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DOI
10.1016/j.enbuild.2025.115407

Publication date
2025

Document Version
Final published version

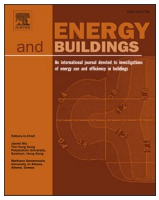
Published in
Energy and Buildings

Energy & Buildings 332 (2025) 115407

Contents lists available at ScienceDirect

Energy & Buildings

journal homepage: www.elsevier.com/locate/enb



A critical assessment on China's old neighborhood renovation: Barriers analysis, solutions and future research prospects☆

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ARTICLE INFO

Keywords:
Sustainable urban neighborhood
Old neighborhood renovation
Energy-efficient renovation
Barriers analysis
Innovative strategies

ABSTRACT

The renovation of old neighborhood plays a pivotal role in augmenting the quality of life and catalyzing urban development. Currently, numerous old neighborhoods in China necessitate renovation due to insufficient maintenance and management, inadequate supporting infrastructure, and suboptimal energy efficiency. Despite extensive research and practical endeavors dedicated to old neighborhood renovation, a research gap in critical analysis emerged during the literature review. This study endeavors a comprehensive analysis to delineate the current state of renovation endeavors, elucidate barriers encountered, and propose innovative strategies to surmount these barriers. Firstly, this study provides a comprehensive overview of ongoing status of renovation efforts and their key focal points. Secondly, this study furnishes an encompassing summary of the fundamental aspects of old neighborhood renovation, encompassing sponge city renovation, environmental enhancement, building energy-efficient renovation, elevator installation, and modernizing elderly facilities and services. Furthermore, this paper meticulously analyzes the barriers such as stakeholder conflicts, resident skepticism, funding limitations, divergent perceptions, limited resident participation, and intricate decision-making processes. To solve these identified barriers, some targeted practical solutions are proposed including bolstering the governmental leadership, exploring diversified funding mechanisms, expanding policy implementation agents, improving resident communication, and establishing collaborative multi-party framework. These measures provide practical guidance to facilitate the seamless progression of renovation initiatives. This study aspires to furnish theoretical insights, practical guidance for policy formulation, and actionable recommendations for sustainable urban neighborhood renovation, contributing to the scholarly discourse and practice in this field.

1. Introduction

Urban renovation has emerged as a persistent theme within the context of globalization and urbanization, spanning across both developing and developed nations [1]. Recognized as a strategic endeavor, urban renovation aims to bolster land values, improve environmental quality, address urban decay, and achieve diverse social and economic objectives [2]. With the rapid pace of urban development and the rising demand for enhanced living environments, the focus of urban renovation has evolved from rudimentary large-scale slum clearance to the renovation of old urban areas [3]. EU has emerged as a frontrunner in the renovation of historical urban areas, boasting numerous effective practices [4]. This leadership position is attributed to the fact that three-quarters of the region's urban neighborhood are marked as energy inefficient, and more than one-third of them have histories spanning over 50 years [5]. Consequently, there renovation efforts have become a focal point of research and practice within the EU. In contrast, in China, the term "old neighborhoods" primarily refers to those constructed during the 1980 s and 1990 s that remain in use. The main reason is that some neighborhoods built more than 20 years ago are no longer able to meet residents' expectations of a modern lifestyle and are in urgent need of renovation due to various factors such as low building standards, lack

Abbreviations: BIM, Building Information Modeling; EU, European Union; LID, Low Impact Development; PESTLE, Political, Economic, Sociological, Technological, Legal and Environmental; Phy-H, Physical-health; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; Psy-H, Psychological-health; SR, Social Relationship; SWOT, Strengths, Weaknesses, Opportunities, and Threats.

☆ This article is part of a special issue entitled: 'Housing energy transition' published in Energy & Buildings.

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https://doi.org/10.1016/j.enbuild.2025.115407
Received 17 January 2024; Received in revised form 3 May 2024; Accepted 30 January 2025
Available online 6 February 2025

of technological sophistication, subpar construction management, inadequate maintenance, and evolving urban development needs [6]. According to statistical data from the Ministry of Housing and Urban-Rural Development of China, currently, 160,000 old neighborhoods in China were built before the year 2000, accommodating over 42 million residents and spanning approximately 400 billion square kilometers [7]. These old neighborhoods were constructed with relatively low standards, outdated facilities, incomplete functional support, and lacked sustainable management mechanisms [8]. This has resulted in a progressively accentuated issue of incongruence between old urban neighborhoods and their associated facilities and environment [9].

Since the commencement of China's reform and opening up in 1978, its urban landscape has undergone profound changes [10]. Particularly noteworthy is the urban renovation initiative focused on inner-city aged areas, a practice that has garnered considerable attention and generated substantial debate [11]. The progression of China's renovation of old cities has traversed five distinct stages, each dedicated to the renovation of old residential neighborhood [12]. Concurrently, the Chinese government has diligently sought to fortify and streamline the renovation of old neighborhood through a series of policies [13]. The initial stage is characterized by the inception of renovation, exemplified by the renovation of Juer Hutong in Beijing [14]. Simultaneously, Wu [15] introduced the theory of organic renovation during this renovation phase. The subsequent stage marks the advent of the property management era. In 1997, the National Property Management Work Site Meeting held in Dalian explicitly advocated for the implementation of property management in old neighborhood. The nationwide enforcement of The Property Management Regulations commenced in 2003 [16]. The third stage centers on energy-efficient renovation, with China's efforts dating back to the 1980 s [17], primarily targeting northern cold regions and areas with centralized heating [18]. By around 2007, China's energy-efficient renovation of existing buildings began to scale up, and in 2011, it entered a phase of full-scale promotion [19]. The fourth stage signifies the comprehensive renovation period. Following thorough research and the assimilation of advanced urban experiences in the comprehensive renovation of old residential areas, the former Ministry of Construction formally issued guidance on the development of old residential rectification and renovation in 2007 [20]. Concurrently, the State Council issued opinions emphasizing the active promotion of comprehensive renovation of old residential areas [21]. This period is still referred to as the "orderly promotion of comprehensive renovation of old residential neighborhood". In 2017, during a working symposium in Xiamen, the Ministry of Housing and Urban-Rural Development proposed pilot projects for the renovation of old neighborhoods in 15 cities, formally introducing the term "renovation of old neighborhood" to the public eye [22]. On July 20, 2020, the General Office of the State Council issued the "Guiding Opinions on Comprehensive Advancement of the Renovation of Old Residential Areas in Urban Areas", marking the nationwide and comprehensive launch of old neighborhood renovation initiative [23].

Presently, research on the renovation of old neighborhood has reached significant milestones, encompassing diverse dimensions. Tang et al. [24] and Xu et al. [25] conducted analyses and assessments of policies using methodologies including content analysis, bibliometrics, and text mining, thereby furnishing valuable references for policy formulation and enhancement. From a pragmatic standpoint, Zhang et al. [26,27] expounded on policies, experiences, measures, and promotional plans for the renovation of old neighborhood, offering insights and guidance to governments at all levels for the comprehensive advancement of such initiatives. Concentrating on pivotal issues, challenges, and focal points of the renovation process, Wang et al. [28] presented constructive viewpoints and implementation suggestions. Wang and Sun [29] summarized both domestic and international experiences in renovating old neighborhood, delineating goals, principles, content, and mechanisms pertinent to urban renovation efforts.

In addition to nationwide explorations of old neighborhood renovation, specific regional studies have emerged, such as those focused on Beijing [30,31]. Building upon Beijing's practices, He et al. [32] conducted review of the process, needs, and characteristics of old neighborhood renovation, with a specific emphasis on updating the physical environment. Since 2000, Hangzhou has tailored its renovation and enhancement efforts for old neighborhoods based on factors such as neighborhood conditions, resident preferences, and demographic structures [33]. Wang et al. [34] showcased Hangzhou's practices and explorations in improving old neighborhood renovation from three perspectives: "design concepts", "policies and regulations", and "Hangzhou practices". Mei et al. [35] grounded in the reality of Jiangsu Province, accurately identified issues and resident needs in old neighborhood through field research and big data analysis. They constructed a systematic, progressive renovation content system, guiding context-specific and targeted strategies for old neighborhood renovation. Furthermore, some researchers have delved into specific aspects of old neighborhood renovation, such as sponge city renovation [36–38], the modernization of road spaces [39], micro-renovation [40], and he equitable distribution of benefits after renovations [41]. These studies contribute comprehensive theoretical and practical support to the ongoing efforts in the renovation of old neighborhood.

In spite of commendable progress, the renovation of old neighborhood encounters multifaceted barriers, prominently within the realms of management, economics, society, and institutional barriers [42–44]. Management barriers are conspicuous, marked by the absence of robust property management and the opacity surrounding stakeholders' interests [45]. Financial barriers persist due to reliance on singular funding sources, low private sector profitability, and residents limited financial contribution [46]. Social barriers are evident with insufficient public engagement, weak social networks, and compromised neighborhood cohesion [47]. Policy barriers encompass a lack of policy continuity and immature legal frameworks [48]. A thorough examination of existing literature reveals a focus on various aspects such as urban renovation policies, specific renovation practices and cases, and comprehensive technological solutions. However, there are still several notable research gaps in the existing studies, which merit attention and further investigation. These gaps primarily revolve around the following dimensions: 1) Existing studies lack comprehensive analyses of evolving research priorities and emerging trends in old neighborhood renovation. There is a need for examination and synthesis of the prevailing research emphasis to identify gaps and potential avenues for further exploration; 2) The critical assessment addressing the various barriers encountered throughout the renovation process is rare in the current literature. A systematic assessment of these barriers (including social, economic, and institutional factors) is essential for developing effective strategies to overcome these barriers and facilitate the success of renovation efforts; 3) There is a notable lack of strategies proposed to address the current barriers encountered in renovation efforts as well as discussion of the future prospects of renovation endeavors. Practical and feasible recommendations are needed to address these barriers and guide future initiatives towards sustainable and effective renovation practices. To address these research gaps, this paper aims to provide a concise synthesis of prevailing trends in old neighborhood renovation, with a specific focus on critically analyzing research priorities and emerging trends. This analytical approach will provide valuable insights into evolving renovation research, highlighting areas that deserve more attention and exploration. Furthermore, this paper will undertake a comprehensive examination of the diverse barriers encountered in current renovation endeavors, proposing practical and feasible recommendations to address these barriers. By delving into these gaps, this paper seeks to provide a nuanced perspective on overcoming barriers and facilitating the development of effective policies for the old neighborhood renovation. By proposing practical solutions and exploring future prospects, this study will be possible to contribute to the advancement of sustainable renovation practices in old neighborhoods. Through a comprehensive exploration of these issues, this paper aspires

to provide a theoretical reference and guide for policymakers and researchers, ultimately contributing to the betterment of urban environments and neighborhoods.

