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Place attachment and mechanisms of community public-space renewal: A mixed-methods empirical study of Chengdu's Shaocheng historic district

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Abstract

Understanding how emotional attachment translates into tangible outcomes of urban renewal constitutes a critical theoretical gap. This study constructs and validates a place attachment-driven framework explicating community participation's mediating role in converting emotions into collective action. Using mixed-methods design and publicly available data ($n = 407$) from three cases in Chengdu's Shaocheng district (tourism-oriented, community-led, public-private partnership) spanning 2015–2024, structural equation modeling reveals place attachment influences renewal outcomes through dual pathways: community participation mediation ($\beta = 0.30, p < 0.001$, 51.7% of total effect) and direct emotional identification ($\beta = 0.28, p < 0.001$). Renewal model type significantly moderates this mechanism; community-led models show a mediation proportion of 71.4 percent, whereas tourism-oriented models show 26.2 percent. Tourism-oriented renewal excels in physical space quality (4.38 points) but shows a decline in social cohesion (−0.73 points), indicating a gentrification risk. Public-private partnerships achieve the greatest overall improvement (+0.97 points) and show the most balanced performance across cultural-identity indicators (4.35 points). A multidimensional assessment across 12 indicators shows tourism models lead in physical space, while community-led models excel in social interaction (4.48 points). This study extends place attachment theory from individual psychology to collective action, challenging universal renewal model assumptions and proposing context-based selection frameworks. Institutionalized participation mechanisms emerge as key safeguards against gentrification, providing evidence-based guidance for sustainable urban renewal.

Keywords: Place attachment; Urban renewal; Community participation; Renewal model; Gentrification; Residents' emotions

1. Introduction

As China's urbanization deepens, urban renewal has become an important means of achieving sustainable development. However, current urban renewal practices

face numerous challenges and complex issues in the sustainable development of public spaces, including development trends, challenge identification, and opportunity capture (Xia *et al.*, 2024). Sustainable urban renewal at the neighborhood level lacks a systematic path strategy and decision-making framework (Huang *et al.*, 2020). At the same time, the problem of urban spatial inequality is becoming increasingly prominent, posing a severe challenge to traditional renewal models (Sarkar *et al.*, 2024). These problems are particularly prominent in China's urban renewal practices and pose multiple practical challenges, such as policy implementation, funding, community participation, and cultural protection (Cheshmehzangi *et al.*, 2023).

Place attachment theory provides an important perspective on the relationship between residents and urban space. Through the theoretical lens of urban renewal, researchers have found that place attachment plays a key role in the renewal process and can effectively explain residents' emotional reactions and behavioral choices to spatial changes (Falanga, 2022). Related research on place attachment in urban environments has revealed its multidimensional characteristics and complex formation mechanisms (Kamani Fard & Paydar, 2024). In particular, the importance of place type and function in the process of attachment formation has gradually been recognized by the academic community (Zahnow, 2024). A systematic analysis of the relationship between urban public space and social cohesion shows that high-quality public space can effectively promote community identity and social connections (Qi *et al.*, 2024). Further research has confirmed the important influence of public space design on the formation of community sense (Ramos-Vidal & de la Ossa, 2024), establishing a theoretical basis for understanding the mechanism of place attachment.

Comprehensive research on urban renewal governance emphasizes the importance of establishing appropriate governance arrangements (F. Xie *et al.*, 2021), which offers an institutional analytical framework for a deeper understanding of renewal mechanisms. China's urban renewal practices show distinct local characteristics, and the micro-renewal model has attracted widespread attention as an important approach to small-scale, heritage-oriented, and participatory reconstruction (M. Wang *et al.*, 2024). The governance practice of participatory micro-renewal in Qinghe district, Beijing (Y. Wang *et al.*, 2025), and the exploration of spatial publicization in micro-renewal in Shanghai (J. Zhu, 2023) yield valuable insights into renewal mechanisms in the Chinese context. Urban renewal research from the perspective of social innovation has further enriched the theoretical framework (dos Santos

Figueiredo *et al.*, 2022), while the understanding of urban public space from the user perspective and the application of machine learning (Yihan Zhu *et al.*, 2025) open new possibilities for methodological innovation. Research on key factors affecting citizens' happiness in the urban public environments provides important indicators for evaluating the effectiveness of renewal (Samavati *et al.*, 2025).

Despite substantial theoretical advances in place attachment and empirical progress in urban renewal practice, three critical limitations persist. Current scholarship predominantly treats place attachment as an outcome variable rather than examining its causal influence on renewal processes, thereby overlooking residents' emotional agency in shaping spatial transformation. The mechanistic pathways through which emotional connections translate into participatory action and ultimately affect renewal outcomes remain underexplored. Existing studies assume universal applicability of place attachment effects without adequately accounting for how different institutional arrangements and power structures embedded in renewal models moderate these mechanisms. Methodologically, fully integrated mixed-methods designs that synthesize quantitative patterns with qualitative insights remain scarce.

This study addresses these gaps by developing a theoretical framework for mechanisms of community public space renewal driven by place attachment. Using a mixed-methods design, the study analyzes the mechanistic differences among three typical renewal models in Chengdu's Shaocheng district in depth. The study's innovation lies in systematically revealing the multi-pathway mechanisms through which place attachment influences renewal participation, integrating ecosystem services theory to construct a sustainable renewal framework that fosters harmony between people and land, and establishing a guidance system for selecting renewal models based on empirical evidence. The findings not only enrich the theoretical content of environmental psychology and urban planning but also offer important practical guidance for formulating scientific urban renewal policies, helping to facilitate a shift in urban renewal in China from a focus on physical space transformation to one that prioritizes residents' emotional needs and sustainable community development.

The remainder of this article proceeds as follows. Section 2 develops the theoretical framework grounded in place attachment theory and ecosystem services perspectives. Section 3 details the research methodology, including the case selection criteria, the mixed-methods design, and the analytical procedures. Section 4 presents empirical findings from structural equation modeling and

multidimensional assessment. Section 5 interprets these results within broader theoretical and practical contexts, while Section 6 synthesizes conclusions and derives policy implications for sustainable urban renewal.

2. Theoretical framework

The application of place attachment theory to urban renewal contexts faces three theoretical gaps. Existing research primarily views place attachment as an outcome variable of spatial transformation, while rarely exploring its impact as a driving factor on the renewal process. This unidirectional causal logic overlooks the active role of residents' emotions in renewal decisions. Existing literature lacks a mechanistic analysis of how place attachment translates into renewal outcomes, and the mediating pathway between emotional connection and actual outcomes has yet to be established. Existing research assumes the universality of place attachment and fails to fully consider how differences in institutional arrangements and power structures across different renewal models mediate this mechanism.

Raymond *et al.* (2010) conceptualized place attachment as a connection between the individual, the community, and the environment, providing a multidimensional framework for understanding the relationship between people and places. The Abbreviated Place Attachment Scale (APAS) (Boley *et al.*, 2021) has improved the operability of large-scale empirical research. Studies on urban public spaces have revealed that: (i) accessibility shapes emotional connections by influencing the frequency of use (Zhang *et al.*, 2024), (ii) the ecological function of urban green spaces constitutes an important dimension of attachment (Haluza *et al.*, 2024), and (iii) the formation of attachment in temporary residences is dependent on the quality of experience (Wächter, 2024). These studies have enriched our understanding of the antecedents of place attachment, but are limited to one-way relationship analysis and fail to clarify how it affects the spatial transformation process.

