

Gamifying Participatory Design: A Digital Platform for Urban Renewal in Gangxia Urban Village, Shenzhen

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Abstract

China's urbanization has spurred the growth of urban villages, with Shenzhen's Gangxia exemplifying intersections of social complexity, policy shifts, and digital innovation. This study designs a gamified digital platform engaging migrant workers, landlords, and officials in participatory urban planning. Quantitative coding of structured interviews revealed core interaction patterns and preference clusters, informing platform architecture integrating real-time feedback loops and tiered rewards. Key findings: 1) Adaptive UI/UX layers address technological literacy gaps; 2) Dynamic scoring algorithms reconcile power asymmetries; 3) Behavioral data granularity determines platform efficacy. This data-driven approach demonstrates context-sensitive digital tools for informal settlements, proposing a replicable framework for technology-mediated planning that bridges socioeconomic divides while enhancing governance. The research advances practical applications of gamification and AI analytics in sustainable urban renewal.

Keywords: Urban Villages, Gamification, Digital Participatory Design, Digital Platform - Urban Renewal

1. Introduction

Since the economic reforms of 1978, China has experienced transformative socio-economic growth, with substantial increases in investment, consumption, and overall living standards that have reshaped the urban landscape and driven significant rural-to-urban migration (Hao et al., 2011). In this context, urban villages—known as “villages in the city” (Chengzhongcun)—have emerged as distinctive informal settlements within Chinese urban centers. Originally traditional rural villages, they have become gradually surrounded by expanding urban zones, evolving into unique communities that coexist within the larger urban fabric (Wang et al., 2009). In first-tier cities such as Shenzhen, the status quo of urban villages has created a series of challenges, including poor housing conditions, low land utilization and poor infrastructure. Meanwhile, Different social groups within urban villages have varying resources, including capital, skills, land rights, and social rights, leading to conflicts of interest (He et al., 2010). These villages play a critical role in providing affordable housing and fostering informal economies, yet they face significant challenges such as poor infrastructure, weak governance, and limited public participation in urban renewal processes (Lin et al., 2014). Traditional top-down urban planning approaches often exclude local residents from decision-making, resulting in conflicts and inefficiencies in redevelopment projects (Wu, 2016).

Digital participatory design (DPD) has emerged as a promising solution to address these challenges by integrating digital tools into participatory urban planning (Foth et al., 2009). Community digital interaction platforms, such as mini-programs, offer accessible interfaces that enable residents to express their preferences, provide feedback, and engage with urban renewal initiatives. However, the willingness and ability of urban village residents to adopt such tools remain uncertain, particularly given their unique socio-economic conditions and varying levels of digital literacy.

While digital participation has been extensively studied in urban governance (Stern et al., 2020), its application in informal urban areas like urban villages requires further exploration. Residents of urban villages often face barriers such as limited digital skills, low trust in government initiatives, and distinct socio-economic constraints, all of which may influence their acceptance of digital participation platforms. Therefore, understanding their technology acceptance and developing a tailored digital participation framework is essential for enhancing their involvement in urban planning. This research proposes a gamified digital platform tailored to the unique context of Gangxia Village to address the challenges of participatory urban renewal. Grounded in quantitative coding of structured interviews with key stakeholder groups—including migrant workers, landlords, and municipal officials—the study systematically identifies interaction patterns, participation barriers, and preference clusters.

These insights directly inform the platform's architecture, including adaptive user interfaces, real-time feedback mechanisms, and a tiered reward system designed to incentivize engagement and mitigate power asymmetries.

The findings underscore two core insights: first, localized, data-driven interface design is essential to accommodate varying levels of technological literacy and cultural diversity; second, gamification fosters not only participation but also cross-group empathy, reframing urban planning as a collaborative rather than transactional process. By demonstrating how context-sensitive digital tools can support inclusive planning in informal settlements, this research offers a replicable framework for developing technology-mediated participation platforms, contributing practical strategies for more equitable and sustainable urban governance.