2. Methodology

A systematic search of influential journals and papers in ScienceDirect and Scopus was conducted using a consistent combination of search phrases. The search scope encompassed titles, abstracts, and keywords. The search outcomes are detailed in Table 1, which illustrates the number of retrieved papers using identical search phrases across both databases.

From Table 1, it can be seen that a total of 401 articles were retrieved from the ScienceDirect and Scopus databases. To ensure relevance to our study objectives, a stringent selection process was undertaken following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology [49], as depicted in Fig. 1. Initially, duplicate articles were identified and removed, resulting in the exclusion of 157 articles. Subsequently, articles not directly pertinent to the topic of old neighborhood renovation in the context of China were excluded, reducing the selection by 83 articles. A thorough evaluation of the remaining 161 articles was then conducted, leading to the exclusion of an additional 35 articles. Among this subset of 35 articles, 12 were excluded due to other language constraints (e.g., Japanese, Korean, etc.), and 19 conference papers were omitted for not meeting the criteria for journal article inclusion. Furthermore, considering the contemporary technological and regulatory prerequisites of old neighborhood renovation, articles published before 2008 were excluded, resulting in the final inclusion of 126 journal articles spanning from January 2008 to April 2024.

Based on the detailed analysis of the literature involved in the above search results, this study systematically examines the current research priorities and practices of renovation in old neighborhoods. Further, this study systematically classifies and critically analyses the various barriers encountered in the whole renovation process through the PESTLE (i.e., Political, Economic, Sociological, Technological, Legal and Environmental) method and SWOT (i.e., Strengths, Weaknesses, Opportunities, and Threats) analysis. Based on the results of these analyses, this study categories and critically analyses the barriers and strategies to promote the renovation of old neighborhoods, and proposes effective strategies to promote the renovation practices and future research endeavors.

3. Research priorities and renovation contents of old neighborhood

3.1. Analysis on the research priorities of old neighborhood renovation

To explore the primary aspects of ongoing renovations in old neighborhoods across China, 126 papers obtained from the above selected were analyzed using VOSviewer. This analysis allowed us to extract key insights regarding the research priorities and renovation contents in this domain, which are presented in Fig. 2. This visualization in Fig. 2 provides a clear overview of the primary themes and topics addressed in the literature on old neighborhood renovation.

The exhaustive review of the existing literature reveals that the current focus on renovation of old neighborhoods can be broadly categorized into two main domains: building energy-efficient renovation and non-building energy-efficient renovation. Building energy-efficient renovation encompasses efforts aimed at improving the energy efficiency of existing structures through measures such as wall insulation, window upgrades, and renewable energy application. On the other hand, non-building energy-efficient renovation extends beyond the physical structures themselves. This domain encompasses a diverse array of initiatives, including fundamental infrastructure renovation to upgrade utilities and services, environmental improvement and construction to bolster green spaces and combat pollution, as well as initiatives aimed at fostering resident participation and satisfaction. Fig. 3 provides a detailed summary of the renovation contents discussed in the literature, highlighting the diverse range of topics and priorities within this field. By categorizing and visualizing these themes, this section aims to provide researchers and practitioners with a comprehensive overview of the salient areas of focus in old neighborhood renovation research.

From Fig. 3, the present study landscape of research in the field particularly emphasizing topics such as building energy-efficient renovation and environment improvement and construction of old neighborhood. Following this, there is an amount of research on resident participation in the renovation process of the old neighborhood. Notably, there is a presence of studies exploring fundamental infrastructure renovation, resident satisfaction, and changes in value after renovation. However, the landscape also highlights a relative scarcity of studies evaluating post-renovation conditions, assessing the current renovation status, exploring the management of old neighborhood post-renovation, and investigating factors influencing the renovation process. These areas represent potential avenues for future research to enrich the existing knowledge base in the field of old neighborhood renovation.

3.2. Analysis on renovation contents in current literature

Building upon the aforementioned analysis, this section's content will be examined, encompassing building energy-efficient renovation, environmental enhancement and construction, foundational infrastructure renovation, elevator installation, age-friendly renovation, and so on.

3.2.1. Building energy-efficient renovation

Building energy-efficient renovation is paramount in the overall renovation of an old neighborhood. Historically, the building industry has consistently remained a principal domain of energy consumption [50]. Most urban residential buildings in China, especially those constructed before 2000, fall under low energy-efficient buildings [51]. A partial assessment and statistical analysis indicate that a mere fraction, less than 10 %, of China's extant architectural landscape qualifies as an energy-efficient building [52]. Hence, energy-efficient renovation of existing buildings is paramount [53]. In the ongoing pursuit of energy-efficient renovation in old neighborhoods, the comprehensive renovation programs are multifaceted, encompassing the optimization of the building envelope, integration of energy-efficient windows, implementation of advanced heat metering systems, and meticulous regulation of heating system temperatures. Furthermore, renewable technologies offer opportunities for enhancing energy efficiency in building renovation. For instance, solar energy systems can augment domestic hot water supply and contribute to reducing household electricity consumption [54]. However, research indicates that energy-efficient building designs may not always translate into low-energy

Table 1
Search phrases and literature search outcomes.

Keywords			Number	
Keyword 1 and	Keyword 2 and	Keyword 3	Science Direct (67)	Scopus (334)
Old community	Renovation	China	5	41
Old community	Retrofitting	China	2	7
Old community	Renewal	China	12	85
Old community	Transformation	China	21	109
Old neighborhood	Renovation	China	5	16
Old neighborhood	Retrofitting	China	3	4
Old neighborhood	Renewal	China	12	45
Old neighborhood	Transformation	China	7	27

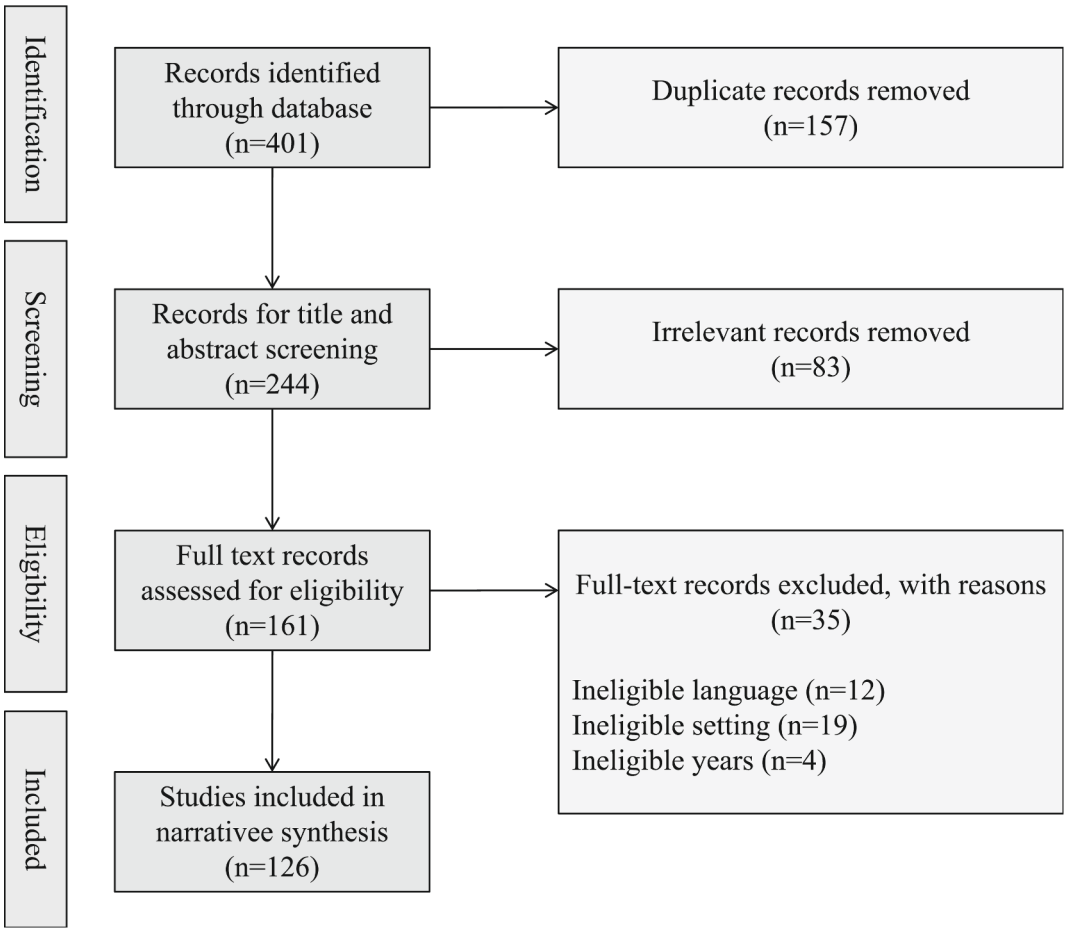

Fig. 1. Schematic diagram of PRISMA literature screening steps.