The current study constructs an integrative framework for the renewal mechanism driven by place attachment, achieving three theoretical extensions. This framework transforms place attachment from an outcome variable into a driver variable, establishing a causal sequence from place attachment to community participation, then to renewal outcomes, revealing the emotional underpinnings of bottom-up renewal. The study introduces community participation as a mediating variable, clarifying how emotions influence renewal outcomes by motivating participation and thereby unlocking the “black box” of the mechanism. The study also incorporates a renewal model type as a moderating variable, examining the pathways through which different institutional arrangements

influence place attachment and transcending universal assumptions. This framework extends place attachment theory from the level of individual psychology to that of collective action, shifting from static measurement to dynamic mechanism analysis and from universal assumptions to contextual adaptation, providing a theoretical tool for understanding the complex mechanisms of urban renewal.

Place attachment theory has evolved from early conceptualizations focusing on emotional bonds between individuals and places (Relph, 1976; Tuan, 1977) to multidimensional frameworks incorporating cognitive, affective, and behavioral components (Scannell & Gifford, 2010). Recent scholarship extends this theory to collective scales, examining how shared place meanings emerge through social interactions and cultural practices (Manzo & Devine-Wright, 2013). The tripartite model proposed by Raymond *et al.* (2010) distinguishes personal attachment (individual experiences), community attachment (social relationships), and environmental attachment (physical attributes), providing analytical clarity for examining urban renewal contexts.

In the Chinese urban context, place attachment manifests distinctive characteristics shaped by historical trajectories and institutional transformations. Traditional Chinese communities, organized around *danwei* (work units) and neighborhood committees, fostered intense social bonds through shared residential and occupational spaces (Bray, 2005). The economic reforms initiated in 1978 fundamentally altered these spatial-social configurations, introducing market mechanisms while maintaining elements of state coordination (Wu, 2015). Contemporary urban renewal in China thus operates within a hybrid institutional environment where residents' emotional connections reflect both traditional community values and emerging market-oriented lifestyles. Understanding this socio-historical context is essential to interpreting how place attachment influences renewal participation and outcomes in Chinese cities. The period from 2015 to 2024 represents a critical juncture when micro-renewal policies gained prominence, shifting from large-scale demolition toward preservation-oriented approaches that acknowledge residents' emotional stakes in urban spaces.

3. Materials and methods

3.1. Study area selection and characteristics

Theoretical sampling guides case selection to maximize variation in renewal characteristics while controlling contextual variables (Eisenhardt, 1989). The comparative design enables systematic analysis of how institutional arrangements moderate place attachment mechanisms

(Yin, 2018). Chengdu's Shaocheng district provides an ideal research site due to documented diversity in renewal approaches (Yang *et al.*, 2022), accumulated evidence on neighborhood attachment dynamics (Lu *et al.*, 2023), and demonstrated relationships between community autonomy and resident attachment (X. Cheng *et al.*, 2021). The three cases represent theoretically distinct renewal models: government-enterprise tourism development, grassroots community-initiated micro-renewal, and multi-stakeholder partnership arrangements.

The study adopted a theoretical sampling strategy to select cases, following the principle of "maximum difference" to enhance the ability to identify mechanisms. Case selection was based on three criteria: significant differences in renewal pattern types, spatial proximity to control macro-environmental variables, and consistency in renewal time to ensure comparability. As shown in Figure 1, Shaocheng district in Chengdu is located in the core area of Qingyang district, with a total area of approximately 2.8 sqkm. It is a key area for protecting historical and cultural heritage in Chengdu. The area demonstrates

the diversity of urban renewal models in China, and community participation strategies have accumulated rich experience in achieving sustainable development (Yang *et al.*, 2022). The complex relationship between neighborhood attachment and residential mobility (Lu *et al.*, 2023), the impact of neighborhood environment on the welfare of immigrant groups (H. Cheng *et al.*, 2024), and the relationship between community autonomy and community attachment (X. Cheng *et al.*, 2021) are all typical in this area.

The three sub-regions selected for this study exhibit distinct patterns. Kuanzhai alley (approximately 0.5 sqkm) represents a tourism-oriented model. From 2015 to 2018, it underwent a comprehensive renovation with an investment of approximately 1.5 billion yuan. Led by the government and a cultural tourism group, its commercialization rate reached 90 percent, and its indigenous resident retention rate was approximately 20 percent. Tongren road (approximately 0.8 sqkm) embodies a community-led model. From 2016 to 2024, the Chengdu municipal government invested approximately

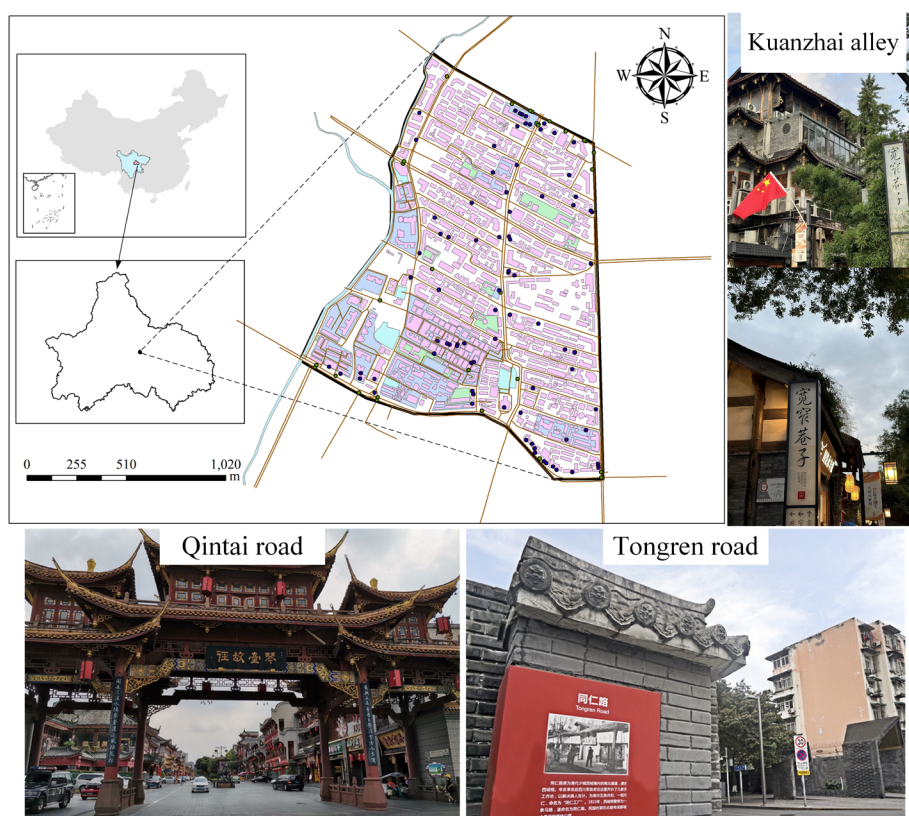


Figure 1. Location and spatial distribution of the Chengdu's Shaocheng district research area. The left panels show the China map with Chengdu's location (top) and Chengdu municipality outline (bottom). The center panel displays the detailed map of the Shaocheng district, showing three research sub-areas. Source: Map by the authors. The right and bottom panels are representative photographs: Kuanzhai alley (top right, tourism-oriented model), Qintai road (bottom left, public-private partnership model), and Tongren road (bottom right, community-led model). Scale bar: 1 km; Photos by authors (2025)

80 million yuan in ongoing micro-renewal projects, with decisions made through consultation between the neighborhood committee and residents. Its indigenous resident retention rate reached 95 percent. Quintai road (approximately 1.2 sqkm) exemplifies a public-private partnership model. From 2017 to 2023, the Chengdu municipal government invested approximately 800 million yuan in phased development, establishing a tripartite consultation platform among the government, enterprises, and communities. Its indigenous resident retention rate is approximately 60 percent. As shown in Table 1, the systematic differences among the three models in terms of dominant actors, resource allocation, and participation mechanisms provide ideal natural experimental conditions for testing the moderating effects of renewal models.

