

A Review of the Livability Assessment Framework for Urban Old Residential Communities

Yufei Wang^{1,a,*}

¹*Faculty of Geography, Yunnan Normal University, Kunming, China*

^a*2264862664@qq.com*

**Corresponding author*

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Abstract: Renewal of old residential communities is an important means of improving the living environment in the stage of urban stock development. A scientific and operational livability assessment framework provides a basis for identifying renewal deficiencies, defining renovation priorities, and examining implementation outcomes. This review synthesizes research on livability assessment frameworks for old residential communities, with emphasis on assessment concepts, dimensional composition, indicator systems, data methods, and practical application. Research has expanded from early physical assessments focused on housing quality, infrastructure, and environmental remediation to comprehensive assessments that incorporate public services, public space, residents' perceptions, social relations, and community governance. The integration of multi-source spatial data, street-view imagery, and resident-satisfaction surveys has improved the granularity and dynamic capacity of assessment. Existing studies continue to face fragmented indicator systems, insufficient integration of objective and subjective evidence, difficulties in cross-scale conversion, and limited contextual adaptation. Future work should establish a multidimensional framework centered on environmental quality, service accessibility, residents' perceptions, and governance and maintenance, and develop an application loop of assessment, diagnosis, optimization, and feedback to provide more targeted support for the renewal of old residential communities.

1. Introduction

Most old residential communities were developed during periods of rapid urban construction. After long-term use, they often experience building deterioration, outdated infrastructure, insufficient public space, imbalances in parking and travel organization, and weak property management. Early research largely treated these communities as issues of housing repair and environmental improvement, focusing on building safety, utility-network upgrades, road improvement, and the provision of supporting facilities. As urban development has shifted toward stock optimization, research has increasingly recognized that the renewal of old residential communities affects residents' everyday lives, public-service provision, neighbourhood interaction, and community governance. Its outcomes should therefore be assessed through residents' actual experiences in addition to physical

improvements.

Within this shift, livability assessment has become an important tool linking problem identification with renewal decision-making. Studies of renewal efficiency from the perspective of resident satisfaction indicate that construction investment, service improvement, and long-term management need to be coordinated[1]. Research on public participation also shows that pre-renewal needs assessment, information exchange, and feedback mechanisms influence residents' trust in and satisfaction with the renewal process[2]. Livability assessment for old residential communities should therefore integrate objective environmental conditions with residents' subjective perceptions and translate assessment results into renewal priorities and renovation strategies.

This review examines livability assessment frameworks for old residential communities. It outlines assessment concepts and research evolution, summarizes assessment dimensions, indicator systems, and data methods, and discusses the main limitations of existing frameworks and directions for their improvement. The review focuses on the assessment framework itself, while spatial equity, resident participation, and long-term maintenance are discussed only as necessary components of assessment dimensions and the application of assessment results.

2. Concepts and Evolution of Livability Assessment for Old Residential Communities

Livability research places people at the center of assessment and emphasizes the combined effects of spatial environments on everyday life, health, social interaction, and subjective perceptions. Jacobs's discussion of diversity in street life[3] and Lynch's research on the image of the city[4] shifted assessment beyond buildings and facilities toward users' perceptions and spatial experience. Subsequent theories of spatial justice and collaborative planning further suggest that the distribution of public services, open spaces, and opportunities for participation shapes residents' evaluations of their community environment[5,6]. These perspectives provide a foundation for moving from single physical indicators to comprehensive living-environment assessment in old residential communities. The evolution of assessment research can be broadly divided into three stages. The first emphasized physical elements such as housing, roads, utility networks, greenery, and environmental sanitation, addressing whether basic conditions were adequate. The second incorporated public services, transport accessibility, public-space quality, and community safety, focusing on the convenience of daily life. The third further introduced resident satisfaction, neighborhood relations, participation processes, and governance capacity, emphasizing whether renewal genuinely improves residents' lives. Research on neighborhood sustainability assessment indicates that environmental, social, and economic dimensions should be integrated within a single framework rather than allowing individual indicators to substitute for complex residential experience[7].