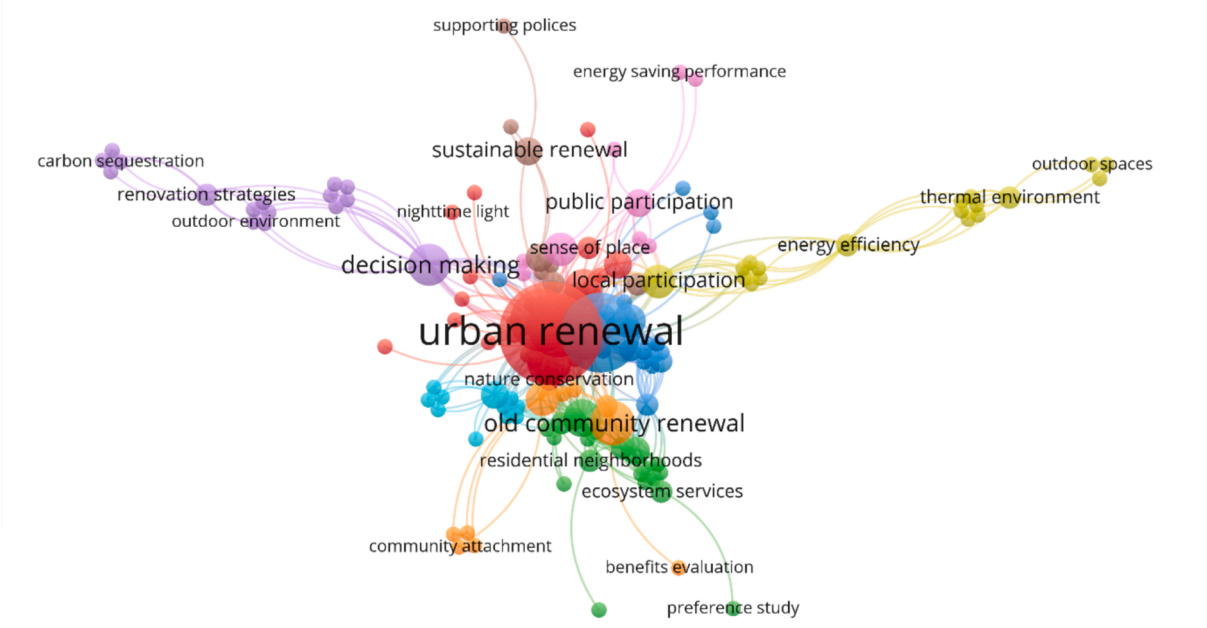

Fig. 2. Analysis of literature content through VOSviewer.

consumption buildings [55]. This discrepancy between anticipated and actual energy usage in buildings is largely attributed to human factors [56]. Hence, contemporary understanding acknowledges that achieving energy efficiency is not solely a technical challenge but is also intricately linked to occupants' behaviors and usage patterns [57–60]. Therefore, from energy-efficient renovation technologies, renewable energy

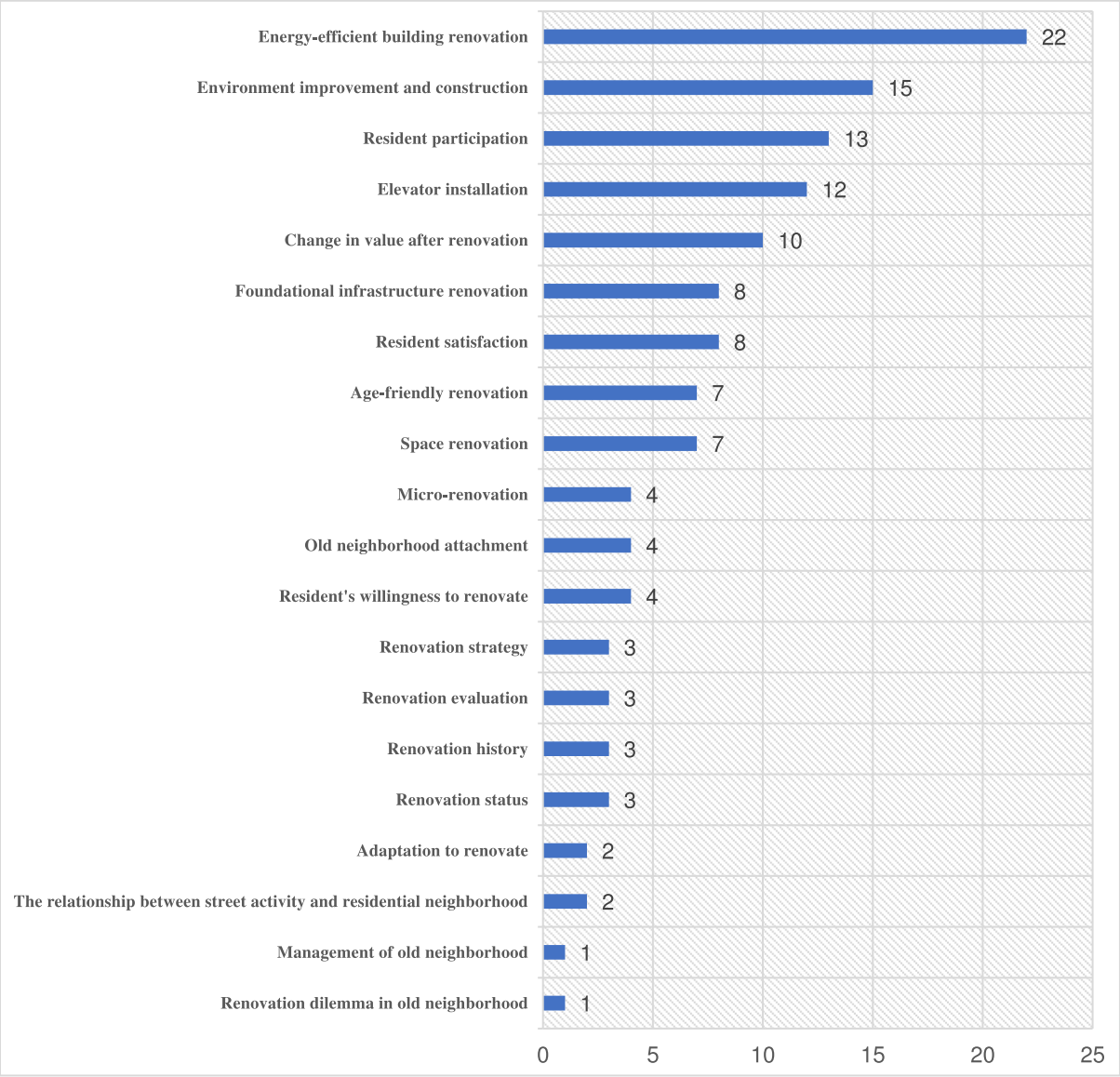

Fig. 3. Summary of the renovation contents in the literature.

technologies, and improving occupant behavior perspectives to summarize building energy-efficient renovation in old neighborhood, the details are shown in Fig. 4.

The energy-efficiency renovation of residential buildings constitutes a multifaceted system encompassing pre-renovate surveys, energy audits, performance assessments, on-site implementation, and energy efficiency verification [61,62]. However, numerous barriers hinder progress within these processes [63,64]. Consequently, the Chinese government has implemented a series of policies to achieve its ambitious goals and enhance the energy performance of existing residential buildings. This study concentrates on policies enacted by the central government to advance energy efficiency renovation in residential buildings. Drawing inspiration from existing policy categories, the central government's policies are categorized into five types: regulation policies, financial incentives, information policies, and technology policies, as illustrated in Fig. 5.

Concurrently, the establishment of a robust and discerning green renovation assessment framework assumes paramount importance. This framework serves the crucial function of enabling residents to grasp the intricacies associated with renovation endeavors while offering a clear and systematic roadmap for the entire renovation process. Within this framework, the utilization of renewable energy emerges as a key criterion and a pivotal factor in the overall assessment [65]. Furthermore, the meticulous design and execution of the renovation process demand a nuanced consideration of the motivations, intentions, and living habits of the residents. Emphasizing the paramount significance of public participation becomes pivotal for the successful development and implementation of energy efficiency policies in the Chinese context [66]. However, given the top-down nature of energy-efficient renovation in residential buildings, achieving coordination and securing active consent from residents become indispensable prerequisites. Consequently, a series of proactive measures are implemented prior to renovate, encompassing the dissemination of informative notices and the facilitation of meetings between neighborhood committee staff and resident representatives, all aimed at persuading residents to actively engage in and support energy efficiency renovate initiatives [67].

It's noteworthy that building energy-efficient renovation is not just a simple technical endeavor but a comprehensive task involving social, economic, and environmental aspects [57]. In the renovation process, resident plays a pivotal role as stakeholders, contributing to the success or failure of energy-efficient renovation. Genuine advancement and accomplishments can only be achieved by meeting residents' needs and

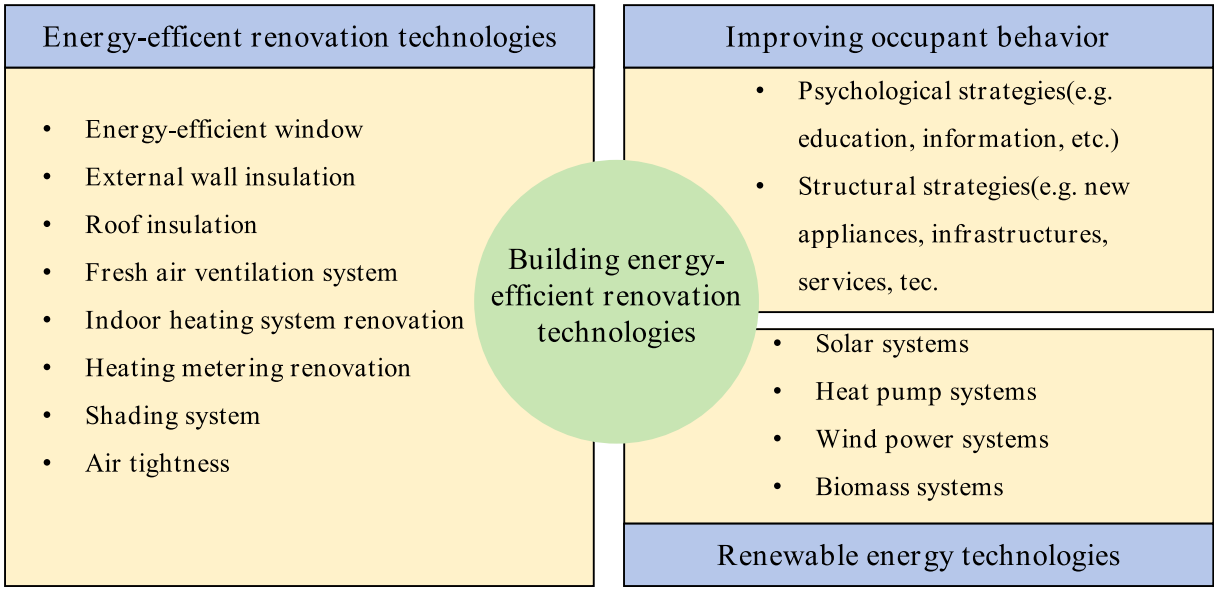

Fig. 4. Main categories of building energy-efficient renovation technologies.

