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The Evaluation of Residents' Participation Intention in Smart Community Construction: A Case Study of Shenzhen, China

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ABSTRACT: In the context of smart community construction, understanding residents' participation intention is crucial to ensure the sustainability, inclusiveness, and overall success of these projects. Most studies on residents' participation intention in smart community construction focus on the determinants of residents' participation intention and improvement path, while existing studies on the evaluation of residents' participation intention are limited. This study addresses this issue by dividing the smart community project life cycle into three key stages: the planning phase, construction phase, and maintenance phase, and develops a comprehensive evaluation framework with 11 indicators to quantify residents' participation intention in these stages. Through expert interviews and the CRITIC method, objective weights are assigned to each indicator, and the fuzzy comprehensive evaluation is performed to empirically evaluate residents' participation intention in Shenzhen. The results show that Shenzhen residents have a high participation intention, but there are differences in the three stages of smart community construction. Thus, several improvement measures are proposed, including building a resident-driven smart community participation mechanism, establishing a digital and transparent feedback system for construction, and promoting smart maintenance and adaptive community governance. This study not only provides a structured approach to evaluate residents' participation intention but also offers practical insights for policymakers and developers. By promoting the active participation of residents, this study aims to support the sustainable and people-oriented development of smart community construction.

1. INTRODUCTION

With the rapid development of modern science and technology, smart communities have become an important trend in community development (Wang et al. 2018). Smart communities are service-oriented communities that use advanced technologies to improve the quality of life of residents. Governments of various countries actively promote smart community construction (SCC) (Li et al. 2019). In China, the government supports the development of SCC through policies such as the 'Guidelines for the Construction of Smart Communities' (Gu et al. 2024b). However, actual implementation faces many challenges, such as low resident participation, insufficient demand matching, and funding shortages (Wang et al. 2021). In particular, low resident participation directly leads to high investment but low efficiency.

Research generally agrees that resident participation is crucial to the success of SCC (Wan and Jiang 2022). Residents' active participation in all stages of SCC not only helps to express their needs but also enhances their understanding of the importance of SCC. Therefore, residents' participation intention (RPI) has become an essential issue in both the research and practice of smart community development, as it directly influences residents' actual engagement behavior (Ajzen 1991). A high level of RPI can foster social trust, improve the effectiveness of smart community services, and promote long-term sustainability by encouraging residents to actively engage in the co-building and co-governance of smart communities (Gu et al. 2024b). In contrast, low RPI may lead to slow project implementation, resource inefficiency, and policy

failure. For example, in the practical development of smart communities in China, the lack of communication, trust, and feedback mechanisms has often resulted in residents playing a passive role, which has become a major barrier to some construction projects (Gu et al. 2024b). Although RPI is crucial to the implementation of SCC, there is a significant lack of systematic evaluation of RPI, and the inability to understand whether residents are willing to participate in SCC has greatly hindered the promotion of SCC.

Recent studies have explored RPI and community renewal. Related studies have shown that RPI is a key factor affecting project success and sustainability (Li et al. 2019). They also focus on the motivation, influencing factors, participation model, and the policy support of residents' participation (Tang et al. 2022). Although these studies have promoted residents' participation in the context of community renewal, evaluating RPI remains crucial because it helps decision-makers to understand the status of RPI and take measures. For evaluating methods, various Multi-criteria Decision Making (MCDM) methods have been applied, such as the CRITIC (Criteria Importance Through Intercriteria Correlation) - TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method, AHP (Analytic Hierarchy Process) -TOPSIS method, and ANP (Analytic Network Process) - FCE (Fuzzy Comprehensive Evaluation) method (Hacioglu and Dincer 2015; Wang et al. 2023; Zou et al. 2018). These methods provide a research paradigm for taking into account multiple evaluation indicators and improving the scientific nature of decision-making. Although these studies have provided many insights, research gaps remain. Firstly, there is a lack of research on the evaluation of RPI in the context of SCC. Secondly, there is a lack of a comprehensive evaluation indicator system for RPI in SCC. Finally, limited research existing that combines CRITIC and FCE for RPI evaluation. Therefore, establishing a scientific and systematic RPI evaluation method is of great significance for optimizing SCC policies and improving residents' participation.

