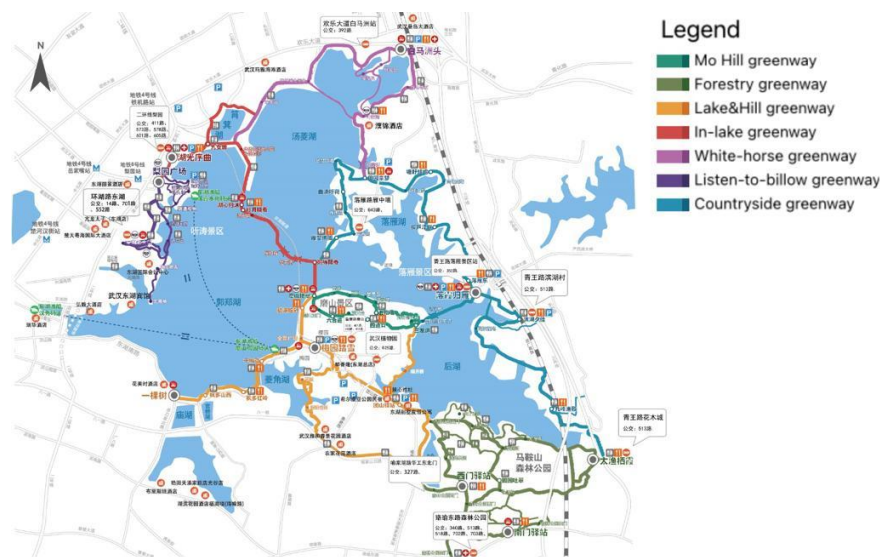


Fig. 1 Map of East Lake greenway in Wuhan (Adapted from <https://www.donghulvdao.com/>)

Data collection focuses on the enabling factors of citizen participation in this platform from the aspects of technical preparation, awareness-raising, and process management. For crowdsourcing projects, the government always wants to expand project influence as much as possible. Accordingly, substantive information is released in official documents, mass media coverage, and social media interaction. Semi-structured interviews with the key stakeholders were conducted as well. We asked the platform administrators what kind of measures were taken to overcome the challenges regarding developing and operating a new digital planning platform; the professional planners’ perception and use of this platform; the public experience of using this platform to express opinions and their daily use of greenways. We also collected information from the crowdsourcing platform and reviewed the questionnaire distributed by the Bureau.

4. Results

The development of Wuhan’s crowdsourcing planning is a trial-and-error process; the East Lake greenway program is the first pilot project of this platform. The Bureau established an ad hoc working group to work on this platform, including platform preparation, citizen mobilization, and process management. The interviews show that the ad hoc group developed strategies to make the platform operate smoothly (Table 1). When the greenway program first planned through this platform proved effective and satisfactory, the platform was further applied to other urban projects. During 2015-2021, in addition to the greenway program, dozens of other urban projects were launched through this platform as well.

Table1 Strategies to experiment with a new planning support system

Enabling factors	Measures
Technical preparation	-Planning data collection and publicity on the platform -Onsite PSS demonstration -Inviting the public for a pre-test of the PSS

	-Rules of participation
Awareness raising and mobilization	-Collaborate with media to improve the visibility of planning calls -Incentives for public participation -Two-way interaction with participants
Process management	-To start with an easy project -To differentiate participation steps and allow citizens with different levels of knowledge to contribute -To materialize PSS's benefits in a short period

Source: by authors

4.1 Technical preparation for the platform

The interviews show that the ad hoc group made extensive preparatory work, including data publicity, pre-test, demonstration, and rule clarification to ensure that the platform is user-friendly. All necessary supporting data for the greenway planning call are uploaded and embedded in the platform. The ad hoc group and planners from the Bureau conducted extensive field investigations to collect basic data, took pictures and videos of the East Lake to make 360° street views, and displayed relevant scenarios. Data such as the base map, lists of businesses in the area, and locations of parks, were made available, too. The public can see the latest road situation and the surrounding buildings by clicking the videos or pictures.