2. Literature Review

2.1 Spatial Marginality in Urban Villages

The establishment of the Shenzhen Special Economic Zone initiated a fragmented land acquisition process, wherein the nascent government selectively appropriated agricultural land for critical public infrastructure—including the civic center—while largely excluding existing village settlements from urban road networks and municipal services (Wang et al., 2009). This piecemeal spatial governance, compounded by fiscal constraints that hindered comprehensive employment provision, accelerated the dissolution of agrarian landscapes. As urbanization intensified post-1990s, residual rural enclaves evolved into “urban villages,” their transformation propelled by market-driven responses to rural migrants' demand for affordable housing (Zhang, 2005). These urban villages now epitomize a paradoxical spatiality: While functioning as self-contained nodes through dense commercial ecosystems (Laclau & Mouffe, 1985; Abrahamson, 2005), they simultaneously exhibit infrastructural collapse—manifested in chronic sewage overflow and waste accumulation (Liu et al., 2010). This duality reflects deeper contradictions in urban rights allocation. Traditional communal spaces like ancestral halls coexist uneasily with gated sports facilities and pay-to-access venues (Chung, 2010; Hsing, 2010), materializing the erosion of spatial justice into a structural impediment to sustainable community development. Spatial segregation further crystallizes identity politics. The hukou system institutionalizes rural migrants as “floating populations” (Fan, 2002; Wu, 2004), a bureaucratic label that persists despite their demonstrated aspirations for permanent settlement and civic engagement (Wu, 2012). Excluded from participatory planning processes, migrants inhabit a liminal state of “physical presence but political absence” (Kochan, 2009), a condition amplified by local residents' monopolization of social capital. Consequently, urban villages become both symbolic markers of failed integration in mainstream discourse (Siu, 2007) and concrete arenas for class antagonism.

By 2021, Shenzhen hosted over 1,000 urban villages exhibiting divergent evolutionary trajectories. Some retain low-rise vernacular architectures encircled by remnant farmland, while others metamorphose into high-density mid-rise clusters embedded within modern urban grids. This morphological diversity encapsulates the contested interplay between institutional elasticity and capitalist spatial logic.

2.2 Evolution and Digitalization of Public Participation

Citizen participation refers to the process by which citizens actively engage in political and economic processes through the redistribution of power, enabling previously marginalized poor citizens to be intentionally included in shaping the future. Public participation is crucial in urban planning and decision-making, allowing community members to take part in policy formulation, spatial planning, and project development. With the rapid pace of urbanization and the increasing complexity of social demands, the significance of public participation has grown substantially. However, Arnstein's (1969) “Ladder of Citizen Participation” model highlights the issue of tokenistic participation in traditional civic engagement, where actual power devolution remains limited.

In the context of urban renewal, low-income community residents often lack long-term planning capabilities, are unfamiliar with abstract matters, distrust urban institutions, and experience a low sense of efficacy in organized actions, making them less likely to engage proactively in urban governance. The concept of “planning with residents” assumes that communities have the willingness and capacity to collaborate in pursuing the common good. However, when urban renewal entails large-scale demolition, mandatory housing standard upgrades, or

requires residents to bear renovation costs themselves, this willingness is often absent. Additionally, due to differences in organizational capacity across social classes, middle-class groups are more likely to be included in “collaborative planning,” while low-income groups tend to be excluded, becoming passive recipients of urban renewal processes (Wilson, 1963). These issues are particularly pronounced in informal urban areas such as urban villages, where many residents are migrants with limited access to information and resources. The urban-rural divide further exacerbates their exclusion, highlighting the need to explore new mechanisms to enhance participation and inclusivity.

