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Practical Research on Mixed-PPGIS Promoting Public Participation in Urban Micro-Public Space Renewal †

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Abstract: Based on the public participation geographic information system (PPGIS), the research platform is designed to facilitate and provide a basis for public participation. The platform includes the application of three core links: information acquisition, planning participation, and decision-making participation. To solve the problems in the planning and design of the micro-public space in China's urban and rural planning system, the renewal practice of the micro-public space in Jimei College Village, Xiamen, China was used as a study case to explore how the mixed-PPGIS can be applied to micro-public space renewal by promoting the realization of "public participation". The research results show that the mixed-PPGIS is a combination of technical methods that leads to the improvement of bottom-up participatory planning. At the same time, the importance of "people" in the mixed-PPGIS construction was emphasized.

Keywords: mixed-PPGIS; micro-public space; Jimei College Village; renewal

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1. Introduction

A micro-space refers to a specific space available in daily life from the perspective of geography. The concept of the vest-pocket park, the neighborhood park, and the pocket park was subsequently applied to the micro-public space [1]. Marcus and Francis described humanized space in which public spaces serve users at different times, ages, and habits [2]. Definitions of an urban micro-public space vary according to its size. The scale of urban micro-public space is usually small, ranging between 300 and 5000 m^2 with several types including street parks, small-sized squares, community parks, stadiums, and others. Its main function is to be present in the residents' daily lives. Micro-public spaces with frequent use are mostly located in areas with excellent accessibility and large demands and requirements of residents [3].

Various problems exist in the planning and design, construction, use, and management of micro-public space due to the lack of responsibility of the personnel working in the current urban and rural planning system. Dong et al. described the planning and design principles of urban micro-public space as "embedding, fixing, and public participation" [3]. Comprehensive research and in-depth analysis of the major issues for micro-public space have been conducted only by a limited number of professionals. Many scholars have proposed renewed practices of micro-public spaces, combining digital participation platforms.

In the Zhonggulou District of Beijing, China, the Zhonggulou community public participation platform was combined with WebGIS and Baidu Map for the process of the reconstruction of the district to provide interactive channels for diversified social cooperation and community participation. Xiang proposed the planning of a micro-public space for Xiling community, Yichang, Hubei, China, through data collection, sorting, and analysis with a PPGIS platform based on public participation in the new era [4]. Peng et al.

designed the micro-public space based on a micro-climate environment with the measured and simulated mobile big data and WeChat data to represent public participation [5]. The innovative use of digital technology was considered to enhance public participation. The construction of multiple opinion feedback channels based on the Internet and multimedia is believed to be a necessary action for the introduction of group wisdom and the realization of "public participation" [6].

Previous studies showed that the establishment of a digital participation platform is important in the preliminary survey, process, and planning for decision making in planning public space through public participation. However, how to participate in the whole process of planning and design has not been described in detail. Hence, the present study designs the participation platform using the mixed public participation geographic information system (PPGIS) and applies it to the renewal of the micro-public space of Jimei School Village, Xiamen. In the design, the public participates in the whole process of information acquisition, project survey, project visualization, planning, and decision making, acquiring public requirements, visual simulation of design solutions, and online interaction.

2. Research Method

PPGIS is a combination of GIS and societal participation. The traditional top-down planning by experts since the 1960s has not been applied to the current social development anymore, so decision making based on the concept of participation has gradually developed. Participation is a process to condense the will of local people, improve their understanding of events to reach a consensus on decision making, and achieve a goal with residents' empowerment. Based on the research on PPGIS, the present study designs a mixed-PPGIS platform characterized by integration which provides convenient channels for the public to participate in planning according to their interest. Three core links are involved in the platform: message acquisition, planning participation, and decision making.

Mixed PPGIS is an integrated PPGIS that is embodied in the following three aspects:

- Combination of community local knowledge with scientific knowledge;
- Combination of the traditional PPGIS workshop with network technology;
- Combination of diverse participatory groups.

The architecture of the mixed-PPGIS platform includes the user layer, display layer, interlayer, and data layer, as mixed-PPGIS integrates the PPGIS workshop and network technology. The network participation is supported by corresponding system software, including Local Space Viewer 4 developed by Suzhou Map New Media Co., Ltd. (Suzhou, China) and WeChat platform developed by China Tencent (Shenzhen, China).

2.1. Local Space Viewer (LSV4)

Local Space Viewer 4 is a new, professional, and three-dimensional (3D) digital software program that quickly browses, measures, analyzes, and labels 3D geographic information data. Researchers and residents open maps on computers or mobile phones to browse with the downloaded LSV. Meanwhile, plans and designs are implemented based on the tools provided by LSV based on the questionnaire survey.