Therefore, this study constructed a comprehensive evaluation indicator system and introduced a hybrid evaluation approach integrating the CRITIC and FCE methods. This combination facilitates an intuitive quantification of RPI in SCC while maintaining objectivity and systematic evaluation. By enhancing the evaluation framework for SCC, this study also offers practical strategies to encourage resident participation, supporting the sustainable development of various smart community projects.

2. METHODOLOGY

In order to quantitatively evaluate the level of RPI in SCC, an innovative evaluation indicator system was developed, and a hybrid method combining CRITIC and FCE was established. The procedural steps of the evaluation method are shown in Figure 1. It is worth noting that the hybrid method can be used to conduct a comprehensive and objective evaluation of RPI, which improves the reliability and robustness of the evaluation results.
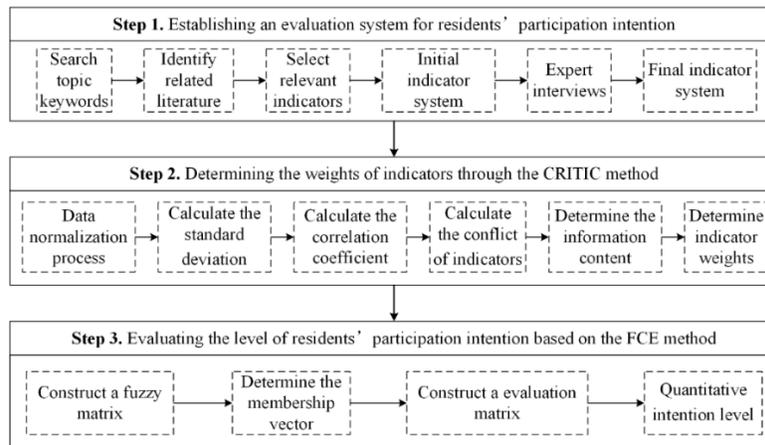

Figure 1 The procedural steps of the evaluation method

2.1   Establishing an Evaluation System for Smart Community Services

Establishing a comprehensive indicator system is crucial for evaluating RPI. This study first identified and classified relevant indicators using a systematic literature review (SLR), forming an initial system with 3 dimensions and 15 indicators. To refine the indicators, 26 experts participated in a VOOV Meeting interview, each providing input during a one-hour session. Based on their feedback, redundant indicators were optimized, resulting in a final system with 11 indicators across 3 dimensions (Table 1).

Table 1 Evaluation indicator system of RPI in SCC

Dimension	Indicators	Code	Reference
RPI in the Planning Phase	Intention to participate in community planning discussions	PP1	
	Intention to participate in community needs surveys	PP2	
	Intention to evaluate planning schemes	PP3	
RPI in the Construction Phase	Intention to verify project compliance and alignment with needs	CP1	(Dong et al. 2023; Granier and Kudo 2016; Gu et al. 2024b)
	Intention to supervise construction progress	CP2	
	Intention to oversee construction quality	CP3	
	Intention to assist construction workers	CP4	
RPI in the Maintenance Phase	Intention to provide feedback and suggestions	MP1	
	Intention to monitor the operational efficiency of smart platforms	MP2	
	Intention to promote smart community concepts and demonstrate applications	MP3	
	Intention to participate in community facility management	MP4	

2.2   Determining the Indicator Weights Using the CRITIC Method

To assign specific weights to each indicator, the 26 experts were invited again to evaluate their importance. Using a scale from 1 (very unimportant) to 5 (very important), experts rated each indicator. The reliability of the collected data, measured by Cronbach's α, was 0.937, indicating high consistency (Gu et al. 2024a). Then the weight determination of evaluation indicators follows a structured approach to ensure accuracy and objectivity. First, the decision matrix is normalized using Equation 1 to standardize indicator values. Next, the variability of each indicator is calculated using Equation 2. Then, the correlation coefficient between indicators is determined using Equation 3 to identify redundant or highly related indicators. The conflict among indicators is measured using Equation 4 to ensure a balanced evaluation system. Based on this, the information content of each indicator is assessed to quantify its contribution using Equation 5. Finally, the weight of each indicator is computed using Equation 6, as shown in Figure 2 and Table 2.