Highly technical data must be made easy to understand, such as roadway dimensions, traffic flows, and municipal regulations and codes (Brabham 2009). Information presented to the public should be free from jargon and professional formation (Hanzl 2007). To ensure that the platform can be easily used by the public, platform developers invited some citizens to do pre-tests and improved the functionalities according to pre-testers' feedback, such as to improve the platform's information visualization. The Bureau launched an onsite demonstration to introduce this digital platform and to encourage the public to engage in planning using this platform (Zhang et al. 2019).

The platform has five technical sections: the drawing tools, the editing tools, the mapping section, the save button, and the instruction section. The public can draw the main and secondary greenway trails on the platform or locate facilities, such as parking lots, greenway entrances, and rest stations on the map by using the drawing tools. Citizens can also vote and communicate on the bulletin board of the platform. The rules of participation are also made clear, such as users' submitted planning schemes will be reviewed by the planning officers, winning plans would be owned by the Bureau and put into implementation. Winning participants would be rewarded with either cash or various in-kind prizes, such as phone credit.

4.2 Increasing program visibility and mobilizing stakeholders

A large participant base is a precondition of successful PSS. The objective of improving program visibility is to mobilize potential users, which includes citizens, professional planners, and private developers. Although the planning agency calls on public participation in a PSS, it can be difficult to get stakeholders involved (Hanzl 2007). This would be more so in a society where public involvement in state affairs is less a norm. The public used to remain silent in the urban planning process. Crowdsourcing planning is a new approach not only for the public but also for private developers (who have new projects that need to be planned) and professional planners, so it is very

important to increase the visibility of both the platform and the planning calls.

Through interviews with platform administrators, we understood that the Bureau took three different measures to mobilize the stakeholders. First, the ad hoc group tried to attract more projects to put on the crowdsourcing platform. While most city-level planning projects are administrated by the Bureau, many smaller ones at district levels are usually commissioned by responsible institutes directly to their planning partners, with limited public participation. The ad hoc group visited district-level planning agencies, planning companies, and private developers one by one. They asked them to try out the platform and put their projects on the platform or invited professional planners to use this platform. This was initially a slow marketing process but sped up after the first one or two project calls proved successful. Second, for each new project call, the Bureau collaborated with the local mainstream media, to publicize every crowdsourcing call and enthusiastically invite citizens to contribute. The Public's feedback can also be submitted via these media channels. This proves an efficient way to let the public know about the platform and the calls. The platform also developed its own WeChat public account to release information. Finally, the Bureau organized influential activities to mobilize the public and instill a sense of "greenway for public health". In November 2015, the Bureau sponsored the First Greenway Planning Jog for Health, which was routed along a 12 km-long greenway. Over 200 citizens joined the Jog activity. To encourage extensive participation, participants were awarded a suite of sportswear, and the cheering squads were given scarfs as souvenirs. The Health Jog improved the public's experience and sense of the urban greenway.

4.3 Strategic process management

According to Brabham (2009), if a planning project in question can be framed clearly, and if all the relevant data can be made available, then the problem can be crowdsourced. However, it still requires strategic process management in order to maximize the outcome. Through the interviews and online information, we identified a four-stage incremental participation scheme for the platform. Each project is flexible to include these stages based on the characteristics of the project; the public can choose which stages to participate in per individual knowledge and interest. In each stage, the ad hoc group publicizes the planning call through local media and the WeChat account and interacts with the engaged public online. Appropriate incentives and awards were also applied.

(1) Public consultation through online survey questionnaires

This is the easiest stage with the least time and professional knowledge requirement from participants. As the platform administrators told us, they published a questionnaire on the platform about the public's preference for the construction of new greenway facilities, including a Smart Greenway Panorama Exhibition Center, and Thematic Rest Stations with different themes such as Lego, Children's Picture Book, and AR-man. The public's preferences help decision-makers to decide whether to implement these facilities or not and how to implement them. Every citizen, regardless of age, education, occupation, and residence can contribute based on their local knowledge and living experience. Organizers prepared 100 lucky-draw gifts to encourage more responses. Finally, 508 questionnaire responses were collected, and 265 planning comments were received (Zhou 2016). Numerous comments were collected as well, such as taking greenway safety into consideration in planning, separating the greenway section cycling from the section of walking, and improving lake water quality (Niu 2019).