In terms of assessment objectives, livability assessment for old residential communities has expanded from static measurement of existing conditions to the full renewal process. Pre-renewal assessment identifies safety risks, facility deficiencies, and service gaps. Assessment during renewal addresses resource allocation, resident participation, and implementation quality. Post-renewal assessment examines environmental improvement, resident satisfaction, and continuing maintenance. An assessment framework should thus reflect current community conditions while supporting renewal decisions and evaluating renovation outcomes.

3. Concepts and Evolution of Livability Assessment for Old Residential Communities

3.1. Core Assessment Dimensions

Existing studies generally organize livability assessment for old residential communities around four dimensions: the physical environment, service accessibility, social experience, and governance

support. The physical-environment dimension includes housing and building conditions, infrastructure, road and traffic conditions, green environments, sanitation, and safety, which form the basis for basic residential quality. Research on outdoor spaces in old residential areas has developed assessment systems covering spatial function, environmental quality, and facility provision[8], indicating that public space is an important assessment unit connecting physical improvement with everyday experience. The service-accessibility dimension focuses on the quantity, distance, and convenience of educational, medical, elderly-care, commercial, cultural, sports, and public-transport facilities. Research on the 15-minute neighborhood assesses facility provision through residents' daily activity ranges and offers a common approach to measuring service accessibility. The social-experience dimension incorporates resident satisfaction, sense of belonging, neighborhood interaction, perceived spatial safety, and willingness to use space. Gehl's observations of behavior in public space indicate that users' activities and duration of stay can reflect spatial quality[9]. Research on residential satisfaction also demonstrates a close relationship between the built environment and subjective well-being[10]. The governance-support dimension concerns property services, community deliberation, information disclosure, maintenance mechanisms, and post-renewal management. It helps explain variation in perceived livability among communities with similar physical conditions and determines whether renovation outcomes can be sustained. Research on policy-relevant livability indicators stresses that assessment frameworks should balance conceptual rigor with usability in public decision-making[11,12]. Assessment indicators should therefore support more than scoring and ranking; they should also clarify corresponding governance responsibilities and improvement pathways.

3.2. Indicator Organization and Cross-Scale Linkage

In terms of indicator organization, the livability assessment of old residential communities can adopt a basic structure of goal, dimension, and indicator levels. The goal level addresses overall livability. The dimension level comprises environmental quality, service accessibility, residents' perceptions, and governance and maintenance. The indicator level specifies observable variables according to community conditions, including building integrity, utility-network conditions, green space and activity sites, walkable access to facilities, lighting and safety, satisfaction, participation, and maintenance frequency. This structure retains the stability of the assessment framework while allowing indicators to be adjusted in response to practical problems in different communities.

Cross-scale linkage is a key issue in framework design. The dwelling and building levels are suitable for examining building quality, utilities, and barrier-free conditions. The community level is suited to the assessment of public spaces, facility provision, sanitation, and governance services. Neighbourhood and urban levels help assess the accessibility of public services, transport, and green-space resources. Multi-level assessment prevents internal community conditions from standing in for external service provision and prevents macro-level averages from concealing specific deficiencies at the building or courtyard level. Research on multiscale spatial indicators provides a reference for linking local assessment with public policy[11].

Indicator selection should also balance general applicability with contextual adaptation. Infrastructure safety, environmental sanitation, and service accessibility have strong general relevance, whereas topographic conditions, climate risks, demographic structure, cultural practices, and residents' lifestyles affect the weighting and measurement of specific indicators. An assessment framework can therefore retain common core dimensions while using supplementary indicators to respond to the practical needs of different communities.