[1] $y_{mn} = \frac{\alpha_{mn} - (\alpha_{mn})_{min}}{(\alpha_{mn})_{max} - (\alpha_{mn})_{min}}$

[2] $\sigma_n = \sqrt{\frac{\sum_{m=1}^{i}(y_{mn} - \overline{\alpha}_n)^2}{i}}$

[3] $r_{tn} = \frac{\sum_{m=1}^{i}(y_{mt} - \overline{y}_t)(y_{mn} - \overline{y}_n)}{\sqrt{\sum_{m=1}^{i}(y_{mt} - \overline{y}_t)^2 \times \sum_{m=1}^{i}(y_{mn} - \overline{y}_n)^2}}$

[4] $R_n = \sum_{t=1}^{j}(1 - r_{tn})$

[5] $c_n = \sigma_n \times R_n$

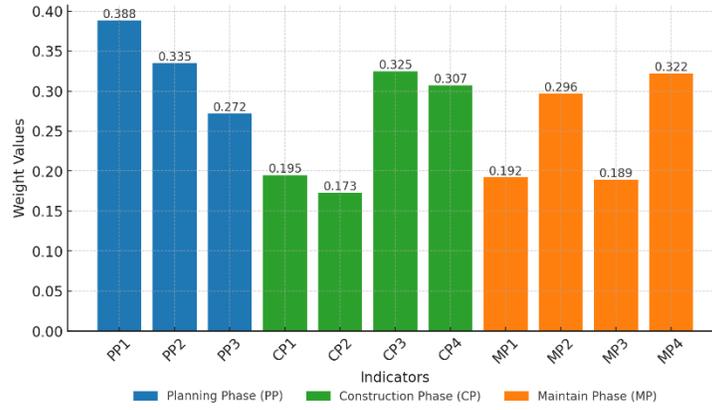[6] $w_n = \frac{c_n}{\sum_{n=1}^{j} c_n}$

Figure 2 The weight of each lever 2 evaluation indicator

Table 2 Weights of the evaluation system

Dimensions	Indicators	Weights	Overall Weights	Weights Rank
PP (0.321)	PP1	0.388	0.125	1
	PP2	0.335	0.107	4
	PP3	0.272	0.087	7
CP (0.380)	CP1	0.195	0.074	8
	CP2	0.173	0.066	9
	CP3	0.325	0.124	2
	CP4	0.307	0.117	3
MP (0.299)	MP1	0.192	0.058	10
	MP2	0.296	0.089	6
	MP3	0.189	0.057	11
	MP4	0.322	0.096	5

2.3 Quantifying RPI through the FCE Method

Fuzzy comprehensive evaluation (FCE) is based on fuzzy set theory and can be used to quantitatively evaluate complex objects affected by multiple factors (Zou et al. 2018). This method first determines an evaluation indicator set and then establishes a comment set V = [5, 4, 3, 2, 1], representing very high, high, average, low, and very low evaluation levels. Then, a fuzzy matrix R (Equation 7) is constructed, in which each element reflects the degree of membership (the number of respondents is represented by K, and n_{tyq} represents the frequency of a certain comment). The comprehensive evaluation vector is calculated using Equation 8, and the weight vector w_n is obtained through CRITIC. Finally, the overall evaluation score N is obtained using Equation 9.

[7] $R_t = \begin{bmatrix} r_{i11} & r_{i12} & \cdots & r_{i1m} \\ r_{i21} & r_{i22} & \cdots & r_{i2m} \\ \vdots & \vdots & \ddots & \vdots \\ r_{in1} & r_{in2} & \cdots & r_{inm} \end{bmatrix}, \quad r_{tyq} = \frac{n_{tyq}}{K}$