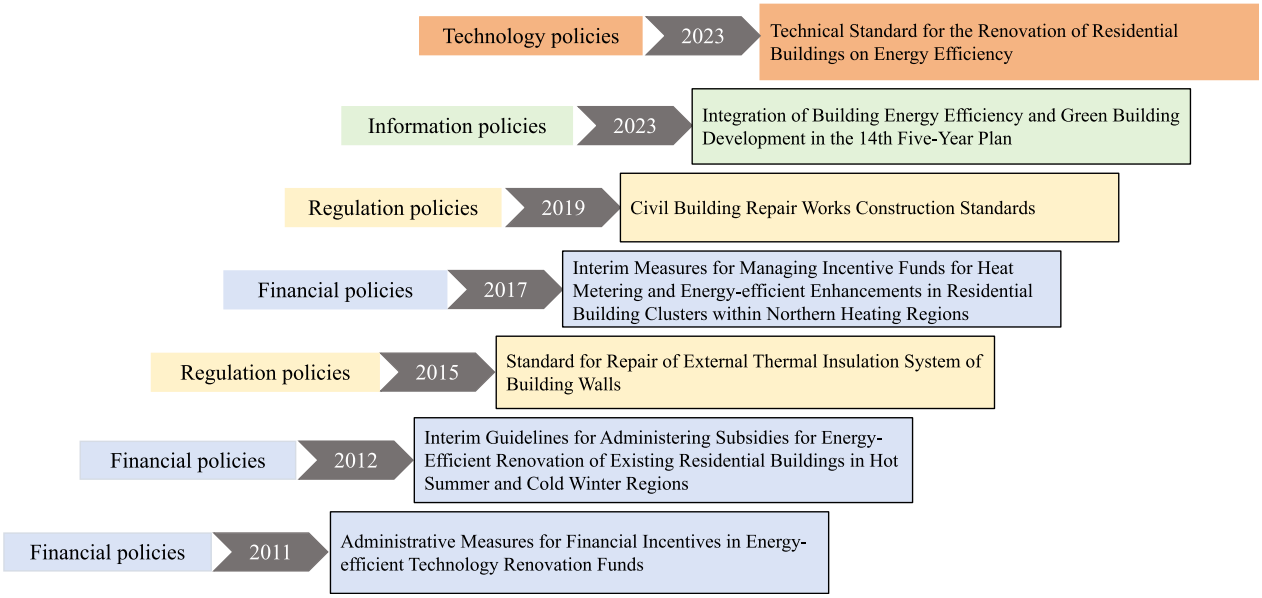

Fig. 5. Policies related to building energy-efficiency renovation.

promoting low-energy-consumption lifestyles [68].

3.2.2. Environmental improvement and construction

When urban environments undergo change, it often leads to an exacerbation of social and economic disparities, rendering the visually impaired population particularly vulnerable [69]. Given the prevalent issue of environmental degradation in old neighborhoods within urban settings [70], numerous researchers have endeavored to explore diverse approaches to enhance the living conditions in such areas, ultimately aiming to improve the overall well-being of residents [71–73]. Against the backdrop of an unprecedented global demographic shift towards an aging population [74], there has been a growing momentum in research investigating the intricate relationship between the built environment, social surroundings, and the health of the elderly [75]. Yan et al. [76] delved into the correlation between the life satisfaction of the elderly and the interplay between senior care services and the living environment in Beijing. Simultaneously, investigations have indicated that the built environment can yield both physical benefits, encompassing the maintenance and enhancement of physical health and function, and psychological benefits, such as stress reduction, improved quality of life, and heightened subjective well-being for older adults [77]. As a rising number of old neighborhoods grapple with environmental deterioration and degradation of public spaces, certain studies advocate for measures such as increasing the green space rate and expanding the area of public green spaces to achieve air purification, pollution control, noise reduction, and overall beautification [78–80,81]. Additionally, other researchers have sought to enhance the quality and comfort of living spaces while mitigating the impact of environmental pollution on residents' health by refining the spatial layout of existing structures and alleviating the accumulation of air pollutants and water vapors in confined spaces [82,83].

In renovating the old neighborhood, a dialectical tension often emerges between the new and the old, the past and the present. Nevertheless, a fascinating trend has been revealed through diligent

inquiry and comprehensive study. Beyond renovating the existing architectural environment, the resident also has a propensity to preserve the urban environment's natural heritage, such as stone walls and trees. These elements are perceived as ornamenting their everyday surroundings and holding intrinsic aesthetic value and profound historical significance. These endeavors signify a reshaping of cultural values and serve as a means of urban heritage conservation [84,85]. During the progress of urban renovation and the renovation of old neighborhood, preserving and utilizing urban historical heritage have arisen as paramount consideration. This pursuit seeks to deftly balance progress with the imperative to conserve the urban history and cultural legacy [86].

In summary, researchers, employing diverse perspectives and methodologies, diligently strive to enhance the residential environment of an old neighborhood, aiming to elevate residents' overall well-being. Through elucidating urban renovation objectives, implementing greening initiatives, fine-tuning architectural spatial layouts, and safeguarding urban heritage, the outcomes of renovating the old neighborhood will be better aligned with the needs of residents, ultimately creating a more favorable living environment. These studies offer valuable insights into urban renovation and robust support for the successful advancement of old neighborhood renovation.

3.2.3. Foundational infrastructure renovation content

Fundamental renovations influence the practical application of sustainable development principles [87]. This encompasses enhancement and renovation of municipal infrastructure, including water supply, drainage, and power systems, as well as the maintenance of public areas within the neighborhood, such as roofs, external walls, and staircases. Among the selected papers, the fundamental renovation of old neighborhood primarily centers around the renovation into a sponge city while simultaneously addressing improvements in the neighborhood's transportation environment.

The concept of the sponge city has emerged as an innovative urban stormwater management approach introduced by the Chinese government [88]. Many old neighborhoods were initially designed without incorporating the "sponge" concept, leaving them ill-equipped to address the barriers of continuous rainfall, affecting residents' daily lives [89]. Consequently, improving infrastructure and integrating the concept of a sponge city is crucial for urban renovation projects [38,90]. In response to the pressing rainwater issues amidst China's rapid urbanization renovating the old neighborhood into a sponge city has gained momentum [91]. Notably, relevant research indicates that adopting a Low Impact Development (LID) method, combined with the synergy of green and gray infrastructure paradigms in sponge city construction, enhances water quality and effectively manages urban runoff within the old neighborhood [92]. However, it is noteworthy that the implementation of sponge city renovation may encounter challenges such as technology and funding, necessitating close collaboration between the governments, property owners, and neighborhoods [93].

The significance of foundational infrastructure renovation for residents inhabiting old neighborhoods is indisputable. These renovation measures directly affect resident's quality of life and safety needs. However, excessive focus on sponge city renovation might overshadow other equally crucial fundamental infrastructure renovation. Apart from addressing rainwater issues, attention should also be paid to aging water supply networks, deficiencies in power infrastructure, and more. Neglecting to enhance and maintain these fundamental facilities timely could lead to various safety hazards and jeopardize resident's well-being. Hence, a comprehensive approach is indispensable to strike a harmonious equilibrium between sponge city renovation and other infrastructure enhancement. This approach ensures that the renovation projects holistically cater to resident's multifaceted needs. Only by considering the overall renovation can achieve the sustainable development of old neighborhood renovation, bringing more benefits to the city and its residents.

3.2.4. Elevator installation

The elevator installation is pivotal in the old neighborhood's renovation process. In the past, due to an amalgamation of technological and financial constraints, many old neighborhoods lacked the installation of elevators. However, the escalating phenomenon of China's aging population and an augmenting elderly demographic lends newfound significance to integrating elevators in these old neighborhoods [94]. In terms of funding sources foe elevator installation, a model emphasizing self-financing by residents has been proposed. Primarily, owners should undertake self-financing for the initial phase of elevator renovation, with residents sharing a designated percentage of the costs based on the floor they reside on. Subsequently, housing provident funds can be strategically utilized as an additional funding source. Finally, provincial governments can play a pivotal role by offering financial support to economically disadvantaged areas. This support may encompass a spectrum of incentives, subsidies, and other mechanisms involving the redirection of transfer payments. Such financial backing aims to catalyze and facilitate the effective implementation and execution of elevator renovation initiatives [95]. To enhance the quality of life for senior residents and facilitate the living environment, a comprehensive assessment of the multifaceted ramifications stemming from the structural adjustment necessitated by elevator installation becomes imperative. When deliberating on the implementation of elevator systems, meticulous evaluation and holistic integration of factors encompassing air quality, outdoor thermal environment, and air pollution are prerequisites. These multifaceted aspects directly impact the residents' well-being and health status [96].