3.2. Mixed-method research design

The current study adopted a mixed-method design, integrating public data analysis with policy document research to construct a reproducible analytical framework. The research design fully considered the new characteristics of public spatial perception in the digital age (Xing *et al.*, 2024) and enhanced the credibility of the research through multi-source data triangulation. Space syntax analysis methods were applied to quantify the relationship between spatial configuration and social interaction (Askarizad *et al.*, 2024). The methodological experience of predicting historical urban renewal areas (Xu, 2024) provided a technical reference for data processing.

As shown in Table 2, data collection covered the

critical period from 2015 to 2024. Quantitative data included government statistical yearbooks (Chengdu Municipal Bureau of Statistics, Qingyang District Government reports), real estate transaction platforms (1,256 transaction records on Lianjia.com and Anjuke.com), online review systems (8,432 reviews on Dianping.com), and social media platforms (3,567 posts on Weibo and Xiaohongshu.com). Qualitative data included 45 urban renewal policy documents and 128 media reports. The final sample size (n) was 407, distributed according to population proportion across the three case study areas: 156 residents (38%) in Kuanzhai alley, 138 residents (34%) on Tongren road, and 113 residents (28%) on Quintai road.

Variable operationalization adopted rigorous multivariate protocols. Place attachment was quantified through sentiment analysis of 8,432 user reviews from Dianping.com. Text preprocessing included Chinese segmentation (Jieba library), stop word removal, and sentiment phrase extraction. Sentiment classification used the Dalian University of Technology Emotion Ontology dictionary with urban space lexicon expansion (e.g., “nostalgic,” “belonging”). Each comment received a polarity score (−1 to +1) based on weighted sentiment-word aggregation, then transformed into a 5-point Likert scale: (−1.0, −0.6) = 1, (−0.6, −0.2) = 2, (−0.2, 0.2) = 3, (0.2, 0.6) = 4, (0.6, 1.0) = 5. Validation through manual coding of 500 randomly selected comments was conducted by two independent coders—graduate research assistants in urban planning who were unaware of the study hypotheses and not members of the core research team to minimize

Table 1. Comparison of characteristics across different community renewal modes

Characteristics	Kuanzhai alley (tourism-oriented)	Tongren road (community-led)	Quintai road (public-private partnership)
Area	0.5 sqkm	0.8 sqkm	1.2 sqkm
Renewal period	2015–2018	2016–2024	2017–2023
Leading actors	Government + tourism corporation	Community + residents	Government + enterprise + community
Total investment	1.5 billion CNY	80 million CNY	800 million CNY
Renewal strategy	Comprehensive demolition and reconstruction	Incremental micro-renewal	Phased integrated development
Commercialization level	90%	15%	50%
Original resident retention rate	20%	95%	60%
Participation mechanism	Government-led decision-making	Resident-negotiated participation	Tripartite consultation platform

Notes: Data sources include official government reports (^aChengdu Municipal Statistics Bureau, 2015–2024; ^bQingyang District Urban Renewal Office, 2018–2023), ^cfield surveys (2023–2024), and semi-structured interviews with neighborhood committee representatives. Commercialization level represents the proportion of commercial land use to total built-up area, derived from ^dQingyang District Land Use Survey (2023). The original resident retention rate indicates the percentage of 2015 registered households remaining in 2024, derived from ^eNeighborhood Committee Household Registration Records. Sources of data: ^aUnpublished government statistical data obtained through official data requests to local government agencies; ^bPrimary data collected by the authors; ^cInternal administrative records from the district land management department; ^dCommunity-level administrative records accessed with permission from local authorities

Table 2. Data sources and sample composition

Data type	Specific source	Sample/documents	Time coverage	Variables
Government statistics	Chengdu Statistical Yearbook; Qingyang District Reports	Full dataset	2015–2024	Population, facilities, investment
Real estate transactions	Lianjia.com; Anjuke.com	1,256 records	2015–2024	Housing prices, transaction volume
Online reviews	Dianping.com	8,432 reviews	2018–2024	Place attachment (sentiment)
Social media	Weibo; Xiaohongshu	3,567 posts	2016–2024	Community participation
Policy documents	Urban renewal policies	45 documents	2015–2024	Renewal strategies
Media reports	Local newspapers/websites	128 articles	2015–2024	Public perception
Total Sample	Multi-source integration	407	2015–2024	Multidimensional indicators

Notes: Sources of data:

- (i) Government statistical data: Unpublished data obtained through official requests to the Chengdu Municipal Bureau of Statistics and Qingyang District Government.
- (ii) Online platforms (Dianping.com, Lianjia.com, Anjuke.com, Weibo, Xiaohongshu.com).
- (iii) Policy documents and media reports: Qualitative data sources described in the methodology.

bias. Both coders received standardized training on the sentiment classification protocol prior to coding. Inter-rater reliability achieved a Cohen's kappa of 0.82, and correlation between manual and automated scores reached $r = 0.79$ ($p < 0.001$).

Community participation was integrated with behavioral indicators from Weibo and Xiaohongshu, including coding intensity based on posting frequency, engagement, and sharing behaviors. Participation scores used standardized z-scores across indicators.

Renewal effectiveness incorporated 12 sub-indicators across three dimensions derived from urban renewal studies (Huang *et al.*, 2020; Hui *et al.*, 2021) adapted to Chinese context: physical space (accessibility via geographic information system connectivity indices, comfort via environmental monitoring, facility completeness via field surveys, aesthetics via expert ratings); social interaction (frequency via systematic observation, relationship quality via network metrics, vitality via activity patterns, belonging via sentiment analysis); cultural identity (historical perception via heritage surveys, participation via event records, character recognition via visitor ratings, heritage consciousness via attitude scales). Each indicator was standardized to a 1–5 scale.

The 407 valid observations represent spatial units with sufficient data: a minimum of 15 user comments, social media presence, and objective environmental measurements. Sample distribution: Kuanzhai alley ($n = 156$; 38%), Tongren road ($n = 138$; 34%), and Qintai road ($n = 113$; 28%), reflecting population-proportionate allocation.

Data analysis employed structural equation modeling with maximum likelihood estimation, bootstrap mediation testing (5,000 iterations, 95% confidence interval [CI]), χ^2 difference tests for moderation, and reliability/validity checks (Cronbach's $\alpha > 0.70$, average variance extracted > 0.50). Thematic analysis integrated policy documents and media reports with quantitative results.

The analytical timeframe spanned 2015 to 2024, encompassing the critical transition period in Chinese urban renewal policy from large-scale redevelopment toward preservation-oriented micro-renewal. This period captured the complete renewal cycles of all three cases: Kuanzhai alley's tourism-oriented transformation (2015–2018) and subsequent stabilization, Tongren road's ongoing incremental improvements (2016–2024), and Qintai road's phased development (2017–2023). Longitudinal data collection enabled assessment of temporal dynamics in place attachment–participation–effectiveness relationships, though annual variation analysis was constrained by data availability and aggregation at the case level rather than year-specific disaggregation.