To address these challenges, Digital Participatory Design (DPD) has emerged as a potential solution, leveraging information technology and digital platforms to facilitate community engagement in urban planning and governance (Smith, 2009). Digital platforms offer an accessible and interactive means for residents to participate in decision-making, providing real-time feedback and opportunities for involvement (Lee & Kim, 2019). This is particularly important in urban villages, where the lack of physical public spaces for participation limits engagement. However, the implementation of DPD also raises concerns, including the digital divide, technological adaptability, and platform usability (Muller, 2017). Many urban village residents, especially older generations and those with limited digital literacy, may struggle to use these technologies effectively. Furthermore, debates persist over whether digital platforms genuinely enhance democratic decision-making or merely serve as symbolic participation tools (Carver et al., 2008). To maximize the effectiveness of DPD, platform design must align with community needs, minimize accessibility barriers, and foster meaningful interactions among residents.

By integrating discussions on public participation challenges, digital participatory design, and technology adoption theories, this analysis underscores the importance of bridging both digital and social divides in urban village governance. Ensuring that digital participation platforms are both accessible and effective can play a transformative role in enhancing civic engagement, promoting social inclusion, and improving urban planning outcomes in informal settlements.

3. Research Methodology

3.1 Case study Area Background information - Gangxia, Shenzhen

China's open-door policy, initiated in 1979, led to the establishment of Shenzhen as an innovative and experimental metropolis. Situated in the Pearl River Delta of South China, Shenzhen has since evolved into one of the country's most dynamic cities, characterized by extraordinary economic growth and rapid population expansion, largely driven by its market-oriented economy (Ng, 2003). Originally a small border town with a population of approximately 310,000, Shenzhen's strategic proximity to Hong Kong made it an ideal candidate for developing an export-driven economy. In 1980, Shenzhen was designated as China's first Special Economic Zone (SEZ), marking a pivotal shift towards a market economy aimed at attracting foreign investment, advanced technology, and modern management expertise. Over the decades, Shenzhen has transformed into a sprawling metropolis with a population of 14 million (Zacharias & Tang, 2010), significantly surpassing the official count of 8.8 million recorded in 2008 (Yearbook, 2020). The Shenzhen SEZ encompasses 410 square kilometers across the districts of Luohu, Futian, Yantian, and Nanshan, while the adjacent districts of Baoan and Longgang, covering 714 km² and 845 km² respectively, extend to its north.

When the Shenzhen Special Economic Zone was established, the government acquired land for development from nearby villages in a gradual and piecemeal manner. While ancient villages were preserved, new agricultural land was repurposed for planning the civic center and other significant public structures. Village dwellings were often excluded from road and infrastructure projects, creating a unique urban-rural dichotomy. The nascent administration faced challenges in providing employment opportunities for all local village residents due to its limited size and financial constraints. As urbanization accelerated and more agricultural land was converted for urban use, these ancient villages gradually evolved into “urban villages” (Wang et al., 2009). These urban villages emerged as a direct consequence of urban expansion, but their transformation into migrant enclaves was a commercial response to the growing demand for affordable housing among rural migrants (Zhang, 2005). Under China's hukou system (Fan, 2002; Wu, 2004), rural migrants, often referred to as the “floating population” (Good-

kind & West, 2002), are considered transient residents in urban areas. Consequently, the influx of these migrants has fueled the growth of urban villages. By 2021, Shenzhen was home to over 1,000 urban villages, evenly distributed across the city (Du, 2020). Over the past four decades of rapid urbanization, these urban villages have undergone significant transformations, albeit at varying speeds and times depending on their locations. They have transitioned from “low-rise traditional building forms surrounded by large tracts of farmland” to “high-density mid-rise building forms surrounded by modern urban blocks.”

This study focuses on the urban villages in Shenzhen: Gangxia Village (Table 1).