Furthermore, the neighborhood effect is also a pivotal factor influencing decisions regarding elevator installation. Research findings demonstrate that elevators within a specific neighborhood positively influence the decision to install elevators in other buildings. This effect extends beyond the individual neighborhood, where the number of elevators in the proximate neighborhood positively influences the decision to install an elevator in the subject neighborhood. However, this influence diminishes as the geographical distance between adjacent neighborhoods expands. Therefore, interactivity and collaboration between neighborhoods hold paramount significance in the context of elevator renovation [97]. In addition to the neighborhood effect, the impact of the neighborhood environment on elevator installation is also a noteworthy consideration [98]. Neighborhood planning and special arrangements directly affect the feasibility and convenience of elevator installation. For instance, public spaces and transportation infrastructure design can substantially influence elevator renovation.

Conclusively, the elevator installation is a proactive measure that substantially impacts renovating the old neighborhood. However, achieving a seamless elevator installation necessitates a holistic approach that considers the resident's requirements and the distinct attributes of the neighborhood. This process should be facilitated by governmental support and planning. Through meticulous and well-informed decision-making, the elevator installation holds the potential to enhance the convenience and comfort of living for residents in the old neighborhood. This endeavor propels urban renovation toward a more human-centered and age-friendly trajectory.

3.2.5. Age-friendly renovation content

Currently, the renovation of old residential areas encompasses a variety of upgrading-oriented measures aimed at enhancing neighborhood service provision, elevating residents' quality of life, and actively enhancing the surrounding environment. Because China currently boasts one of the largest aging populations globally, projected to peak at approximately 500 million by 2050, with nearly 20 % anticipated to experience disabilities [99]. To foster independent living within familiar neighborhoods and alleviate the adverse effects of declining capacities on life satisfaction, government and local agencies have advocated for initiatives like age-friendly neighborhood and livable environments, aiming to provide essential support for healthy aging [100]. Therefore, a

key focus of this type renovation work is age-friendly renovation.

Numerous old neighborhoods are home to a substantial elderly population. However, due to insufficient consideration for aging-related issues during their initial construction, these neighborhoods' living environments have gradually become inadequate in meeting the specialized needs of the elderly, thus leading to irreconcilable contradictions [101]. To address this issue, it becomes imperative to implement targeted measures to enhance these old neighborhoods' age-friendliness. Therefore, the suggestions for improving an age-friendly neighborhood environment assume paramount significance, necessitating consideration of a range of factors influencing the elderly, encompassing aspects such as physical health, psychological health, and social relationships. Based on the feedback obtained from the survey results, the formulation of recommendations geared towards fostering an age-friendly neighborhood environment demands a comprehensive consideration of an array of interrelated factors. These encompass the realms of physical health (Phy-H), psychological health (Psy-H), and social relationships (SR) [102]. Furthermore, government support should be directed towards financial investments in updating elderly care facilities and services while renovating the old neighborhood [103].

In summary, upgrading-oriented renovation initiatives are pivotal to elevating residents' quality of life and neighborhood service standards. Through age-friendly modifications and intelligent construction, old neighborhood can be renovated into more livable, convenient, and comfortable living spaces, positively impacting residents' lives. However, governments and relevant authorities need to invest more effort and resources to thoroughly understand the actual needs of the residents and formulate scientifically grounded renovation plans, thereby ensuring the sustainable development of upgrading-oriented renovation in old neighborhood.

3.2.6. Resident participation

Resident participation plays a crucial role in the renovation of old neighborhood. Through active participation in the decision-making process of renovation, residents can enhance the existing environment and create a livable neighborhood. Such resident participation not only ensures rational and democratic renovation but also contributes to increased neighborhood awareness and satisfaction among residents [104]. Conventionally, urban renovation activities such as renovating old neighborhoods are organized by neighborhood committees, which serve as the most minor administrative units of local government in China and play a pivotal role in this process [105,106]. Despite limited experience in public participation, incorporating public engagement as a vital approach to address the barriers of renovating old neighborhood has emerged as a trend to avoid the risks of single-directional decision-making [107].

The research utilizes diverse theories and methodologies to validate resident participation in renovating old neighborhood, providing corresponding insights. The Theory of Planned Behavior is frequently used to unveil determinants of residents' inclination and behavior to renovate the old neighborhood. Empirical evidence indicates that attitude towards participation, subjective norms, and perceived behavioral control significantly and positively influence residents' engagement in renovating an old neighborhood, subsequently impacting their participation behavior [108–110]. Furthermore, researchers propose the establishment of volunteer teams to organize activities as an effective method to encourage active resident participation [46,111]. Additionally, the resident is recognized as a pivotal stakeholder, ensuring the triumphant outcome of renovation projects for the old neighborhood [66]. According to this perspective, some local government authorities facilitate the comprehensive progress of renovating old neighborhood by directly involving residents in the renovation process [112].

Given the significance of resident participation, establishing a platform for communication and interaction among residents, government authorities, and urban planners becomes imperative. This approach facilitates the multifaceted participation of residents, thereby fostering principles of equitable development and inclusivity [113]. During the renovation process, actively listening to residents' needs and opinions, thoroughly considering their interests, and incorporating their expectations into the planning process will contribute to cultivating a more harmonious and cohesive neighborhood environment.

3.2.7. Resident satisfaction

The disparity between pre-and post-renovation conditions in old neighborhoods directly impacts residents' interests and satisfaction [114]. Therefore, renovation outcomes in these old neighborhoods correlate with the resident's overall satisfaction, a crucial objective in urban management and research [115]. External factors influence residential satisfaction, including government subsidies, neighborhood organizations, and homeowners' committee actions, all of which positively correlate with resident satisfaction [116]. Simultaneously, the neighborhood environment, housing conditions, and surrounding amenities constitute the three most influential factors affecting residential satisfaction [117,118]. Furthermore, residents with higher education levels, higher income, a strong sense of neighborhood belonging, and active participation in renovation projects tend to exhibit higher levels of residential satisfaction [90].

It is important to note that enhanced resident satisfaction is not universally guaranteed across all renovated old neighborhoods. Resident satisfaction might decrease if the renovation disrupts residents' social networks or reduces neighborhood activities. Thus, exploring optimized urban renovation models that comprehensively consider material and social aspects is imperative to benefit residents [119]. When undertaking renovation projects in an old neighborhood, governments and planners should thoroughly consider resident's needs and expectations, engaging in active communication and collaboration with them. This ensures that renovation projects meet residents' practical requirements and elevate their satisfaction.

When evaluating residents' satisfaction, focusing on the material improvements and the various social dimensions becomes crucial. The significance of resident's social connections and neighborhood engagement in enhancing satisfaction cannot be overstated. Therefore, to increase resident's happiness, it is essential to broaden the scope of evaluation beyond improving the physical environment, actively fostering a dynamic neighborhood culture, encouraging interaction and collaboration among residents, and facilitating the frequency of neighborhood activities are all vital endeavors. These proposed measures contribute to strengthening the bonds among residents and enhancing neighborhood cohesion.

3.2.8. Changes in value after renovation

The renovation of old neighborhood can yield various benefits for both the neighborhood and its residents, encompassing social, ecological, and economic advantages [3,120,121]. However, when evaluating the post-renovation outcomes within the neighborhood, it becomes evident that the affirmative impacts are primarily manifested through the improvement of building structures and the neighborhood environment, with an appreciation of property values being an ancillary benefit [122]. While renovating an old neighborhood can yield positive outcomes, it doesn't guarantee universal benefits across all aspects [123]. For instance, in historically valuable old districts, real estate capital involvement may lead to reassessment of existing buildings, escalating neighborhood property values, and yielding benefits for property owners and local government [124]. Paradoxically, this phenomenon might not directly benefit the broader original residents, potentially exposing them to the risk of being displaced from the neighborhood [125]. Therefore, in urban renovation, a balanced approach should be adopted to accommodate the interests of diverse groups, aiming to mitigate both positive and negative value shifts resulting from the renovation.

A comprehensive analysis is essential when assessing the value changes after renovating the old neighborhood. Firstly, the renovation

should harmonize with residents' authentic requisites and anticipations, furnishing an elevated habitat and communal amenities to amplify their quality of life and satisfaction. Secondly, the post-renovation neighborhood should prioritize ecological benefits achieved through sponge city concepts and eco-friendly renovation measures. This entails enhancing the environmental quality, expanding green spaces, and promoting ecological equilibrium. Simultaneously, it is essential to consider the preservation and inheritance of the historical and cultural heritage of the neighborhood during the renovation process. Respecting existing neighborhood characteristics and cultural values is crucial to prevent the loss of uniqueness due to the renovation.

3.2.9. Other perspectives

Beyond the aforementioned literature addressing diverse aspects of old neighborhood renovation, additional studies cover the following dimensions: 1) Barriers encountered in the renovation of old neighborhood: Certain literature extensively examines the diverse barriers faced during the renovation of old neighborhood, including issues of insufficient funding, technological barriers, and incomplete policies [10], These barriers could impact the implementation and effectiveness of renovation plans, thus necessitating the exploration of strategies to overcome such hurdles; 2) Management issues during the renovation process: Some literature discusses management concerns arising during the renovation process of old neighborhood, particularly those related to resident involvement and communication [126]. Effective management is pivotal in ensuring smooth progress and success of renovation projects, making research on improving management approaches essential for project success; 3) Resident's attachment to living environment and place: Several studies focus on the emotional attachment of residents in old neighborhood to their living environment and neighborhood [84,127–129]. Understanding residents' emotional needs and sense of neighborhood identity contributes to better-preserving neighborhood features and history during the renovation process, thereby catering to residents' emotional requirements. In summary, renovating old neighborhood is a complex and multifaceted endeavor, encompassing various issues and barriers [130]. Through in-depth research into these aspects, comprehensive and practical guidance can be provided for the planning and implementation of renovation projects in old neighborhoods, thereby ensuring successful outcomes.

4. Discussions

4.1. PESTLE analysis

PESTLE, an abbreviations for Political, Economic, Social, Technological, Legal and Environmental factors, robust analytical tool for organizations and industries seeking a holistic understanding of their operational environment. This method facilitates a comprehensive assessment of various factors, including politics, economics, society, technology, law, and the environment [131]. In this study, the application of PESTLE analysis aids in elucidating the current barriers and opportunities influencing the renovation of old neighborhoods in China, thereby enabling the formulation of effective solutions for their revitalization.