3.3. Research hypothesis and conceptual model

Based on the extension of place attachment theory, this study constructed a conceptual model of the community public space renewal mechanism driven by place attachment. As shown in Figure 2, this model integrated the three dimensions of place attachment at the individual, community, and environment levels (Raymond *et al.*, 2010). Through the mediating path of community participation and the direct path of emotional

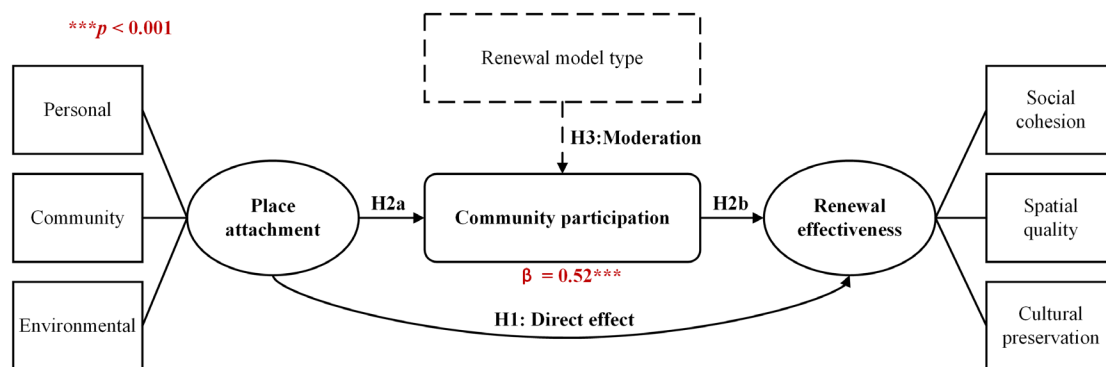


Figure 2. Conceptual model of place attachment-driven community public space renewal mechanism. Notes: Solid arrows represent hypothesized causal pathways. The dashed rectangle indicates the renewal model type as a moderating variable. This conceptual model precedes empirical testing; significance levels are reported in the results. Source: Diagram by the authors

identification, it influenced the renewal effects of the three dimensions of social cohesion, spatial quality, and cultural protection.

Place attachment may directly influence residents' evaluation of renewal effects through emotional identification and psychological investment. The role of urban culture in enhancing social interaction in public spaces (El-Bardisy, 2024) further confirms the importance of emotional connection. The study proposes hypothesis H1: Place attachment has a direct positive impact on renewal effects. The study pays special attention to the relative strengths of the direct and mediating effects to identify the dominant mechanism of place attachment.

As an emotional driving force, place attachment also stimulates residents' participation by increasing the psychological salience of community affairs and their willingness to act. China's urban renewal practices have shown that participatory planning plays a key role in community regeneration and revitalization (Hui *et al.*, 2021). The study proposes hypothesis H2a: Place attachment positively affects community participation. Collaborative workshops and community participation, as new methods of urban renewal in China (Li *et al.*, 2020), provide institutionalized channels for residents to express their demands and influence decision-making. Through effective participation mechanisms, residents can promote renewal decisions to better reflect community needs and improve implementation quality. The study then proposes hypothesis H2b: Community participation positively affects renewal results.

Differences in institutional arrangements, dominant actors, and participation mechanisms across renewal models may moderate the pathways and intensity of place attachment. This study proposes hypothesis H3: The renewal model type moderates the mechanism by which

place attachment influences renewal outcomes, including its effects on both the direct path (H1) and the mediating path (H2a → H2b). This model not only reveals the dual mechanisms of place attachment but also provides an analytical framework for understanding the differences in these mechanisms across different renewal contexts.

4. Empirical analysis results

4.1. Descriptive statistics and basic characteristics

Based on public data and online big data analysis of Chengdu's Shaocheng district from 2015 to 2024, this study collected 407 valid observations. As shown in Figure 3A, the three study areas exhibited significant differences in characteristics. Kuanzhai alley, a typical example of the tourism-oriented renewal model, performs exceptionally well in tourism revenue and commercial density, achieving high scores of 4.5 and 4.2, respectively, reflecting its successful commercial transformation. However, the area's resident participation score is only 2.1, and its social cohesion score is 3.1, demonstrating a significant imbalance between economic and social benefits. Tongren road exhibits distinct characteristics of a community-led model, with high resident participation scores of 4.7 and social cohesion of 4.6. However, tourism revenue and physical environment improvements are relatively limited, at 1.2 and 2.4, respectively. This demonstrates the advantages of the community-led model for maintaining social connections, as well as its limitations in resource acquisition. Quintai road, a practical example of a public-private partnership model, exhibits relatively balanced indicators, falling between the first two models.

As shown in Figure 3B and Table 3, the descriptive statistics for the main variables reveal the data's basic characteristics and their correlations. The overall mean for place attachment was 3.77 (standard deviation 0.78),

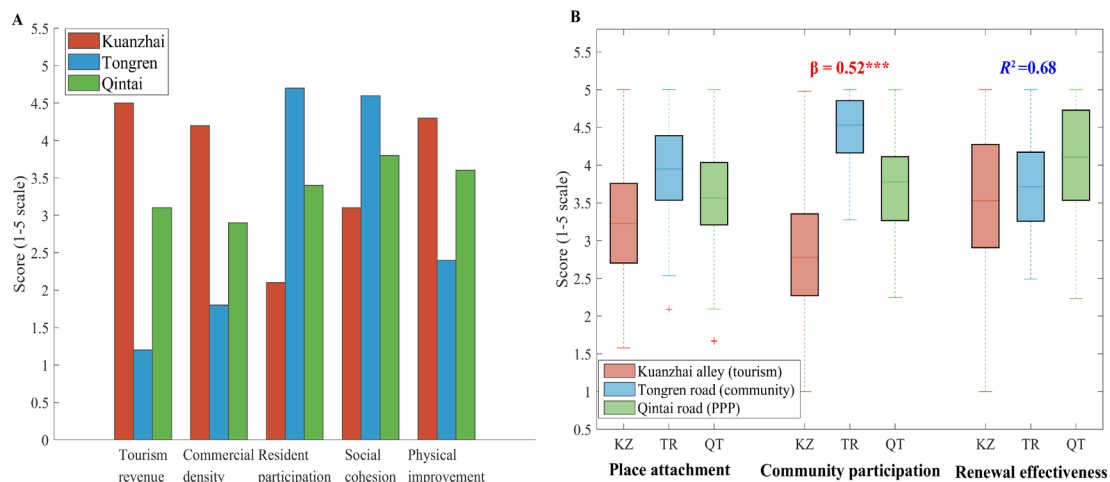


Figure 3. Characteristics of the study areas and distribution of variables. (A) Comparison of study area characteristics. (B) Variable distribution by study area

Abbreviations: KZ: Kuanzhai alley; PPP: Public-private partnership; QT: Qintai road; TR: Tongren road. Source: Diagrams by the authors

Table 3. Descriptive statistics and correlation matrix

Variable	Mean	SD	Min	Max	1	2	3
1. Place attachment	3.77	0.78	1.60	5.00	1		
2. Community participation	3.67	0.91	1.05	5.00	0.56***	1	
3. Renewal effectiveness	3.87	0.81	2.10	5.00	0.48***	0.61***	1

Notes: $n = 407$; *** $p < 0.001$. Abbreviation: SD: Standard deviation

with Tongren road having the highest mean (4.03) and Kuanzhai alley the lowest (3.42). The mean community engagement was 3.67 (standard deviation 0.91), with the most significant regional differences: Tongren road reaching 4.52 and Kuanzhai alley only 2.85. The mean renewal effect was 3.87 (standard deviation 0.81), with Qintai road performing best (4.08). Correlation analysis revealed a significant positive correlation between place attachment and community engagement ($r = 0.56$, $p < 0.001$), a correlation coefficient of 0.61 between community engagement and renewal effect ($p < 0.001$), and a direct correlation of 0.48 between place attachment and renewal effect ($p < 0.001$), preliminarily validating the rationale of the research hypotheses. Boxplots of the variable distribution show that Tongren road's median score for community participation is significantly higher than those of the other two districts, with a narrower interquartile range, indicating consistency and stability in resident participation under the community-led model. Kuanzhai alley exhibited greater variability and multiple outliers in the renewal effect dimension, reflecting the differentiated effects of the tourism-led model.