Table 1. The information of Gangxia

Category	Content
Village Name	Gangxia Village
Location	Located in central Futian, Shenzhen
Area	Approximately 151,600 m ²
Population	Around 100,000 people
Initial Redevelopment Proposal	Proposed by the municipal government in 1998 (Hin & Xin, 2011)
Project Launch	Initiated by the Futian Urban Renewal Office (FURO) in 2002 (Hin & Xin, 2011)
Start of Demolition	April 2009, after redevelopment agreements were reached (Hin & Xin, 2011)
Impact of 1992 Urbanization Reforms	- Transition from rural to urban governance - Villagers granted urban household registration - Village committees converted into neighborhood committees - Production teams restructured as joint-stock companies - Legalized leasing led to dense rental housing and commercial construction (O'Donnell, 2021)
Designation as Urban Renewal Unit (URU)	Officially designated in 2009 as part of early urban renewal efforts (Hin & Xin, 2011)
Shift in Renewal Strategy	In response to resident concerns, a more integrated rehabilitation approach was adopted in 2016, focusing on infrastructure upgrades while preserving community identity (Hin & Xin, 2011)
Community Function	Provided affordable housing and diverse commercial services such as family-run shops, restaurants, and small businesses (O'Donnell, 2021)
Economic and Geographic Role	Due to its proximity to high-end urban infrastructure, Gangxia served as an accessible space for workers and businesses priced out of other parts of Shenzhen (O'Donnell, 2021)
Social Structure	- Original residents: property owners relying on rental income - Migrant workers: attracted by low rents, working in low-income sectors - Shop owners: operating small-scale businesses - Renters: short- or long-term tenants (He et al., 2010)
Social Relations and Power Dynamics	- Economically interdependent groups - Original residents hold the most decision-making power, especially in redevelopment matters - Migrants and shop owners are vulnerable to displacement and lack formal representation (He et al., 2010)
Challenges in Redevelopment	- Issues of safety, sanitation, and unregulated development - Tensions due to unequal influence in redevelopment decisions - Balancing renewal with community preservation (Hin & Xin, 2011; He et al., 2010)

3.2 Interview Design

The study provides insights into the willingness, needs and barriers of different stakeholders to use digital participation platforms in urban regeneration, and therefore semi-structured interviews were conducted in Gangxia Village, Shenzhen, with three key groups: migrant tenants (n=15), local landlords (n=15), and government officials (n=10), for a total of 40 interviewees. In order to guarantee representativeness while accounting for the viability of research resources, the sample size was determined using Creswell's (2013) guidelines for qualitative research in case studies. Purposive and snowball sampling techniques were used to recruit participants in order to guarantee diversity in terms of age, gender, occupation, and degree of digital literacy. Interviews were conducted mainly face-to-face, with some interviewees being interviewed by telephone or video, and each interview lasted approximately 30 minutes, and was recorded with the written or verbal informed consent of the interviewees and with strict protection of their privacy.

A number of central themes guided the interview outline, such as respondents' perceptions of the usefulness and usability of digital platforms, their experiences participating in communities at the moment, potential obstacles (such as the digital divide, a lack of trust, and power asymmetry), and their expectations for future digital participation tools. The questions were customised according to the respondents' identities to better reflect their specific roles and concerns: migrant tenants' questions focused on the living environment, the use of digital devices, and motivation to participate; landlords focused on policy attitudes and acceptability of the platform; and government officials focused on the difficulties of policy implementation, cross-sectoral collaboration, and the role of technological tools in governance. The design of the questions follows a logical sequence from individual experience to attitude expression, and from problem recognition to policy recommendations.

The interview data were transcribed and processed using thematic analysis, with open coding to extract core information units, and then axial coding to summarise key themes such as 'digital trust', 'data accessibility', 'motivation to participate', 'perception of fairness', and so on. The main themes such as 'digital trust', 'accessibility', 'participation fatigue' and 'perception of fairness' were then summarised through axial coding. The qualitative interview findings from the study were not only used to understand user perspectives, but also directly guided the design of the subsequent digital platform system. For example, the multi-role interface, gamified feedback mechanism, and low-threshold interactive features in the platform were all tailored based on the interview findings. Thus, the interview design not only serves as an information-gathering tool, but also lays the empirical foundation for the socio-technical system architecture of this study.