4.1.1. Political factors

National target: China's urbanization, which experienced exponential growth in the 1990 s [132], witnessed the emergence of new urban areas and a surge in commercial property development, resulting in the coexistence of both new and old neighborhoods. However, as urbanization accelerated, the positive impacts of rapid urban growth overshadowed the challenges faced by old neighborhoods, leading to their neglect. Consequently, China encountered a dual urbanization dilemma, with issues in old neighborhoods becoming increasingly prominent [126]. To address this, since 2012, the Chinese government has embarked on a comprehensive nationwide initiative to actively renovate old neighborhoods through systematic renovation endeavors.

State-based financial support: According to relevant statistical data, it is estimated that there are approximately 219,000 old neighborhoods constructed before 2000 across the nation, accommodating nearly 39 million households. Renovating these old neighborhoods demands a substantial financial investment, estimated at a staggering 6 trillion RMB [133]. Funding for these renovation projects primarily emanates from special fiscal allocations arranged by both central and local governments, supplemented by measures such as utilizing revenues generated from land sales [134].

4.1.2. Economic factors

Exclusive funding source for renovation: Renovating old neighborhoods poses barriers due to the substantial investment required, extended timeframes, and high uncertainty regarding returns. Consequently, there is a general lack of enthusiasm among private capital and residents to actively participate in these endeavors, contributing to a widespread "funding procurement dilemma" observed in renovation efforts across various regions [135].

4.1.3. Social factors

Interest conflicting among stakeholders: The main stakeholders involved in the renovation of old neighborhood typically include the government, residents, and private capital [136]. Throughout this process, the government tends to prioritize public and social interests, while developers are more concerned with their own economic gains and profitability. Meanwhile, residents anticipate improvements in living quality and fulfillment of their needs [137]. Consequently, conflicts often arise among these stakeholders during the implementation of old neighborhood renovation projects, necessitating the identification of compromise points among all parties involved.

Unpredictable value: Renovating old neighborhoods is fraught with unforeseeable circumstances or factors, contributing to uncertainty and potential challenges throughout the process [138]. For instance, unexpected architectural structural issues, such as latent damage to buildings or infrastructure, may emerge during renovation [139]. Despite not being evident or detected during the initial assessment, these issues can impact both the renovation timeline and budget.

4.1.4. Technologies factors

Development of sustainable technologies and green buildings: Renovation projects typically incorporate energy-efficient technologies and green building principles to enhance energy efficiency and mitigate environmental impact. This includes the use of energy-efficient materials, installation of energy-efficient equipment, and other sustainable practices aimed at reducing energy consumption and environmental footprint [66].

Information technology and digitization: The implementation of project management systems, coupled with the utilization of Building Information Modeling (BIM) and virtual constraint technologies, constitutes a significant advancement in enhancing both the efficiency and quality of project management [140].

4.1.5. Legal factor

Permissions: Private capital involved in the renovation of old neighborhood is subject to stringent scrutiny of the qualifications, financial status, and credit status [141]. On the other hand, construction enterprises bear the primary responsibility for renovation projects, as developers often lack the requisite construction qualifications [142].

4.1.6. Environment factors

Environmental protection: Residential buildings are main consumers of global energy, and their energy consumption and greenhouse gas emissions pose barriers to global sustainable development [143]. Therefore, renovating existing residential buildings and implementing energy-efficient interventions are crucial for reducing adverse

environmental and economic impacts [144].

Circular economy: The concept of a circular economy endeavors to diminish the overall extraction of resources from the environment and mitigate waste generation stemming from human activities aimed at improving well-being. This approach holds relevance for the construction industry in urban settings. For instance, through the renovation and repurposing of underutilized or abandoned buildings, not only can urban areas be revitalized, but also substantial environmental benefits can be realized [145].

4.2. SWOT analysis

SWOT analysis, focusing on internal factors, encompasses strengths and weaknesses, while exploring opportunities and threats delves into interactions with the broader system and environment, thus enabling a comprehensive evaluation of an organization's or project's internal and external conditions [146]. Conversely, PESTLE analysis primarily scrutinizes external environmental factors, providing a deep understanding of the system's external context. Therefore, integrating SWOT and PESTLE analyses can yield a more thorough and accurate assessment, particularly when examining the multidimensional interactions between complex systems and their environments.

In the context of renovating old neighborhoods, this integrated approach facilitates simultaneous consideration of internal factors, such as neighborhood management and resource allocation, and external factors, including political, economic, social, technological, legal, and environmental aspects. This enhanced understanding aids in identifying the barriers and opportunities inherent in the renovation process. For instance, while SWOT analysis may highlight internal strengths and weaknesses, such as aging infrastructure in old neighborhoods, PESTLE analysis may reveal external factors, such as government policy support and technological innovation, which could offer opportunities for renovation. However, these opportunities may also be threatened by legal constraints and economic factors. Fig. 6 illustrates the SWOT analysis concerning barriers and opportunities of old neighborhood renovation.

4.3. Barriers and strategies for promoting old neighborhood renovation

The renovation of old neighborhoods constitutes a crucial element of urban sustainable development, necessitating a holistic approach that encompasses various dimensions, including social, economic, policy implementation, design, and management aspects. These neighborhoods often face a myriad of barriers stemming from years of neglect, outdated infrastructure, and changing societal needs. By conducting a comprehensive analysis encompassing both internal weaknesses and external threats associated with the transformation of older communities, researchers and policymakers can gain valuable insights into the barriers hindering their revitalization. Social barriers, such as community resistance to change or lack of community engagement, can impede progress. Financial constraints may pose significant barriers, especially when it comes to securing funding for large-scale renovation projects. Policy implementation barriers, such as bureaucratic hurdles or conflicting regulations, can further exacerbate the situation. Additionally, outdated design and infrastructure coupled with ineffective management practices can hinder the successful renovation of old neighborhoods. The integration of PESTLE method and SWOT analysis emerges as an effective tool in this regard, offering actionable strategies to overcome these barriers, as depicted in Fig. 7. By leveraging insights from these analyses, policymakers and stakeholders can devise practical and effective measures tailored to the specific barriers faced by old neighborhoods. Consequently, this study establishes these five conceptual frameworks as the cornerstone for a thorough examination of the inherent barriers and proposes actionable strategies and recommendations for promoting the renovating old neighborhoods. Further details are elaborated in the subsequent sections.

4.3.1. Potential social barrier of conflicting expectations among stakeholders

Stakeholders are "groups or individuals who can affect or be affected by organizations and who can contribute to the achievement of organizational goals" [158]. In renovating the old neighborhood, stakeholders form collaborative relationships, often based on temporary coalitions driven by their distinct interests [159]. By analyzing and summarizing existing literature, stakeholders in renovating an old neighborhood primarily comprise the government, neighborhood residents, and private capital. However, owing to the diverse nature of stakeholder interests and expectations regarding old neighborhood renovation, profound implications arise for implementing and governance renovation projects [160].

Government departments endeavor to ensure the smooth progress of renovating an old neighborhood, concurrently promoting local economic development and meeting residents' aspirations for an improved quality of life. This is achieved through the formulation of relevant incentive policies and the supervision of policy execution. Neighborhood residents primarily yearn for an enhanced living environment and

S	W
• Prime location [139] • Cultural heritage [140] • Neighborhood cohesion [141] • Sustainability awareness [142] • Government support policies [143]	• Aging infrastructure [144] • Resident resistance [145] • Financial constraints [127] [146] • Insufficient planning and design [147] • Ineffective policy implementation [148] • Lack of clarity of property rights [147]
O	**T**
• National target [119] • State-based financial support [126] • Environmental protection [136] • circular economy [137]	• Exclusive funding source for renovation [127] [146] • Interest conflicting among stakeholders [141] • Unpredictable value [149] • Permissions [133] [135]

Fig. 6. SWOT analysis about barriers and opportunities of old neighborhood renovation (the above-mentioned insights of this figure are extracted from the references of [126,134,135,141,143–145,147–157]).