4. Assessment Methods and Data Applications

Traditional assessment methods commonly use the analytic hierarchy process, fuzzy comprehensive evaluation, questionnaire surveys, and field investigations to combine expert judgment with resident evaluations. These methods facilitate the development of clearly structured indicator weights and are particularly suitable for comprehensive assessment of outdoor spaces and renovation projects in old residential communities[8]. Resident-satisfaction surveys can identify the environmental issues that concern users most and inform indicator revision. Research using impact-asymmetry analysis further shows that environmental factors may exert asymmetric effects on satisfaction and dissatisfaction, enabling the identification of critical deficiencies that should be addressed first[13].

In recent years, multi-source data have expanded the spatial coverage and timeliness of assessment. Remote-sensing imagery, points of interest, road-network data, and volunteered geographic information can measure green space, facilities, transport, and environmental conditions. Street-view imagery and computer vision can identify street interfaces, visible greenery, spatial order, and visual perceptions[14]. Livability assessments based on Google Earth Engine and multi-source data, together with remote-sensing assessments at the community scale in large cities, demonstrate the potential for automated and citywide comparison[15,16]. Such data primarily capture observable spatial features and should be cross-validated with field audits and resident surveys. Post-occupancy evaluation offers an important approach to examining renewal outcomes. Relevant studies consider physical environments alongside resident satisfaction and identify renovation effects through buildings, transport, public facilities, infrastructure, and greenery[17]. Research on renovated outdoor spaces further indicates that accessibility, safety, environmental quality, and aesthetic experience jointly influence resident satisfaction[18]. A more complete assessment method should therefore combine pre-renewal baseline surveys, implementation records, and continuous post-renewal monitoring rather than assessing renewal quality only through physical indicators at project completion.

5. Research Review and Directions for Framework Improvement

Existing research shows a shift from physical environments to residents' experiences, from individual indicators to comprehensive assessment, and from static measurement to process evaluation. The core value of an assessment framework lies in converting dispersed community problems into comparable, interpretable, and actionable information, thereby supporting the ranking of renewal projects, the selection of renovation strategies, and the evaluation of outcomes. The inclusion of residents' perceptions, public services, and governance and maintenance also brings assessment closer to everyday residential life.

Several limitations remain. First, indicator systems often lack a unified logical structure. Some studies list numerous indicators in parallel without fully explaining how different dimensions jointly shape perceptions of livability. Second, objective spatial measures and subjective resident evaluations are often applied separately, and the differences between them and their causes require further analysis. Third, indicator conversion and weighting across different scales and communities remain unclear, limiting the comparability of results. Fourth, many assessments remain descriptive and have yet to establish stable mechanisms through which findings directly inform renewal priorities, plan optimization, and subsequent maintenance.

Future research can improve the framework through a cycle of assessment, diagnosis, optimization, and feedback. The assessment stage identifies basic deficiencies and resident needs through core dimensions. The diagnostic stage uses multi-source data and field investigation to explain the spatial distribution and causes of problems. The optimization stage translates findings into prioritized and

differentiated renewal actions. The feedback stage examines renewal outcomes through post-occupancy evaluation and resident-satisfaction surveys. This cycle can transform livability assessment from a one-time scoring instrument into a decision-support tool for the full renewal process.

6. Conclusion

Livability assessment research for old residential communities has developed from measuring the physical conditions of housing and infrastructure to comprehensive assessment encompassing environmental quality, service accessibility, residents' perceptions, and governance and maintenance. Existing studies show that individual physical indicators cannot fully capture residents' everyday living experience. Combining subjective surveys, field audits, and multi-source spatial data can improve the explanatory power and specificity of assessment frameworks.

For the renewal of old residential communities, assessment frameworks should maintain consistent core dimensions, use specific indicators to address differences among communities, and connect environmental problems across building, community, and neighbourhood scales through multiscale analysis. Assessment findings should also inform the determination of renewal priorities, selection of renovation strategies, and post-implementation monitoring. Developing a closed loop of assessment, diagnosis, optimization, and feedback can move livability assessment from judging existing conditions toward decision support throughout the renewal process and provide a more scientific and actionable basis for the renewal of old residential communities.

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