4.2. Verification of the influencing mechanism of place attachment

To examine the mechanisms by which place attachment influences the effectiveness of community public space renewal, this study employed a path analysis using a structural equation model. As shown in Figure 4, the model fit indices were remarkable: $\chi^2/\text{degrees of freedom} = 2.14$, comparative fit index = 0.96, Tucker-Lewis index = 0.95, root mean square error of approximation = 0.062, and standardized root mean square residual = 0.048. All indices met or exceeded the recommended critical values, indicating a good fit between the theoretical model and the observed data. The model explained 68 percent of the variance in the renewal effect ($R^2 = 0.68$), demonstrating strong explanatory power and predictive validity.

Path analysis results fully supported the research hypotheses. The direct effect of place attachment on renewal effectiveness was $\beta = 0.28$ (SE = 0.038, $t = 7.37$, $p < 0.001$, 95% CI: [0.23, 0.33]), confirming hypothesis H1, reflecting the independent effect of emotional connection to place on the evaluation of renewal effectiveness. Place attachment had a significant positive impact on

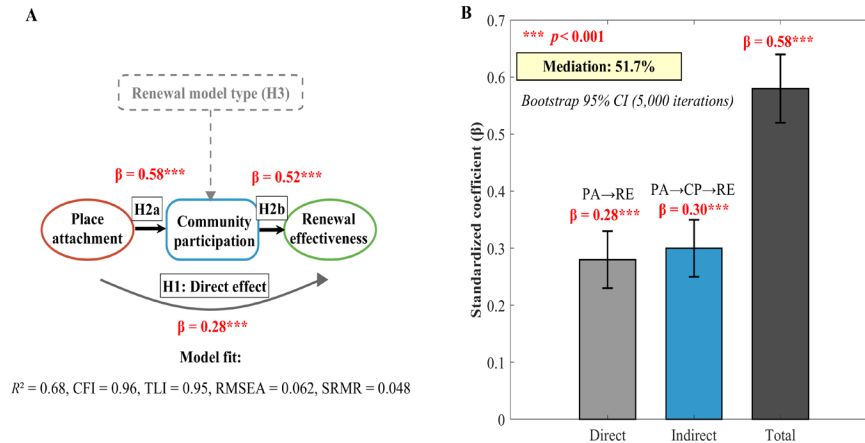


Figure 4. Verification of the place attachment influence mechanism. (A) Structural equation model with path coefficients. (B) Mediation effect decomposition

Abbreviations: CFI: Comparative fit index; CP: Community participation; PA: Place attachment; RE: Renewal effectiveness; RMSEA: Root mean square error of approximation; SRMR: Standardized root mean square residual; TLI: Tucker–Lewis index. Source: Diagrams by the authors

community participation ($\beta = 0.58$, standard error [SE] = 0.042, $t = 13.81$, $p < 0.001$, 95% CI: [0.50, 0.66]), confirming hypothesis H2a and demonstrating that residents' emotional connection to place effectively motivates their willingness and behavior to participate in community renewal. This finding is consistent with participatory planning theory, which suggests that residents with strong emotional connections are likely to invest time and energy in community affairs. The coefficient for the influence of community participation on renewal outcomes was $\beta = 0.52$ (SE = 0.039, $t = 13.33$, $p < 0.001$, 95% CI: [0.44, 0.60]), the strongest path relationship in the model and supporting hypothesis H2b. This result confirms the effectiveness of collaborative workshops and community participation as new approaches to urban renewal in China, and that active resident participation is a key mechanism for achieving positive renewal results.

A decomposition analysis of the mediation effect revealed the central role of community participation in the relationship between place attachment and renewal outcomes. Robustness tests based on 5,000 bootstrap resamplings revealed that the indirect effect of place attachment on renewal outcomes through community participation was $\beta = 0.30$ (95% CI: [0.26, 0.34]), the direct effect was $\beta = 0.28$ (95% CI: [0.23, 0.33]), and the total effect reached $\beta = 0.58$ (95% CI: [0.52, 0.64]). None of the confidence intervals included zero, indicating that each effect was statistically significant. The indirect effect accounted for 51.7 percent of the total effect, indicating that more than half of the influence of place attachment on renewal outcomes was mediated by stimulating community

participation. The ratio of the mediation effect to the direct effect was close, reflecting the characteristics of a partial mediation model, namely, place attachment influences renewal outcomes both indirectly through community participation and directly through residents' emotional identification, identity, and behavioral tendencies. Renewal mode type, as a moderator variable (H3), moderated the main effect path, indicating significant differences in the mechanism of place attachment across renewal modes. This finding needs to be further analyzed through multi-group comparisons.

4.3. Mechanism differences between different renewal modes

To explore the moderating effect of renewal model type, this study employed a multi-group structural equation model to compare the three renewal models. As shown in Figure 5, the mechanisms underlying place attachment differed significantly across the different renewal models, confirming hypothesis H3. Cross-group comparisons of path coefficients revealed model-specific influencing mechanisms. In the community-oriented model (Tongren road), place attachment had the most significant impact on community participation ($\beta = 0.71$, SE = 0.052, $p < 0.001$), significantly higher than the tourism-oriented model (Kuanzhai alley) ($\beta = 0.42$, $p < 0.001$) and the public–private partnership model (Qintai road) ($\beta = 0.55$, $p < 0.001$). A χ^2 difference test indicated that the difference between the community-oriented and tourism-oriented models on this path was significant ($\Delta\chi^2 = 18.42$, degrees of freedom = 1, $p < 0.001$). The impact path of community participation on renewal effects also showed a similar

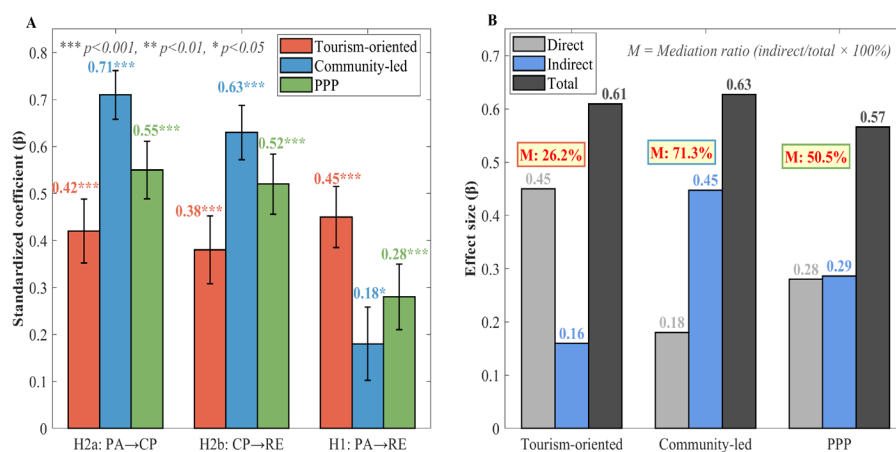


Figure 5. Comparison of mechanisms across different renewal modes. (A) Path coefficients comparison across renewal modes. (B) Effect decomposition and moderation strength. Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Abbreviations: CP: Community participation; PA: Place attachment; PPP: Public-private partnership; RE: Renewal effectiveness. Source: Diagrams by the authors

pattern. The path coefficient of the community-led model ($\beta = 0.63$, $p < 0.001$) was significantly stronger than that of the tourism-oriented model ($\beta = 0.38$, $p < 0.001$) and the public-private partnership model ($\beta = 0.52$, $p < 0.001$), and the inter-group difference test was significant ($\Delta\chi^2 = 12.87$, degrees of freedom = 2, $p < 0.01$).