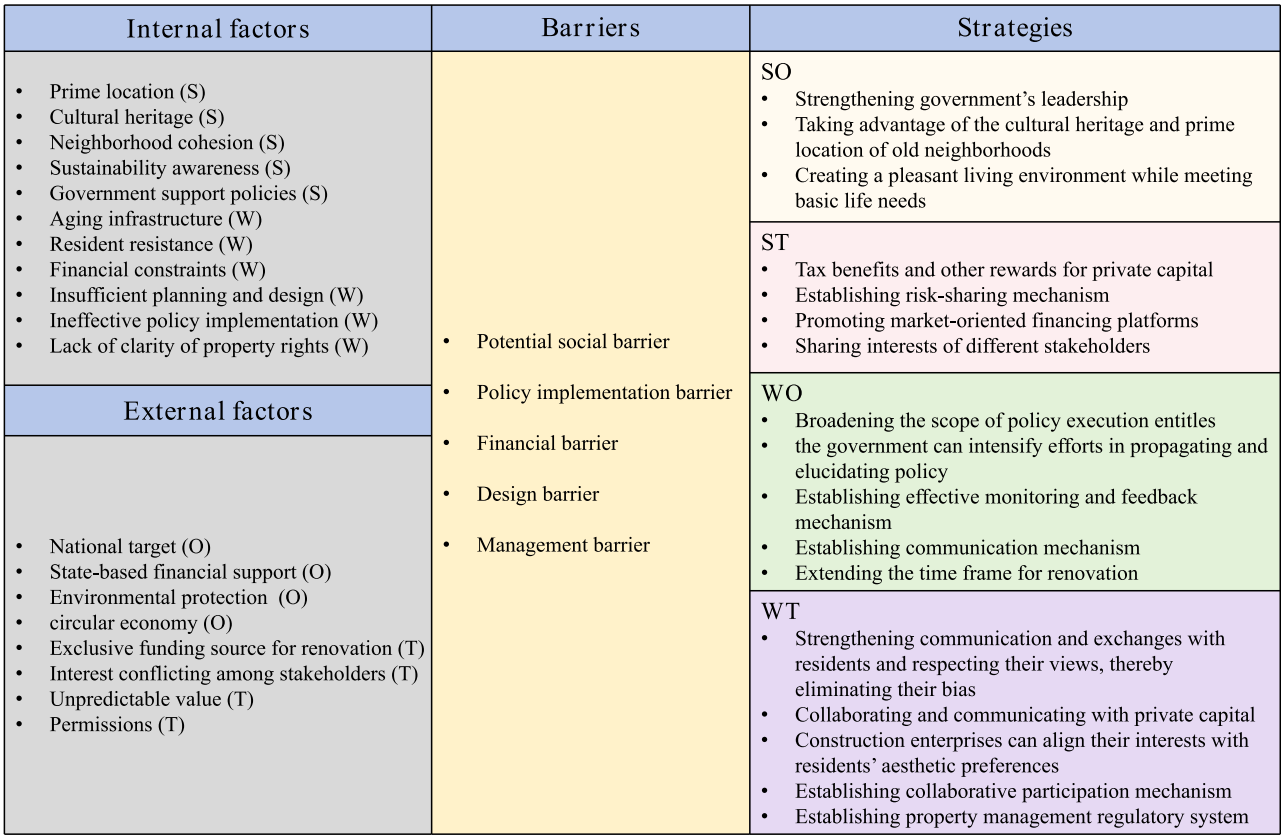

Fig. 7. Integrated analysis of barriers and strategies for promoting old neighborhood renovation using PESTLE method and SWOT analysis.

an improved quality of life while retaining their existing lifestyles and social networks. Private capital, comprising businesses related to renovating the old neighborhood, focuses on economic benefits and profit generation through operational and production activities [137]. Inevitably, conflicting interests among these stakeholders frequently emerge during the renovation process, as illustrated in Fig. 8. Key conflicting relationships involve government-neighborhood residents, government-private capital, and private capital-neighborhood residents. The government may encounter pressure from neighborhood residents and private capital to allocate more resources and provide policy support. neighborhood residents might express dissatisfaction with government-led renovation policies and seek more consideration of their needs and opinions. private capital could harbor a desire for increased incentives and governmental support to engage in renovation projects and achieve economic benefits. These conflicts of interest can impact renovation projects' effective implementation and governance.

Specifically, during renovating an old neighborhood, conflicts of interest between the government and neighborhood residents primarily revolve around the following aspects: 1) Discrepancies exist between the renovation needs articulated by residents and the policies crafted by the government. While the resident focuses more on individual quality of life and demands, the government emphasizes overall planning and public interests. Such disparities can lead to barriers in policy implementation. 2) The resident's awareness of government renovation policies and decisions remains constrained, while the government's disseminating policy information may exhibit timelines gaps or inadequately reach every resident. This can result in mistrust among residents regarding the decision-making and implementation processes of the renovation projects. Conflicting interests between the government and private capital (business) mainly involve the following paradigm: the government prioritizes public interests and societal benefits, whereas businesses are more concerned with economic gains and profitability. During the renovation, friction might emerge between the government and business concerning funding allocation and project planning. The conflicts of interest between business and residents are primarily centered around the fact that business might alter residents' lifestyles and living environment while pursuing profits. For instance, introducing commercial facilities or increased traffic flow might misalign residents' interests and expectations, thus engendering conflicts [161]. When stakeholders' expectations remain unmet or become compromised, it impedes the seamless progress of old neighborhood renovation projects. Furthermore, old neighborhood renovation faces the barrier of resident's distrust of construction projects. This lack of trust is particularly evident in residents' skepticism toward project contractors. Many residents commonly perceive deficient transparency in construction projects and feel uncertain about seeking assistance and advice regarding the renovation projects, ultimately expressing concerns about adverse impacts on their daily lives [154]. Consequently, this phenomenon contributes to a lower willingness among residents to participate in old neighborhood renovation efforts. Moreover, when residents' participation in decision-making and shaping processes is constrained, or their ability to effectively express their opinions is hindered, these issues can lead to lower overall satisfaction with specific projects [162,163].

The following key measures are proposed to mitigate or address stakeholder conflicts of interest and social barriers during the renovation process. Firstly, the government should strengthen its leadership role in the renovation, assuming the dual roles of service provider and regulator to fulfill its responsibilities better and ensure a balance of interests among stakeholders [164]. In this process, the government should establish effective communication mechanisms to facilitate coordination and equilibrium of divergent interests [157]. Secondly, there is a need to cultivate residents' awareness and capacity for participation, enhancing residents' willingness to engage in the renovation process actively [165]. To achieve this, government or private capital to enlist professional technical experts is recommended. These experts can offer specialized insights, rationally elucidating the renovation project's

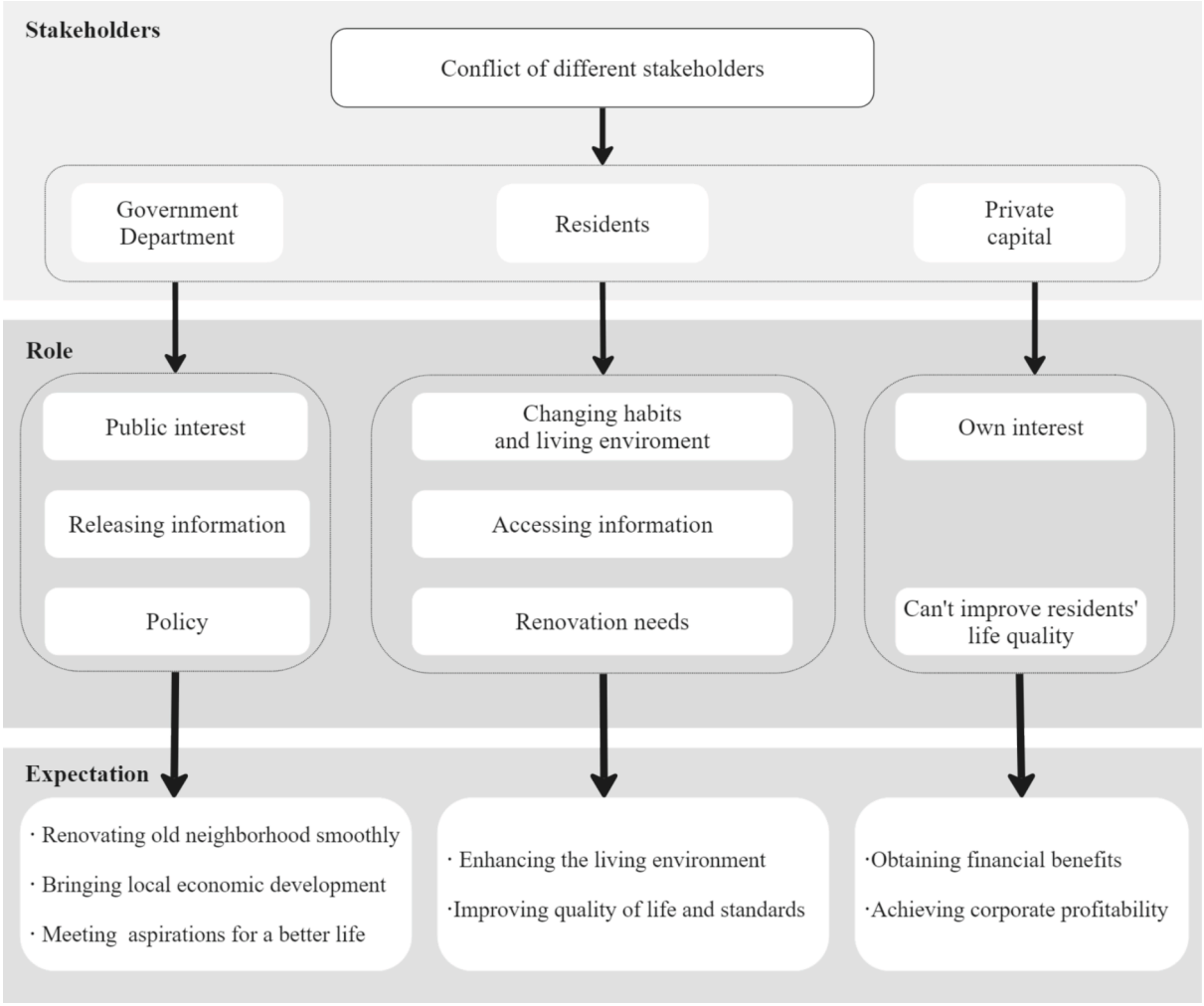

Fig. 8. The conflicting expectations and interests of different stakeholders (The above-mentioned contents of this figure are extracted from references of [158–160,137].).

benefits and dispelling residents' biases and suspicions [166]. By improving resident's understanding and willingness to participate in the renovation project, the implementation of the project can unfold fluidly. Additionally, organizing neighborhood resident forums or consultation activities can ensure that residents' opinions are fully respected. Lastly, a crucial aspect of conflict resolution is harnessing the initiative and proactivity of various societal entities to form a collaborative force for the shared interests of different renovation stakeholders [1]. In this regard, incentive measures and reward mechanisms can be introduced to encourage the active participation of businesses and residents in the renovation project, facilitating the collective sharing of project outcomes. Through these measures, conflicts among stakeholders can be effectively tackled. Thereby enhancing their readiness to cooperate and propelling the seamless implementation of the renovation project. Ultimately, this concerted effort culminates realizing the project's successful and sustainable development. Moreover, these measures contribute to ensuring a balance of interests among various stakeholders during the old neighborhood renovation process, improving renovation projects' feasibility and success rate.

4.3.2. Financial barrier to lack of diversified fundraising models

In China, the funding for renovating old neighborhood is primarily subsidized by the national finance. However, the lack of integration and active participation of private capital has led to a concentration of funding for renovation, resulting in financial barrier faced by ongoing renovation efforts [135,156]. Private capital plays a crucial role within specific societies, facilitating the smooth operation of society [167,168]. As illustrated in Fig. 9, a key constraint to capital entry into the renovation of the old neighborhood lies in the transaction costs associated with private capital seeking returns. These transaction costs encompass negotiation, agency, trust, risk, time, and other associated costs [169].