4. System design

4.1 Functional & Non-Functional Requirements Analysis

To ensure the effectiveness and inclusivity of the gamified digital platform proposed for participatory urban renewal in Gangxia Village, a detailed requirement analysis was conducted. This analysis distinguishes between functional and non-functional requirements to structure the system architecture in a way that responds to the socio-technical complexities identified in prior sections.

Drawing upon the structured interviews with migrant workers, landlords, and local officials, as well as a contextual understanding of the digital divide, power asymmetries, and participatory inertia in informal settlements, the platform must not only provide basic participation functionalities but also address user diversity, trust-building, feedback responsiveness, and long-term behavioral engagement. Therefore, the requirements are rooted in both empirical insights and participatory design principles, ensuring the platform serves as a meaningful vehicle for deliberative engagement and not a mere symbolic interface.

Functionally, the platform must support multi-role user interaction, reward-based engagement, and real-time feedback loops, as these features have been identified as central to enhancing motivation, mitigating decision-making asymmetries, and reinforcing transparency. Non-functional requirements such as accessibility, scalability, adaptability, and usability are equally critical, particularly in contexts characterized by low digital literacy, infrastructural limitations, and cultural heterogeneity.

The following table summarizes the identified requirements:

Table 2. Functional & Non-Functional Requirements

Requirement Type	ID	Description	Justification
Functional Requirements	F1	Multi-role account system: Supports differentiated user roles (migrants, landlords, officials)	Reflects socio-political heterogeneity and supports role-specific interaction paths.
	F2	Gamified feedback mechanism: Real-time scoring, reward tiers, and progress tracking	Enhances user motivation, reduces participation fatigue, and addresses power asymmetry by creating transparent recognition mechanisms.
	F3	Issue reporting and suggestion module: Allows submission of community concerns and renovation suggestions	Enables bottom-up expression of needs, aligned with participatory design objectives.
	F4	Real-time feedback from authorities: Government can respond to suggestions and report renovation progress	Builds trust and accountability through bidirectional communication.
	F5	Community voting and prioritization feature	Facilitates deliberative democracy and helps identify consensus-driven priorities.
	F6	Mobile-friendly interface with intuitive navigation	Addresses digital literacy gaps prevalent in urban village populations.
Non-Functional Requirements	N1	Accessibility across devices and OS platforms	Maximizes reach and ensures usability for users with different technical resources.
	N2	Scalability to other urban villages	Ensures long-term replicability and cross-context adaptation.
	N3	Data privacy and consent safeguards	Addresses concerns over surveillance and fosters digital trust among vulnerable populations.
	N4	High usability and low learning curve	Critical for older residents and digitally marginalized groups; reduces entry barriers.
	N5	Cultural localization: Multilingual options and culturally resonant visual design	Enhances inclusivity and emotional engagement by tailoring the interface to diverse user demographics.
	N6	Offline data caching and low-bandwidth compatibility	Enables reliable use in low-connectivity environments, which is essential in underdeveloped or congested urban infrastructures.

4.2 System Working Flow

The designed system workflow captures the full process of participatory engagement facilitated by a gamified digital platform in the context of Gangxia Urban Village. The system is intentionally structured to accommodate a diverse user base—including migrant workers, landlords, and residents—and to promote their sustained involvement in urban renewal processes through meaningful feedback loops and incentive mechanisms.

The workflow begins when users identify a potential urban issue within their local environment. Utilizing a mobile device or terminal, they request location information via integrated GPS services or mapping APIs (e.g., Google Maps or open-source platforms). Once the digital map of the target area is retrieved, users are prompted to pinpoint the location of the problem.

If the issue can be effectively geolocated, the system activates a problem description interface, where users may provide textual input, visual evidence, and perceived urgency levels. This input is then analyzed by the backend system using a hybrid model combining rule-based filters and AI-driven semantic clustering to determine the problem's significance and validity.