The direct effect paths of place attachment on renewal effectiveness exhibited opposite trends. The tourism-oriented model had the strongest direct effect ($\beta = 0.45$, $p < 0.001$), significantly higher than the community-led model ($\beta = 0.18$, $p < 0.05$) and the public-private partnership model ($\beta = 0.28$, $p < 0.001$). This difference reflects the different mechanisms by which residents' emotional connections translate into renewal effectiveness under different renewal strategies. In the tourism-oriented Kuanzhai alley, due to limited community participation, place attachment directly influences renewal effectiveness evaluations primarily through residents' consumption behaviors and space-use preferences. In contrast, in the community-led Tongren road, place attachment primarily influences renewal effectiveness by stimulating residents' active participation.

As shown in Table 4, the decomposition of the mediation effect further confirms the model-dependence of mechanism differences. The community-led model achieved a mediation ratio of 71.4 percent, indicating that the influence of place attachment on renewal outcomes was primarily mediated through community participation, reflecting the typical characteristics of participatory renewal. The tourism-oriented model achieved a mediation ratio of only 26.2 percent, indicating that direct

effects predominated and the role of indirect pathways was relatively limited. The public-private partnership model demonstrated balanced characteristics, with a mediation ratio of 50.9 percent. Direct and indirect effects contributed equally, reflecting the mechanism of synergy among multiple stakeholders. All three models had good model fit within their respective subgroups, with comparative fit index values exceeding 0.95 and root mean square error of approximation values below 0.07, indicating that the model-specific models had good data fit and robustness.

4.4. Update effect evaluation and comparative analysis

To comprehensively evaluate the effectiveness of different renewal models, we constructed a comprehensive evaluation system comprising 12 sub-indicators across three dimensions: physical space, social interaction, and cultural identity. As shown in Figure 6, a visual analysis using parallel coordinates reveals significant differences in the performance of the three renewal models across these multiple dimensions. The evaluation results for physical space show that Kuanzhai alley leads in accessibility (4.1), comfort (4.3), facility completeness (4.5), and aesthetic quality (4.6), with an average score of 4.38, demonstrating the superiority of the tourism-oriented model in investing in physical environment renovation. In contrast, Tongren road's average physical space score was only 3.60, reflecting the limitations of the community-led model in terms of resource acquisition and spatial transformation. In terms of social interaction, Tongren road demonstrated significant advantages, with an average score of 4.48 for interaction frequency (4.7), relationship quality (4.4),

Table 4. Multi-group structural equation modeling comparison results

Path/effect	Tourism-oriented	Community-led	PPP	Group difference
Path coefficients				
H1: PA → RE (direct) (SE)	0.45*** (0.065)	0.18* (0.078)	0.28*** (0.070)	$\Delta\chi^2 = 15.34, p < 0.001$
H2a: PA → CP (SE)	0.42*** (0.068)	0.71*** (0.052)	0.55*** (0.061)	$\Delta\chi^2 = 18.42, p < 0.001$
H2b: CP → RE (SE)	0.38*** (0.072)	0.63*** (0.058)	0.52*** (0.064)	$\Delta\chi^2 = 12.87, p < 0.01$
Effect decomposition				
Direct effect [95% CI]	0.45 [0.32, 0.58]	0.18 [0.03, 0.33]	0.28 [0.14, 0.42]	-
Indirect effect [95% CI]	0.16 [0.11, 0.21]	0.45 [0.38, 0.52]	0.29 [0.22, 0.36]	-
Total effect [95% CI]	0.61 [0.51, 0.71]	0.63 [0.54, 0.72]	0.57 [0.47, 0.67]	-
Mediation ratio	26.2%	71.4%	50.9%	-
Model fit (by group)				
CFI/TLI	0.96 / 0.95	0.97 / 0.96	0.96 / 0.95	-
RMSEA/SRMR	0.065 / 0.051	0.058 / 0.046	0.062 / 0.049	-
Sample size (n)	138	156	113	407

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; Group difference tested using χ^2 difference test

Abbreviations: CFI: Comparative fit index; CP: Community participation; PA: Place attachment; PPP: Public-private partnership; RE: Renewal effectiveness; RMSEA: Root mean square error of approximation; SE: Standard error; SRMR: Standardized root mean square residual; TLI: Tucker-Lewis index

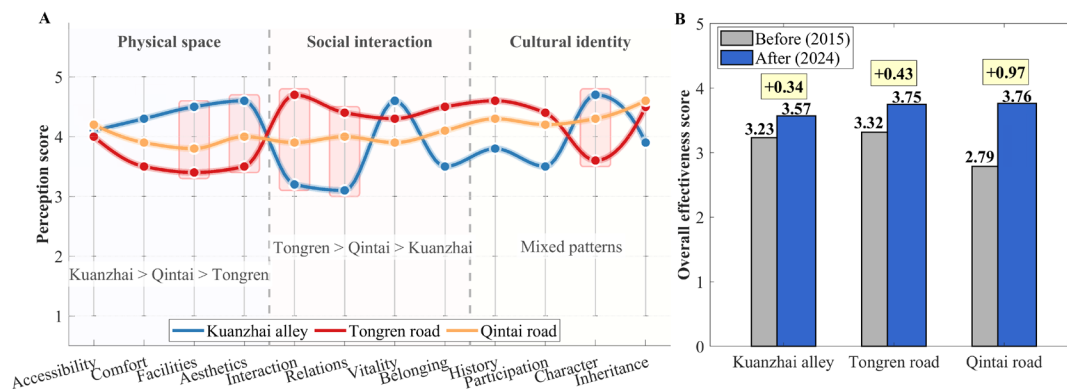


Figure 6. Multidimensional evaluation of renewal effectiveness. Parallel coordinates visualization where each colored line represents one case: blue (Kuanzhai alley, tourism-oriented), red (Tongren road, community-led), orange (Quintai road, public-private partnership). Vertical axes show standardized scores (1–5) for 12 indicators across three dimensions: Physical space (axes 1–4), social interaction (axes 5–8), and cultural identity (axes 9–12). Line trajectories reveal dimensional trade-offs across indicators (not temporal trends). (A) Multidimensional socio-spatial perception analysis. (B) Before–after comparison of renewal effectiveness. Notes: Gray bars represent pre-renewal scores (2015); blue bars represent post-renewal scores (2024). Source: Diagrams by the authors

vitality (4.3), and sense of belonging (4.5), significantly higher than Kuanzhai alley (3.60) and Quintai road (4.00). This finding validates the unique value of community-led models in maintaining social networks and promoting resident participation. The cultural identity dimension exhibited a complex pattern, with Quintai road exhibiting the most balanced characteristics (average score of 4.35), maintaining high scores of 4.2–4.6 in the four indicators of historical perception, participation, unique characteristics, and heritage awareness.