[8] $G_i = w_n \times R_t = (b, b_{n2}, \dots b_{nj})$

[9] $N = G_i \times V^T$

3. CASE STUDY

3.1 Study Area

Shenzhen, China's first Special Economic Zone, was selected as the case city for this study due to its distinctive advantages and challenges in smart community construction. First, the city launched a government-backed SCC initiative as early as 2016, demonstrating strong policy support and institutional commitment. Second, the rapid development and proliferation of smart communities in Shenzhen have significantly increased public exposure and awareness, providing a solid foundation for studying residents' participation. Third, despite these advancements, Shenzhen still faces notable shortcomings in fostering residents' participation intention (RPI), such as insufficient engagement mechanisms and limited feedback channels (Gu et al. 2024a), making it a representative and meaningful case for analysis. Compared with other Chinese cities where SCC is still at a nascent stage or lacks sufficient data support, Shenzhen offers both the maturity and complexity necessary for an in-depth and insightful evaluation. To ensure spatial balance, targeted sampling was used to select five representative communities: Yucui (YCC) with an information service platform, Longgang (LGC) with smart infrastructure, Nanyuan (NYC) with IoT devices, Luohuqiao (LHQC) with a security system, and Xinwei (XWC) with strong safety measures. These communities provide diverse insights into RPI in Shenzhen's SCC. Figure 3 illustrates their locations.
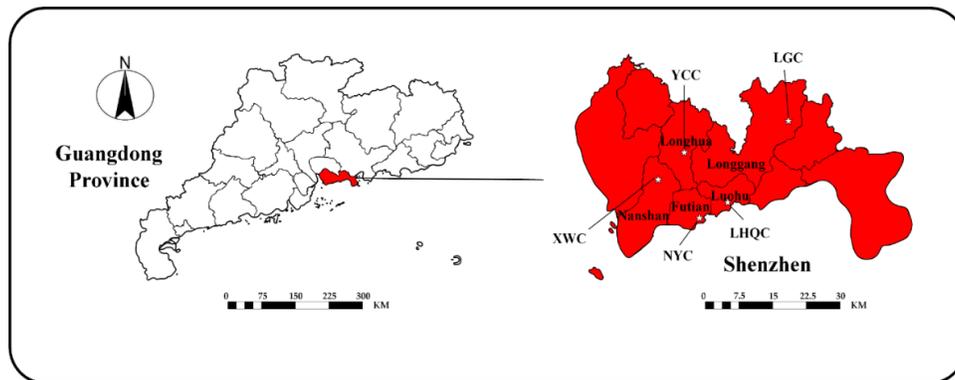

Figure 3 Location of the selected smart communities

3.2 Data Collection

Based on the previously established evaluation indicator system for RPI in SCC, a questionnaire was designed to evaluate RPI. The survey consists of two main sections: individual information of the respondents and measurement items related to RPI. Specifically, it includes three items for RPI in the planning phase, four items for the construction phase, and four items for the maintenance phase. Respondents rate their intention on a 1–5 scale (Likert five-point scale) based on their actual participation intention. The collected data is used for the FCE to ultimately evaluate RPI. The sample size for this study was determined using a standard calculation formula. Given that Shenzhen has a permanent population exceeding 10 million, the sample size was estimated using Equation 10 (Gu et al. 2024b):

$$[10] \quad n = \frac{z^2 p(1-p)}{e^2}$$

where n is the sample size, p is the assumed proportion (0.5 when unknown), z is the confidence level (1.96 for 95%), and e is the margin of error (5%). This yields a required sample size of 385. To account for non-responses, 415 questionnaires were distributed.

Data were collected via an online survey using Wenjuanxing (www.sojump.com), a widely used platform. Questionnaires were distributed through community managers, who used QR code posters, WeChat

groups, and official accounts for dissemination. After a month, 415 responses were collected, with 392 valid responses (94.46% valid return rate).