A novel feature of this platform is its gamified reward system. When the system confirms that the submitted issue is valid and relevant to ongoing urban renewal efforts, the social group responsible for reporting it (e.g., a specific user or user type) receives quantifiable rewards—typically in the form of digital points or merits. These rewards not only contribute to a leaderboard system but are also symbolically visualized in the digital twin environment, where the user's virtual avatar and contribution record are permanently stored. This mechanism fosters long-term engagement, enhances user identity within the community, and transforms digital participation into an emotionally and socially rewarding experience.

In parallel, the issue is routed to government stakeholders through a secure firewall-protected channel, where it is reviewed and incorporated into the digital twin simulation of the target area. IoT sensor data, where available, is utilized to validate and cross-reference the reported issue, further enhancing system accuracy.

Finally, feedback is delivered back to the original user through the platform, including status, timeline for resolution, or requests for additional information. The feedback loop reinforces accountability and provides a clear indication that citizen input translates into visible action. The entire process is visualized in Figure 1, highlighting multi-directional information flows and the integration of reward-driven participation within a socio-technical system for equitable urban governance.

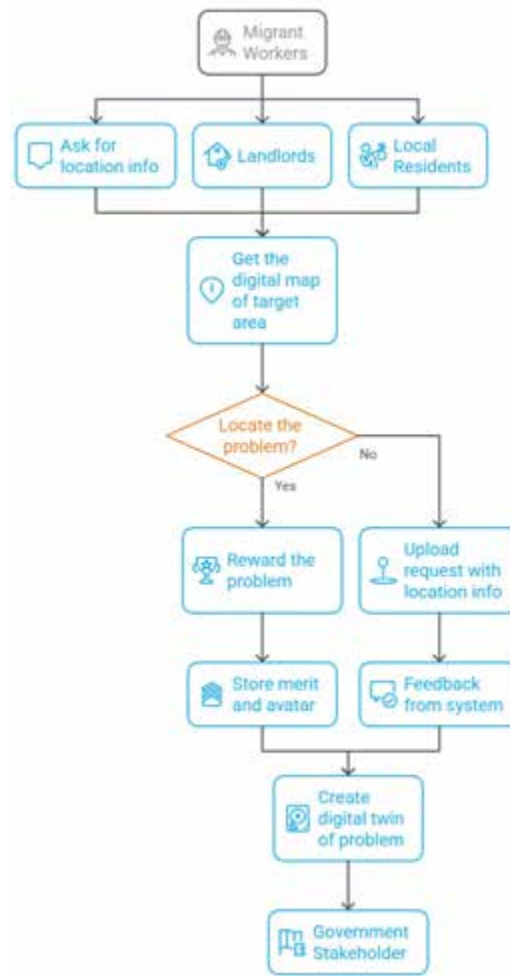


Figure 1. Working Flow of Gamified Urban Issue Reporting System

5. Discussion

This study explores the feasibility of implementing a gamified digital participation platform and its impacts in the urban village of Gangxia, Shenzhen by combining insights from three stakeholder interviews with system design requirements. The findings reveal the complex interplay between digital inclusiveness, power asymmetry, and willingness to participate in informal area renewal contexts.

5.1 Acceptance and expectations vary between stakeholder groups

Semi-structured interviews revealed different expectations and concerns between the three stakeholder groups. Mobile tenants, while expressing dissatisfaction with living conditions, showed cautious optimism about digital platforms, especially when defining them as simple, reward-based systems. Their main concerns include technological unfamiliarity, privacy protection, and scepticism about government responsiveness - issues echoed in the wider literature on digital marginality (Muller, 2017; Stern et al., 2020). In contrast, landlords emphasise property rights protection and are concerned that digital engagement may be detrimental to their financial interests. However, some landlords expressed interest in digital tools for tracking policy updates and accessing curated landlord-only content. Government officials recognise the potential of digital platforms to streamline feedback collection and increase transparency, but also express concerns about disinformation, opinion overload, and the administrative capacity of digital engagement.