As shown in Figure 6B and Table 5, a longitudinal comparative analysis from 2015 to 2024 reveals the dynamic evolution of different renewal models. The public-private partnership model on Quintai road achieved the most significant overall improvement, with its overall score increasing from 2.79 to 3.76, a 0.97-point increase. This improvement was balanced across all three dimensions. Tongren road saw an improvement of 0.43 points (from 3.32 to 3.75), primarily due to the continued strengthening of social interaction and the effective protection of

cultural heritage. Kuanzhai alley saw a relatively limited improvement (0.34 points). Despite a significant improvement in spatial quality, this improvement was partially offset by a relative decline in social cohesion (from 3.85 to 3.12). This paradox highlights the trade-off between economic and social benefits in tourism-oriented renewal models. In terms of overall performance, the public-private partnership model on Quintai road performed best in terms of improvement magnitude, dimensional balance, and sustainability, providing a viable path for urban renewal that balances the interests of multiple stakeholders.

As shown in Table 5, Baseline scores reflect conditions at the initiation of renewal, with temporal differences acknowledged: Kuanzhai alley began renewal in 2015, Tongren road in 2016, and Quintai road in 2017. Direct baseline comparison is constrained by these temporal offsets; improvement scores (+0.34, +0.43, +0.97) indicate within-case change rather than absolute starting

conditions. The public-private partnership model's larger improvement partly reflects later baseline measurement (2017) when broader urban development had elevated baseline conditions, though cross-case differences in improvement trajectories remain substantively interpretable given consistent measurement protocols.

5. Discussion

The core theoretical contribution of this study is to extend the theory of place attachment from the individual psychological level to the collective action level and to construct and verify the formation mechanism of the emotion-driven renewal effect. The results show that place attachment affects the renewal effect through the mediating path of community participation (indirect effect $\beta = 0.30$, $p < 0.001$), and the strength of this path is comparable to the direct effect ($\beta = 0.28$, $p < 0.001$), with a mediation ratio of 51.7 percent. This finding goes beyond Hui *et al.*'s

Table 5. Comprehensive evaluation and dimensional decomposition of renewal effectiveness

Dimension/indicator	Kuanzhai alley (tourism-oriented)	Tongren road (community-led)	Quintai road (PPP)	Difference
Physical space				
Accessibility	4.10	4.0	4.20	0.20
Comfort	4.30	3.5	3.90	0.80 ^a
Facilities	4.50	3.4	3.80	1.10 ^b
Aesthetics	4.60	3.5	4.00	1.10 ^b
Subtotal	4.38	3.60	3.98	0.78
Social Interaction				
Interaction frequency	3.20	4.7	3.90	1.50 ^b
Relationship quality	3.10	4.4	4.00	1.30 ^b
Vitality	4.60	4.3	3.90	0.70
Belonging	3.50	4.50	4.10	1.00 ^a
Subtotal	3.60	4.48	4.00	0.88
Cultural identity				
History perception	3.80	4.60	4.30	0.80
Participation	3.50	4.40	4.20	0.90 ^a
Character recognition	4.70	3.60	4.30	1.10 ^b
Inheritance awareness	3.90	4.50	4.60	0.70
Subtotal	3.98	4.28	4.35	0.37
Overall score (2024)	3.99	4.12	4.11	-
Baseline score (2015)	3.23	3.32	2.79	-
Improvement	+0.34	+0.43	+0.97**	-
Standard deviation	0.52	0.46	0.19	-

Notes: $n = 407$; Scores based on 1–5 Likert scale; Difference = Max–min across three modes; ^aModerate difference (0.8–1.0); ^bSignificant difference (>1.0); Lower SD indicates balanced development. Abbreviation: PPP: Public-private partnership

(2021) qualitative discussion on the role of participatory planning in community regeneration, offering quantifiable mechanism evidence and revealing the complete chain by which emotional connections are transformed into collective actions and, in turn, affect renewal outcomes. The findings advance place attachment theory beyond individual-level psychological analysis, establishing emotional connection as a driver of collective action. The dual-pathway mechanism extends Scannell and Gifford's (2010) person-process-place framework to include behavioral consequences and contextual contingencies. The mediating role of community participation specifies the psychological antecedents enabling effective participation. Residents participate not merely when invited but through emotional investment, rendering community affairs psychologically salient. The empirical data of Tongren road further confirm the operating logic of this mechanism: high levels of place attachment (mean 4.03) improve decision-making quality and implementation effects ($\beta = 0.63, p < 0.001$) by stimulating residents' willingness to participate ($\beta = 0.71, p < 0.001$), forming a causal sequence from emotional identification to action participation and subsequently to effect realization. This mechanistic pathway responds to the practical needs of collaborative workshops as a new approach to urban renewal proposed by Li *et al.* (2020), while the current study further clarifies the psychological and social basis of its effectiveness.

The moderating effect of renewal models revealed in this study challenges the universal model hypothesis in urban renewal research. The significant differences in the strength of the mediating effects of the three renewal models (tourism-oriented: 26.2%; community-led: 71.4%; public-private partnership: 50.9%) suggest that the path of place attachment is deeply influenced by institutional arrangements and power structures. Kuanzhai alley demonstrates the inherent paradox of commercial renewal: although the quality of physical space is significantly improved (mean 4.38), the path of community participation is blocked, resulting in a decline in social cohesion (from 3.85 to 3.12). This contradiction confirms Yushu Zhu and Ye's (2022) theoretical warning on the risks of gentrification.

The case of Kuanzhai alley reveals the potential mechanism of gentrification triggered by tourism-oriented renewal. The significant decline in social cohesion (-0.73 points) and the decrease in resident participation (2.1 points) signal that the voice of indigenous residents has been systematically marginalized during the commercial renewal process, and place attachment has not been effectively transformed into participation ($\beta = 0.42$ vs. 0.71 for Tongren Road). This "participation deficit" leads

to renewal decisions that favor commercial interests while ignoring community needs, ultimately forming the gentrification risk warned by Yushu Zhu and Ye (2022). Data show that high rents and a commercial atmosphere have changed the community's population composition and space use. Thematic analysis of the 45 policy documents and 128 media reports collected in this study substantiates these quantitative patterns. Government reports from the renewal period acknowledged tensions between commercial success and resident displacement, noting concerns about rising living costs affecting permanent residents. Local media coverage documented elderly residents' expressions of alienation as familiar neighbors were replaced by transient tourists and commercial tenants, with recurring themes of "losing the sense of home" and "no longer recognizing the community." These qualitative insights reveal the lived experiences underlying the statistical decline in social cohesion, confirming that tourism-oriented renewal, despite its economic achievements, systematically marginalized indigenous community voices in decision-making processes. The convergence of quantitative indicators (a decline in social cohesion of 0.73 points) with qualitative narratives of displacement and alienation strengthens the validity of our gentrification risk assessment.

Although the aesthetic quality of the space has improved (4.6 points), the sense of community belonging has been significantly weakened (3.5 points vs. 4.5 points for Tongren road). This finding expands El-Bardisy's (2024) theoretical framework on how urban culture enhances social interaction, demonstrating that when physical environment improvements lack community participation mechanisms, they may weaken social connections through population replacement and cultural rupture. In contrast, the public-private partnership model of Qintai road, through an institutionalized participation mechanism (participation score of 4.2), protected community rights and interests while introducing market resources and government support, maintained a relatively high level of social cohesion (3.82 points), and achieved significant improvement ($+0.97$ points) over the past nine years, presenting a feasible practical path for the environmental sustainability goals of smart ecological cities advocated by Bibri *et al.* (2024).