4. RESULTS AND DISCUSSION

4.1 Research Results

4.1.1 Weight of the evaluation indicator system

The evaluation indicator weights based on the CRITIC method reflect the importance of each indicator in evaluating RPI, with the ranking as follows: PP1 > CP3 > CP4 > MP4 > MP2 > PP2 > MP3 > CP1 > CP2 > PP3 > MP1. The overall weights of the three dimensions indicate that the construction phase (CP, 0.380) plays the most critical role, followed by the planning phase (PP, 0.321) and the maintenance phase (MP, 0.299), suggesting that while early-stage planning and long-term maintenance matter, residents prioritize their involvement in the actual implementation of smart communities. At the planning phase, PP1 (0.125, ranked 1st) and PP2 (0.107, ranked 4th) hold significant weight, highlighting that residents' participation in initial planning is crucial for ensuring the smart community aligns with their expectations, while PP3 (0.087, ranked 7th) is relatively less influential, indicating that not all aspects of planning require extensive resident input. In the construction phase, CP3 (0.124, ranked 2nd) and CP4 (0.117, ranked 3rd) emphasize residents' focus on infrastructure development and smart technology deployment, suggesting that residents are more concerned with tangible, user-oriented improvements rather than general construction processes, as seen in CP1 (0.074, ranked 8th) and CP2 (0.066, ranked 9th). Meanwhile, in the maintenance phase, MP4 (0.096, ranked 5th) and MP2 (0.089, ranked 6th) indicate that security management and service optimization are residents' primary concerns, whereas MP3 (0.057, ranked 10th) and MP1 (0.058, ranked 11th) show that certain technical or indirect aspects of maintenance are less relevant to their participation intention. The relatively lower weight of the maintenance phase (0.299) compared to planning and construction suggests that residents focus more on the initial development and infrastructure than on long-term management. These findings imply that smart community projects should enhance RPI in planning and construction, ensuring infrastructure and technology align with community needs while optimizing maintenance strategies to enhance security and service quality without requiring extensive resident involvement.

4.1.2 Results of the fuzzy comprehensive evaluation

Based on the data collected from the questionnaire, normalization was performed to obtain the membership degrees of each evaluation indicator, and a fuzzy matrix was constructed as shown in the table below (Table 3). Then, according to the calculation process of fuzzy comprehensive evaluation mentioned earlier, the steps below were completed.

Table 3 Membership matrix of evaluation indicator

Indicator	V1	V2	V3	V4	V5
PP1	0.0204	0.0128	0.1556	0.6097	0.2015
PP2	0.0153	0.0128	0.1505	0.5969	0.2245
PP3	0.0153	0.0179	0.1582	0.5918	0.2168
CP1	0.0128	0.0153	0.2449	0.5536	0.1735
CP2	0.0128	0.0204	0.1505	0.5638	0.2526
CP3	0.0153	0.0153	0.2092	0.551	0.2092
CP4	0.0077	0.0204	0.1556	0.5893	0.227
MP1	0.0128	0.0077	0.1301	0.6122	0.2372
MP2	0.0128	0.0102	0.1276	0.648	0.2015
MP3	0.0102	0.0102	0.1709	0.5816	0.227
MP4	0.0204	0.0026	0.1403	0.5791	0.2577

$$G_{PP}=[w_{PP1}, w_{PP2}, w_{PP3}]*R_{PP}=[0.0173, 0.0142, 0.1546, 0.6005, 0.2134]$$

$$G_{CP}=[w_{CP1}, w_{CP2}, w_{CP3}, w_{CP4}]*R_{CP}=[0.0120, 0.0177, 0.1896, 0.5655, 0.2152]$$

$$G_{MP}=[w_{MP1}, w_{MP2}, w_{MP3}, w_{MP4}]*R_{CP}=[0.0147, 0.0073, 0.1402, 0.6057, 0.2311]$$

$$G=[w_{PP}, w_{CP}, w_{CP3}]*\begin{bmatrix} G_{PP} \\ G_{CP} \\ G_{MP} \end{bmatrix}=[0.0145, 0.0135, 0.1636, 0.5887, 0.2194]$$