These different perspectives reinforce the need for differentiated design logic and adaptive interfaces, and validate the platform's multi-actor architecture and customisable user experience features. The use of gamification - particularly point-based rewards and visual presentation of contributions - was found to be a cross-group motivator, especially when designed to recognise opinions without undermining authority or triggering economic anxiety.

5.2 Digital divide and power asymmetry

The interviews demonstrated that digital participation in urban villages is not just a matter of tool availability, but is deeply affected by structural inequalities, the digital divide and asymmetries of institutional power. Mobile tenants often lack digital literacy and political voice, resulting in 'physical presence and political absence' (Kochan 2009). At the same time, landlords and officials have easier access to digital and institutional capital. These dynamics are in line with Arnstein's (1969) critique of symbolic participation, which tends to be more symbolic than substantive. The platform is designed with a low-threshold interface, localised language support, offline data caching, and tiered participation features that identify different user capabilities. In addition, gamification mechanisms not only act as incentives, but also provide partial balance to otherwise excluded voices by providing visibility and recognition. However, gamification alone cannot address deeper systemic inequalities, suggesting the need for parallel offline empowerment and institutional reform.

6. Conclusion

This study explores the potential of a gamified digital engagement platform to enhance stakeholder participation in the urban regeneration process of urban villages in Gangxia, Shenzhen. By incorporating semi-structured interviews with stakeholder groups (migrant workers, local landlords, and government officials) into the platform design process, the study designed a contextual system to address technical, social, and institutional barriers common to informal regional settings.

The findings emphasise the capacities, motivations and concerns of different stakeholders. Migrant workers expressed a willingness to participate when the platform was easy to access, trustworthy and practically achievable. For landlords seeking mechanisms that both protect property rights and keep them informed, government officials also acknowledged that such platforms can help improve governance efficiency, despite concerns about inaccurate information and the complexity of data processing. These diverse needs have directly shaped the functionality of the platforms, including multi-role account architectures, gamified feedback systems and adaptive user interfaces.

The research confirms that digital participation is not just a technological intervention, but a socio-political process. The digital divide, unequal access to institutional power and participation fatigue remain structural challenges that cannot be solved by interface design alone e.g. UI, UX. Thus by embedding transparency, recognition and feedback mechanisms, digital platforms can create inclusive digital opportunities while potentially reforming traditional pathways of community governance.

The contribution of this study lies in its empirical foundation, participatory methodology and the application of digital design thinking to complex urban governance issues. This study advances the discussion on digital participatory design (DPD) by demonstrating how gamification can be a strategic tool under the construction of fine contexts that not only enhances participation, but also balances different stakeholders in urban spaces.

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Appendix A

Stakeholders	English Question
Migrant Workers	How long have you lived in Gangxia? Are you satisfied with your current living environment? What aspects would you like to improve?
	Have you ever participated in community affairs? If not, why?
	Do you use mobile phones or apps like WeChat? Do you find them easy to use?
	If a platform allowed you to share suggestions on community improvement, would you use it? Why or why not?
	Would you be concerned about privacy or your opinions being ignored on a digital platform?
	Would earning points or rewards motivate you to participate more actively?
	How do you think the government should listen to the voices of people like you?

Stakeholders	English Question
Local Landlords	What's your view on the current urban renewal policy? Have you participated in related discussions?
	Would you use a digital platform to track progress or express your opinions?
	Do you worry that information on the platform might affect your rental income or property rights?
	Do you think different groups are treated fairly during urban renewal?
	What are the most important issues that need coordination between landlords and tenants?
Government Officials	How does the government currently collect public opinions? Are there challenges in the feedback process?
	Are you concerned about public backlash or irrational comments on the platform? How can these be managed?
	In what ways do you think digital platforms can enhance policy transparency?
	What key features should an ideal digital participation platform include?