Policy document analysis reveals the institutional foundations of this success. Official guidelines establishing the tripartite consultation mechanism mandated formal procedures requiring community representatives' approval before major commercial investments, with explicit provisions for rental subsidies and relocation protections for vulnerable residents. Media reports during the

renewal period highlighted how Quintai road's approach differed fundamentally from wholesale transformation models, emphasizing themes of "continuous negotiation," "resident veto power," and "gradual improvement rather than rapid displacement." Residents quoted in local coverage expressed appreciation for being "treated as stakeholders rather than obstacles to development." These qualitative findings illuminate the mechanisms through which institutionalized participation preserved social cohesion while achieving physical improvements, offering concrete policy templates for gentrification prevention that complement our quantitative path analysis.

This comparison shows that the institutional design of the renewal model directly affects the risk of gentrification and that the community participation mechanism is a key safeguard against it. Comparative analysis with other Chinese cities reveals convergent patterns. Beijing's Hutong regeneration exhibits similar participation deficits in tourism-oriented projects (Y. Wang *et al.*, 2025), while Shanghai's micro-regeneration demonstrates that spatial enhancement can occur without severe displacement when institutional safeguards protect residents (J. Zhu, 2023). International comparisons further contextualize these findings. Barcelona's participatory planning mitigates displacement through formalized input mechanisms (Blanco, 2009), while Tokyo's community-based Machizukuri achieves social cohesion through gradual renewal (George, 2009). The Quintai road case suggests Chinese public-private partnerships can approximate protective functions despite differences in institutional environments.

The context-based renewal model selection framework proposed in this study has important practical value. Unlike Liao and Liu (2023), who only identified the obstacles faced by stakeholders, the current study clarified the judgment dimension of model adaptability: the degree of match between the community's initial conditions (social network density, economic resource availability, and cultural asset abundance) and development goals (economic benefits, social cohesion, and cultural protection). This framework provides a preventive decision-making tool for the social risk identification of urban renewal proposed by H. Xie *et al.* (2024), helping predict potential conflicts and select appropriate strategies during the renewal planning stage. The Tongren road case shows that traditional communities with close social networks but weak economic foundations are suitable for adopting a community-led model, which can maintain a high level of social cohesion (4.68 points) under limited resources but requires external policy and financial support to improve the physical environment. The Kuanzhai alley case shows that blocks with rich historical

and cultural resources and great tourism potential can adopt a tourism-oriented model to quickly improve their physical space, but they must also implement community rights protection measures to prevent gentrification. The Quintai road case proves that blocks seeking balanced development should adopt a public-private partnership model, balancing efficiency and fairness through a multi-party consultation mechanism.

This study has several limitations that require further refinement. The sample was limited to three neighborhoods in Chengdu, a city with geographical and cultural specificities that may limit the generalizability of the findings across contexts. While a research design based on public data and large-scale online data improves replicability and sample size, the lack of in-depth interviews limits our understanding of the formation process of place attachment and the mechanisms of residents' emotional transformation. Field observations conducted during the 2023–2024 data collection provided contextual understanding. The research team visited all three case areas multiple times, documenting physical environments, observing public space usage, and engaging in informal conversations with residents and business operators. These encounters revealed nuances not captured in online data: elderly residents' nostalgic attachments to vanished architectural elements, tensions between longtime inhabitants and newly arrived entrepreneurs, and spatial micro-practices negotiating renewal changes. While these observations informed the analytical framework, formal integration of qualitative interview data would enhance explanatory depth. Although a nine-year longitudinal period captures key phases of renewal, it may not be sufficient to assess intergenerational transmission effects and the long-term evolution of community memory. Future research should adopt a multi-city, multi-case comparative design to test the robustness of the theoretical mechanisms across diverse cultural and institutional contexts. Qualitative research methods should integrate participatory observation and in-depth interviews to explore differences in the formation and expression of place attachment among different population groups (indigenous residents and new residents, and across different age groups). Longer-term follow-up studies (15–20 years) can reveal patterns of intergenerational transmission of community identity and the evolution of social networks. Policy intervention experimental design can examine the causal effects of different measures (such as community activities, participatory design workshops, and rights protection policies) on strengthening place attachment, encouraging resident participation, and mitigating gentrification risks. Such experimental approaches would advance research from observational

analysis to intervention evaluation, offering a robust scientific foundation for evidence-based decision-making.

6. Conclusion

This study addresses three objectives: positioning place attachment as a renewal driver rather than an outcome, testing mechanistic pathways linking emotions to effectiveness, and examining how renewal models moderate these pathways. Empirical analysis confirms dual mechanisms: community participation mediation ($\beta = 0.30, p < 0.001$, accounting for 51.7% of the total effect) and direct emotional identification ($\beta = 0.28, p < 0.001$). The dominant mediating pathway validates expectations that emotional investment translates into improvements primarily through participatory action.

Moderating analysis reveals substantial cross-model variation. Community-led renewal exhibits the strongest mediation (71.4%) compared to tourism-oriented (26.2%) and public-private partnership (50.9%) models. This differential performance demonstrates that institutional arrangements fundamentally shape place attachment operations. Tourism-oriented models, despite superior physical quality (4.38), constrain participation channels, weakening the conversion of emotion to participation and leading to a decline in social cohesion (-0.73). Community-led models activate participation most effectively but face resource constraints. Public-private partnerships achieve balanced outcomes through institutionalized participation, preserving emotion-to-action pathways while mobilizing external resources.

The validated framework offers a context-sensitive alternative to universal renewal models by specifying how institutional arrangements interact with psychological processes. Place attachment operates not as a generic positive force but through mechanisms shaped by participation opportunities, resource configurations, and power distributions in governance structures. The tripartite model linking attachment, participation, and effectiveness through direct and mediated pathways, moderated by institutional contexts, provides analytical tools for diagnosing mechanisms and predicting social risks. This framework integrates environmental psychology with institutional analysis, bridging micro-level emotional processes and macro-level governance arrangements. Policy recommendations should focus on model adaptability and gentrification prevention. For neighborhoods rich in historical and cultural resources, a tourism-oriented model can rapidly improve spatial quality. However, this must be accompanied by mechanisms to protect community rights and interests to prevent the breakdown of social networks caused by

commercialization. Traditional communities with strong social networks but weak economic foundations should adopt a community-led model, using external policies and financial support to compensate for deficiencies in physical environmental improvements. Neighborhoods seeking balanced development are suitable for public-private partnerships, which, through institutionalized participation mechanisms, can introduce market resources while protecting community interests. Policymakers should incorporate place attachment assessments into the early stages of renewal planning and, through the design of community participation mechanisms, transform residents' emotional connections into constructive actions.

The current study is limited by the geographic limitations of the sample, the lack of depth in the method, and the limited time span. Future research should expand to multi-city comparative designs, integrate in-depth interviews to reveal micro-mechanisms, extend follow-up time to examine intergenerational transmission, and employ policy experiments to test the causal effects of interventions, thereby advancing urban renewal research towards mechanistic explanations and evidence-based decision-making.

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Conflict of interest

The authors declare that they have no competing interests.

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Ethics approval and consent to participate

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Availability of data

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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