$$N_{PP} = G_{PP} \times V^T=3.979$$

$$N_{CP} = G_{CP} \times V^T=3.954$$

$$N_{MP} = G_{MP} \times V^T=4.028$$

$$N = G \times V^T=3.984$$

The overall fuzzy comprehensive evaluation result (N = 3.984) indicates that residents in Shenzhen exhibit a high level of participation intention in smart community development, which is closely related to the city's successful experience as a smart city pilot (Große-Bley and Kostka 2021). Since the launch of SCC in 2016, Shenzhen has leveraged strong government support, advanced technological infrastructure, and widespread digital applications, making residents more familiar with the concept of smart communities and fostering greater public participation. As a pioneer in smart city development, Shenzhen has established systematic planning driven by data, intelligent management, and public participation, forming a relatively mature smart community governance system (Gu et al. 2024b). Therefore, the high evaluation score may reflect not only residents' interest but also indicate that the government- and enterprise-led efficient digital governance has reached a certain level of consensus among residents. However, despite the high overall evaluation, there is still room for improvement, particularly in addressing the stage-specific differences in participation intention and the issue of 'passive acceptance' among residents. A high participation score does not necessarily equate to active participation, as residents may be passively integrated into the smart community system due to Shenzhen's highly digitalized and refined management. For example, intelligent access control, digital payments, and smart property management have become daily norms in Shenzhen (Xie et al. 2024). Even if residents do not actively participate in community development, they are still using and adapting to these systems, leading to a 'passive high participation' phenomenon. Additionally, the level of smart community development varies across cities and neighborhoods. In areas with weaker infrastructure or less advanced digital governance, whether residents would exhibit the same level of participation intention remains uncertain.

From the three-stage participation evaluation results, there are notable differences in PRI, with the most striking contradiction being that the construction phase has the highest weight but the lowest participation intention. The high weight of the construction phase indicates that this stage is crucial for the final implementation of smart communities, involving infrastructure development, smart device deployment, and data platform construction, all of which have a profound impact on residents' quality of life, user experience, and the level of smart urbanization. However, despite its importance, residents' actual participation intention is the lowest, likely because the construction phase is primarily dominated by the government, enterprises, and engineering teams, making it highly technical with significant entry barriers, leaving residents with limited opportunities for involvement (Gu et al. 2024c). Shenzhen's smart community development relies heavily on public-private partnerships, with leading technology companies such as Tencent and Huawei overseeing the technological infrastructure, while the government takes charge of policy formulation and regulation. Although this model enhances project implementation efficiency, it simultaneously reduces direct resident involvement in decision-making.

In contrast, the planning phase has a relatively high weight (0.321), and RPI is slightly higher (N_{PP} = 3.979) than in the construction phase but still lower than in the maintenance phase, reflecting the limited influence

of residents in early-stage decision-making. This phase determines the overall development direction, functional layout, and information platform framework of the community, which logically should be a key stage for resident participation. However, in Shenzhen, smart community planning often follows a top-down decision-making model, where the government and technical experts design strategic plans, enterprises provide solutions based on technical feasibility, and residents' input is mainly collected through surveys and community discussions (Wei et al. 2022). While these approaches allow for some degree of public consultation, the actual influence of residents on final decisions remains limited. Additionally, the long duration of the planning phase means that residents may not see immediate benefits from their participation, which can reduce their motivation to participate. On the other hand, some residents may lack the necessary expertise in SCC, making it difficult for them to effectively express their needs, further impacting their participation levels.

Compared to the other two stages, the maintenance phase has the lowest weight (0.299) but the highest participation intention (N_{MP} = 4.028), indicating that residents are more inclined to participate in the long-term management and operation of smart communities rather than early-stage decision-making or the construction process (Ren et al. 2024). This is likely because the maintenance phase is directly related to residents' daily lives, making their experiences more tangible and motivating them to participate in improving community services. Additionally, Shenzhen has established a well-developed resident participation mechanism in the maintenance phase, including smart property management apps, WeChat mini-program feedback platforms, and online voting systems, enabling residents to express opinions, submit suggestions, and receive rapid responses from community management. Compared to the limited communication channels in the planning and construction phases, the maintenance phase offers greater transparency, enhancing RPI.

Overall, Shenzhen residents exhibit varying levels of participation across the three stages of smart community development. The contradiction between the construction phase's high weight and low participation intention is the primary challenge in resident participation, highlighting how technical barriers limit effective involvement. The planning phase shows a more balanced relationship between weight and participation, but its top-down governance model and long planning cycles still constrain residents' influence. Meanwhile, the maintenance phase, despite having the lowest weight, sees the highest resident participation due to its direct impact on daily life and well-established communication channels. Moving forward, optimizing resident participation mechanisms, enhancing transparency in planning, increasing interaction in the construction phase, and strengthening collaborative governance in the maintenance phase will be essential to ensuring that smart communities are not only government- and enterprise-led but also genuinely resident-driven, fostering a model of shared governance that meets the needs of all stakeholders.