2.2. Community Map: WeChat Official Account

A WeChat official account of the community map was developed in the present study based on the geographic information data acquired by LSV. Relevant planning information and a thematic map are presented in the WeChat public address through GIS analysis and are shown to the public. The user obtains the thematic information to participate in planning, discussion, and decision making using a simple interaction design.

3. Renewal of Micro-Public Space in Jimei School Village

3.1. Research Design

Jimei School Village in the Jimei District of Xiamen City is located in Jimei Peninsula, Xiamen. The district is a 20 min drive away from the center of Xiamen City, and convenient transportation is available in a total area of 1.35 km^2. Jimei School Village has many school institutions and historical buildings, being a well-known historical and cultural tourism area. According to the master planning, Jimei School Village has developed its historical buildings for an educational function and introduced commercial and tourism activities for sustainable development with the goal of having a "school area + scenic spot".

We formed a research team including 97 undergraduates from several universities and initiated a public space renovation plan from March to June 2021 based on a general survey for this study. Firstly, we conducted participatory mapping through eight PPGIS workshops. The interview was conducted with residents, merchants, enrolled students, and tourists. Meanwhile, we acquired 35 micro-public spaces which were required to be improved and transformed. In the interview, we recorded the basic situation of the micro-public spaces (area, current facilities, functions, and others) and the evaluation of the current situation. An evaluation was carried out for safety, accessibility, comfort, recognizability, and inclusiveness (Figure 1). The micro-public spaces were classified into "community-based", "street-based", and "public space-based" spaces based on the interview and evaluation results. As a result, special drawings using LSV were drawn (Figure 2). Public opinions were collected and sorted through the PPGIS workshop using LSV4 for research and design.

Micro-Public Space Survey Form (Excerpts from three cases)

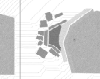
Plot	Plot	Edge	Path	Entrance	Surrounding situation	Current facilities				Topography	functions	Status evaluation					Area	type
						Lighting	Sports	Green	Water scape			Security	Accessibility	Comfort	Identifiability	Inclusivity		
small pocket in Shenggu ang Communi ty						Insufficient	None	Better	None	Flat	Leisure	3	5	3	4	2	54㎡	Community-based
big steps in front of Yanping Building						Adequate	None	Poor	None	Height difference 9 meters	Leisure	3	4	3	4	1	651㎡	Public space-based
parking lot of Aoyan Phase II						Insufficient	None	None	None	Flat	parking	3	3	2	2	1	150㎡	Street-based

Figure 1. Micro-public space design (excerpts from three cases).

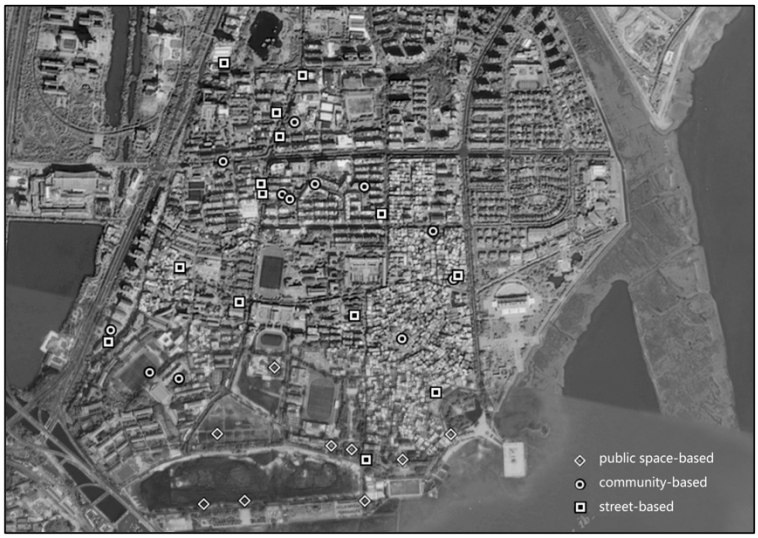


Figure 2. Figure 2. Thematic map.

In the second stage of the research and design, the design for transforming micro-public spaces was constructed based on public demands. Interviews with government departments and relevant construction organizations were performed for a feasibility study. The project design for the first batch of nine micro-public spaces was then confirmed. The project design was conducted by university professors. The three-dimensional drawings were uploaded to LSV (Figure 3) to facilitate the public's browsing and inquiring. Simultaneously, the evaluation of comments and the selection of plans were carried out via WeChat official accounts to promote the participation of the public. Positive responses from the community were received. In online voting at the end of five days, we received 252,238 responses.