(2) Citizens assist in planning

This stage is to ask participants to use local knowledge and personal experience to draw online greenway routes and to locate amenities and facilities, including entrances, parking lots, rest stations, shops, and bike rental. On the platform, participants can draw the greenway routes along with the desirable sites, make comments on why the greenway should be located there, and explain the main functions of the drawn greenway. Participants can also use dots to show the desired location of facilities and explain why they should be there. This step results in 1,686 planning schemes, which were then integrated into hotspot maps and heat maps as references for the routes of greenways and placement of facilities. According to an interviewee, if one place was spotted by most participants, which means a strong public preference for the location, then the planning department should take this into consideration. While these routing and siting work are seemingly quite easy to complete, they decide the greenways' accessibility and usability.

(3) Professional public as planning partners

This stage is targeted more at the professional public, including planners from private firms or university students/teachers. This is also the most challenging part of the participatory planning, which involves detailed design for important nodes including landscape hotspots, rest stations, and facilities along the greenways. Such designs usually require professional knowledge and skills, or experienced planning & design software use, such as AutoCAD and Sketchup. Participants need to submit the final solutions either hand-drawn or exported from professional software with detailed specifications. Every submitted plan was reviewed, evaluated, and became an important reference of final planning. Given this is the most challenging step, the excellent plans would win a cash bonus of 500-5,000 RMB.

(4) Continuous participation

While the above three stages have clear deadlines, this final one is a continuous and dynamic process. Following the previous three stages, the working group summarized all the submitted questionnaires, comments, and plans. Those non-spatial data were transferred into spatial data and uploaded onto the platform to represent public opinions. For instance, the route heatmap was integrated into the final map, per the public's opinions, the center of the overall East Lake greenway system was finalized (Niu 2019). Moreover, as the greenway program proceeded, the working group informed the public of the program process, the new challenges and problems that surfaced in the implementation process, and the calls for the public's continuous comments and solutions. The inquiries included transport organization, whether road sections should be auto-free or not, etc. Thus, the crowdsourcing process becomes a continuous process and public inputs can always be used for future planning improvement.

4.4 Crowdsourcing planning as an effective approach to greenway planning

Since the platform's establishment in 2015, not only greenway projects but many other urban projects have been planned through the platform. The first project - Greenway Phase I - was launched in January 2015. This premiere project obtained extensive attention and appraisal (Zhou 2016). Two years later, Phase II was also planned through the platform. According to the construction company, the Wuhan Real Estate Group, they received so many good suggestions in

Phase I through crowdsourcing, so for Phase II as well as for other related projects, they will continue to use this effective approach. One member from the ad hoc group suggested that when the first project was proved feasible and successful, more institutes became willing to put their projects on the platform and more planners had responded to the Bureau's calls to participate.

Crowdsourcing increased the chance of interdisciplinary knowledge exchange (Pelzer et al. 2014). In the East Lake Greenheart plan scheme, the first-prize proposal was submitted by a netizen from Shanghai, who was a senior professional in hydrology. Although not a citizen of Wuhan, he was excited to have this opportunity to contribute his knowledge. He did lots of research and created very detailed and practical schemes regarding water governance, water knowledge, water recreation, and even water disaster. According to the Bureau, this excellent proposal would be integrated into the development of Greenway Phase III.

Crowdsourcing planning changes the planning paradigm from outcome-oriented to process-oriented. Traditionally, the Bureau often consigns the projects to planning professionals, invites experts to review them, and decides the final schemes. Overall, dozens of professionals/experts contribute knowledge to the planning project. In a crowdsourcing approach, the planning process becomes more complex with the engagement of numerous citizens, so communication and coordination become more important. However, both decision-makers and the public are more satisfied with the planning deliverables. According to one member from the ad hoc group, the successful experiences also encourage the Bureau to institutionalize this mechanism in the near future, which will stipulate that public planning projects must be planned through a crowdsourcing planning approach.