4.2 Strategy Recommendations for Enhancing RPI in SCC

This study proposes a participatory governance model for smart community development, ensuring that residents play an active role in the planning, construction, and maintenance phases. The model adopts a three-tiered participation framework, establishing a sustainable and inclusive participation mechanism.

Firstly, the model is centered on resident-driven smart community initiatives, emphasizing residents' proactive involvement in identifying community needs, co-designing services, and shaping public policies. It leverages digital platforms such as community apps, WeChat groups, and online participatory tools to provide transparent, inclusive, and real-time feedback channels for decision-making.

Secondly, to overcome the limitations of traditional top-down governance models, this study suggests introducing an open innovation framework. A Smart Community Participation Platform (SCPP) can serve as a hub for collaboration among urban planners, technology firms, local authorities, and residents, ensuring that infrastructure design and smart services align with actual community needs rather than being imposed solutions. To address the low level of RPI in the construction phase, this study proposes a digitalized and transparent construction feedback system, utilizing real-time monitoring systems, augmented reality (AR) technology, and 3D community models. These tools enable residents to visually understand the construction progress and provide direct feedback, enhancing their participation in the

process. Once the smart community is established, smart maintenance and adaptive community governance become critical. The study advocates for community-led digital governance, incorporating crowdsourced issue reporting, predictive maintenance alerts, and incentive-based service optimization to maximize resident participation. Additionally, blockchain-enabled governance mechanisms ensure transparent budget allocation, allowing residents to track community expenditures, prioritize upgrades, and optimize services.

Finally, the study proposes a sustainable model for long-term participation, establishing a co-governance ecosystem among residents, the government, and enterprises. By fostering dynamic and adaptive governance, smart community initiatives can continuously evolve in response to residents' changing needs, ultimately forming a self-sustaining participation model.

5. CONCLUSION

This study has made several contributions to the evaluation of PRI in SCC. Firstly, a comprehensive evaluation method was developed to quantitatively analyze RPI from multiple dimensions, enriching the research on performance evaluation in smart community development. Secondly, an evaluation index system covering the entire life cycle of smart community development was proposed, systematically dividing the process into three stages: planning, construction, and maintenance. The study quantitatively analyzed the differences in RPI across these stages, providing a scientific basis for optimizing participation mechanisms and enhancing the sustainability of smart community development. Finally, the study employed a CRITIC-FCE hybrid method to improve the objectivity of weight allocation and evaluation. Compared to the traditional AHP-FCE method, the CRITIC method automatically assigns weights based on the objective variability and internal correlation of indicators, reducing subjective bias in expert scoring. Meanwhile, the FCE method incorporates fuzzy mathematical theory, making the evaluation results more robust and adaptable. This approach not only enhances the scientific rigor of evaluating RPI in SCC but also offers new insights for multi-criteria comprehensive evaluation research.

Nevertheless, this study also has certain limitations. Due to data accessibility and resource constraints, the evaluation framework was only empirically validated using data from Shenzhen. Although Shenzhen is a leading city in SCC with strong representativeness in China, the generalizability of the proposed framework to other cities or regions with different socio-economic and cultural backgrounds requires further validation. Future research could expand empirical testing to a wider range of urban contexts to strengthen the universality and applicability of the model. In addition, while the current study adopted a hybrid method to reduce subjective bias and improve evaluation robustness, it did not incorporate advanced data-driven techniques such as machine learning. These technologies could further enhance the adaptability and predictive power of the RPI evaluation framework by enabling more dynamic and responsive assessments based on real-time behavioral and contextual data.

Future research can refine the evaluation of RPI in SCC by exploring several directions. Examining the evolution of participation intention over time and the effects of policy interventions would provide deeper insights into long-term participation. Expanding the framework to other cities or countries could test its applicability in diverse socio-economic and cultural contexts, offering comparative perspectives. Additionally, incorporating advanced techniques such as machine learning or big data analytics may enhance the objectivity and adaptability of the evaluation, enabling more data-driven and responsive participation mechanisms in smart community governance.

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