Figure 3. Figure 3. 3D drawings based on LSV4.

The project was disclosed with the traditional Chinese planning process in the third stage of the research. Experts from local governments, construction organizations, industry, universities, and on-site viewers were invited to participate in the final voting. Finally, the results of the selected projects were submitted to the government department for implementation.

3.2. Analysis of Research Results

Mixed-PPGIS was integrated into the micro-public space renewal in the present study with public participation. Paul's multidimensional analysis method was referred to for analyzing the planning results. Paul combined the empirical experience of the World Bank regarding community participation for the planning of urban housing, health, and agriculture sectors and proposed a multidimensional analysis framework for community

participation based on the "objectives", "intensity", and "instruments" (Figure 4) [7]. In the micro-public space renewal of Jimei School Village, the whole process of "public participation" was realized in the mixed-PPGIS public participation platform.

- We held several PPGIS workshops in the planning stage with LSV4 for participatory mapping and information acquisition of micro-public spaces. GIS thematic map data were produced and analyzed, too. University teams, residents, and tourists participated in information sharing and decisions through agreement, cooperation, and interaction. The planning results were visualized in an LSV thematic map to encourage public participation through WeChat. Other than the participants, administrative workers and experts were also involved. Participation became more active in the negotiation stage, and the goal of the renewal was achieved through understanding and agreement. The final projects were selected via voting through a WeChat public platform. The public's opinion was shared with experts and government workers. With such participation, the objectives of the renewal were achieved based on the consensus reached in planning and decision making.

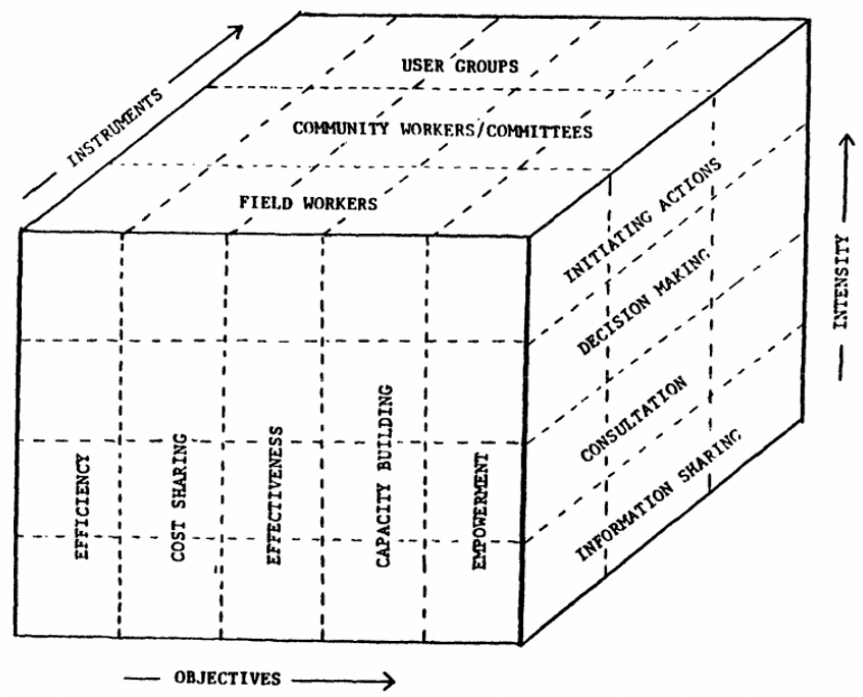


Figure 4. Figure 4. Multidimensional analysis framework for community participation [7].

4. Conclusions and Recommendations

According to the summary of the experience of 50 empirical cases in the World Bank, community participation was not successful in several projects due to technological gaps, weak promotion and supervision, lack of a set of comprehensive services, and failure to implement key policies for the project. Mixed-PPGIS allows technical methods to be integrated into bottom-up participatory planning. Three characteristics such as multiple participation, phase partitioning processing, and mixed development mode were reflected in the present study [8]. The participation platform of mixed-PPGIS played a critical role in the renewal of urban micro-public spaces with "people" as the key factor. The timely and appropriate participation of administrative staff is necessary to promote participatory planning and plays different roles in different stages of the whole micro-public space renewal process. The results show the importance of the university team which plays a role of organization and guidance in the whole process.

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