5. Discussion and conclusion

Crowdsourcing planning is a win-win approach. When the planning process is moved online, the government can provide better public services with lower costs by convening collective intelligence, while the public is empowered to provide feedback and co-design for themselves and enjoy improved public services. Both technical advancement and management strategies facilitate the materialization of such benefits.

For a new PPS, good entrepreneurship and public mobilization help improve the participation level from *being informed* to *co-creating the public service*. Marketing activities, like organizing a greenway health-run, and inviting institutes to use the platform, entail officials' dedication to convincing the stakeholders to engage (Lu et al. 2020). Public participation can be expanded both spatially in extent and temporally in depth. Spatially, in contrast to the traditional public participation, where only a few local people may involve and contribute, the online planning platform allows for extensive and inclusive participation: everyone who gets access to the internet is qualified to participate. For Wuhan's crowdsourcing planning calls, participants are from not only other cities but even from overseas. Temporally, the public can participate at the very beginning of the planning process rather than just being informed at the final stage. When thousands of people's preferences or voices for a project are conveyed online, it has much more potential to influence government decisions. The big data derived from the platform, such as selecting the sites of greenway entrances and parking lots, and broadening the road width in popular areas, help planners better allocate resources based on the majority's preferences.

In crowdsourcing planning, a user-friendly platform with sufficient information release serves as a precondition of effective public contribution. Previously, the government usually informs the public of the results of a planning decision with limited information or data released. Even if citizens want to contribute, their proposals or comments may be superficial or not practical to influence governmental decisions (Brabham 2009). Yu, Li, and Li (2006) contend that under traditional planning, the scales and locations of the greenway development are more arbitrary than basing on the scientific analysis given the difficulty to pool collective intelligence. For online planning, when both general and professional data are available, the collective intelligence pooled through the internet can harness far-flung interdisciplinary talents. For instance, the Shanghai senior hydrologist contributed his expertise in water management to greenway planning, which would be less possible in a traditional approach, as most planners have an urban-planning background, and interdisciplinary work is not the norm. In crowdsourcing planning, local knowledge, individual experiences, and interdisciplinary expertise contribute to sound planning. Of course, collective intelligence may also include some bias. For the survey questionnaires, thanks to the incentives applied, many retired people actively responded; yet, the young or middle-aged constitute only a small part of respondents given their busy work. So administrators still have to be careful when taking advantage of the knowledge pool.

Appropriate process management with observable improved outcomes also proves vital to the sustainability of a PSS. Pelzer et al. (2014) find that the added value of a PSS is to improve communication and collaboration among stakeholders, while a better-informed outcome is less important compared with the process. We would suggest that both the process and outcome are important for a pilot PSS. For experimental programs, it is advisable to choose the right starting project that the public is familiar with, and the influence of public participation can take effect quickly. Wuhan's greenway program is a case in point as "the public is happy with this project" and "this project can be finished within a short time frame" (Zhang et al. 2019, 213). The East Lake area is a popular resort and the city's name card, and citizens are willing to contribute to this program. Meanwhile, this first project, Phase I of the program, was expected to be completed within 1.5-2 years, which implies the outcome of citizens' input would be landed soon and bring participants a sense of achievement. Otherwise, people may lose interest and patience and become reluctant to respond to the next planning call. According to Arnstein (1969), early in the 1960s, residents in ghetto neighborhoods got annoyed and even asked for a fee to participate given the frequent questionnaires and interviews about their problems, yet their problems were slow in solving. To start with a simpler task, organizers can build momentum that can be carried through to the future more challenging planning tasks.

Crowdsourcing platforms prove a promising tool to plan projects with extensive public interests, such as greenways, parks, or other landscape resorts. As shown in the Wuhan case, the skyrocketed annual greenway visitation testifies to the success of this crowdsourcing approach. Practically, it provides better quality public services with relatively lower costs; theoretically, it empowers the public to influence governmental decisions and facilitates a democratic planning process. However, as a new technology, it entails user-friendly platform preparation, skillful public relationship, and strategic process management to fully realize the benefits of a new planning tool.

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