Firstly, the engagement of private capital in renovating the old neighborhood involves a series of review processes, such as project bidding, documentation processing, and construction preparation. The bidding process rigorously examines enterprises' qualifications, financial status, and creditworthiness, prioritizing those with proven experience, technical expertise, and a reputable track record [141]. On the other hand, the responsibility for renovation projects is mainly shoulders by construction enterprises, as development enterprises lack the necessary construction qualifications, thereby limiting the scope of funding sources for renovation [142]. Lastly, private capital is primarily profit-driven. However, many private capital perceive a lack of clarity in the profit model for renovating the old neighborhood [170]. This arises from the predominant focus of old neighborhood renovation on renovating physical spaces, which directly benefits the residents. Since no new properties are created for sale or lease post-renovation, the potential for generating operational income is considerably limited. This limitation hinders establishing a viable investment path for recovering investments and generating profits, thus weakening the incentive for private capital participation. As a result of these factors, private capital's

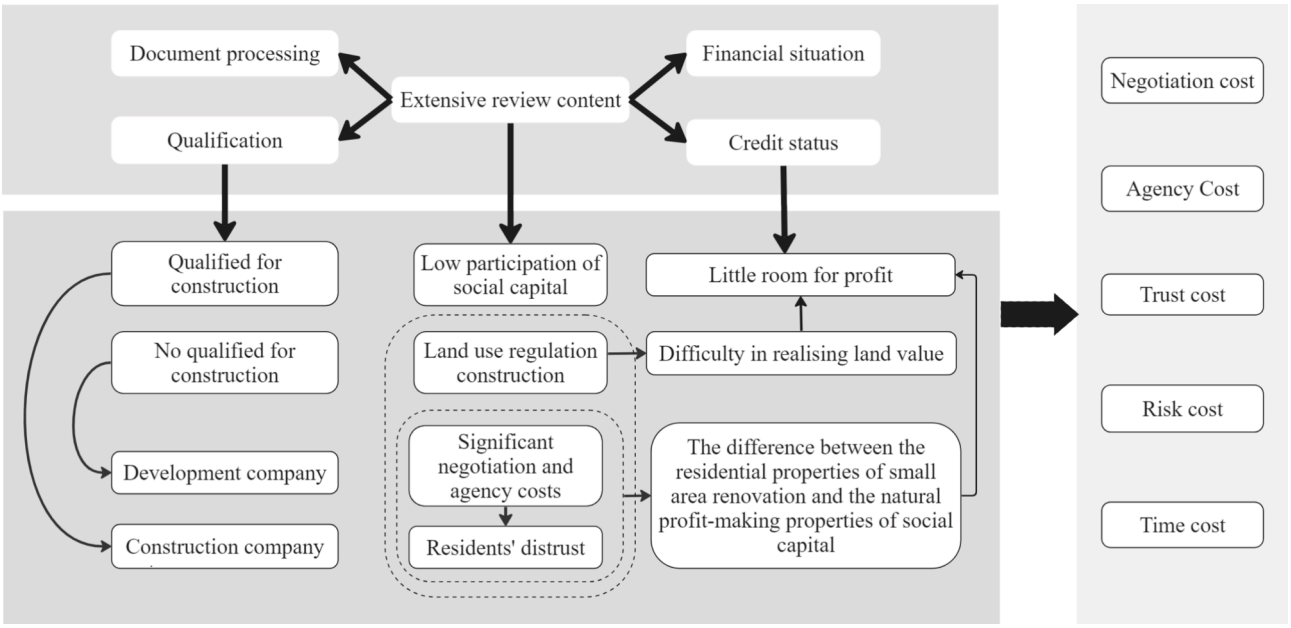

Fig. 9. Analyzing the factors contributing to financial barriers in the process of old neighborhood renovation (The above-mentioned contents of this figure are extracted from references of [128,141,142,149,160,161,169]).

financing opportunities are limited. While some commercial banks strive to offer loans for old neighborhood renovation, enterprises encounter barriers accessing low-interest support comparable to governmental benefits. Consequently, the appeal of private capital involvement in renovating the old neighborhood is diminished.

Considering the substantial investment and extended timeframe needed for renovating the old neighborhood, relying solely on government funding proves inadequate to ensure the sustained impact of the improvement. In response to the barrier posed by a singular funding source, the government can proactively explore diverse financing models to expand private investment in this domain [171]. By encouraging and guiding private capital to invest in neighborhood renovation while establishing flexible and varied market-oriented financing tools, such as fund bonds and public–private partnerships, increased participation of private capital can be garnered. Firstly, incentive policies can be formulated to provide tax benefits and other rewards for private capital renovating the old neighborhood, thus reducing investment risks [172]. Secondly, the establishment of a robust risk-sharing mechanism is imperative. This mechanism entails joint risk assumption and proportional benefit-sharing between governments and private capital upon project completion. Thirdly, promoting market-oriented financing platforms should involve actively engaging an expanded array of financial institutions and private equity funds, thus providing diverse financing products and services. Lastly, a heightened emphasis on collaboration and communication with private capital is crucial in jointly formulating investment return mechanisms for renovation projects, ensuring the balanced distribution of interests. Implementing these measures can secure a broader spectrum of funding sources for neighborhood renovation, alleviating financial barriers and bolstering project sustainability. Simultaneously, diversified financing models will invigorate private capital, attracting more investors and injecting new vitality and momentum into neighborhood renovation efforts. These cooperative models address funding barrier and pool expertise and experience, providing robust support for the smooth progression and successful implementation of renovation projects. Ultimately, this contributes to the sustainable development goals of renovating old neighborhood.

4.3.3. Barriers to imbalanced distribution of benefits in policy implementation

Policy formulation, enacted by governmental and social public authorities, serves as action plans and behavioral guidelines to achieve specific objectives. However, before practical implementation, the policy exists merely as a conceptual document, and its effects can only be realized through actual execution processes [173]. To ensure the smooth progress of old neighborhood renovation, both central and local governments have formulated numerous relevant policies. Nevertheless, they may encounter issues of distortion, obstruction, or even stagnation during the practical implementation [174]. The formulation and execution of policy constitute a complex process that necessitates balancing interests and collaboration among multiple stakeholders. When crafting policy for renovating old neighborhood, the government needs to consider stakeholder groups' requirements and interests to ensure policy aligns with overall societal interests and garners widespread support. However, once the policy is implemented, there might be pressures and opposition from different stakeholders, resulting in obstacles during implementation. This imbalance in the distribution of benefits can hinder the effective execution of policies and impede the desired outcomes of old neighborhood renovation efforts.

Various researchers have presented different perspectives when examining the barriers encountered in the policy implementation process. For instance, Li [175] suggested that policy execution is influenced by the qualitative nature of the policy issue, the effectiveness of policy implementation, and environmental influence. Zhang [176] proposed a direct correlation between policy execution and the basis of implementation, content formulation, specific policy enactment, and the implementation environment. Chen [155] emphasized the persistent presence of conflicting interests among different individuals during policy execution. As depicted in Fig. 10. When formulating policy for old neighborhood renovation, various interest groups contribute their demands to the policy-making system. At the same time, the government adjusts policy based on its interests to allocate social and public benefits. However, during the tangible implementation of policy, conflicts might arise between the localized interests of the implementing region or department and the personal interests of the executors. Furthermore, other factors could disrupt or stall the execution process, preventing the policy from achieving the expected outcomes [177]. To a certain extent,

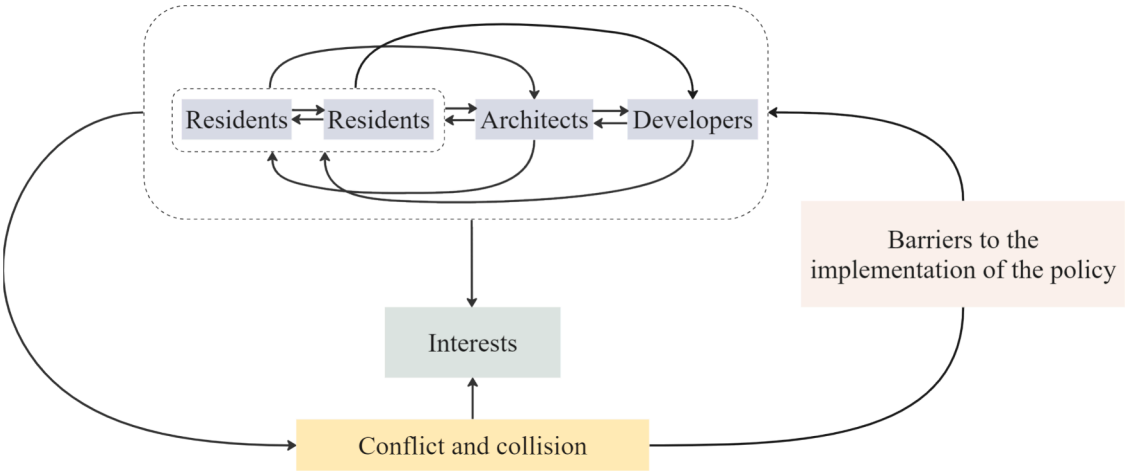

Fig. 10. Analyzing the reasons behind barriers to policy implementation (The above-mentioned contents of this figure are extracted from references of [160,173,174]).

this hinders the smooth progress of old neighborhood renovation and prevents attaining desired effects.

To address barriers in policy implementation, it is essential to broaden the scope of policy execution entities, including non-governmental organizations, thereby reducing public policy execution costs and enhancing operational efficiency. In policy implementation, paramount importance lies in wholeheartedly respecting residents' interests and opinions to establish a solid foundation for smooth execution. When formulating and executing policies for renovating old neighborhood, the government should thoroughly consider the opinions and needs of various stakeholders to ensure a balanced distribution of interests and minimize conflicts. Additionally, the government can

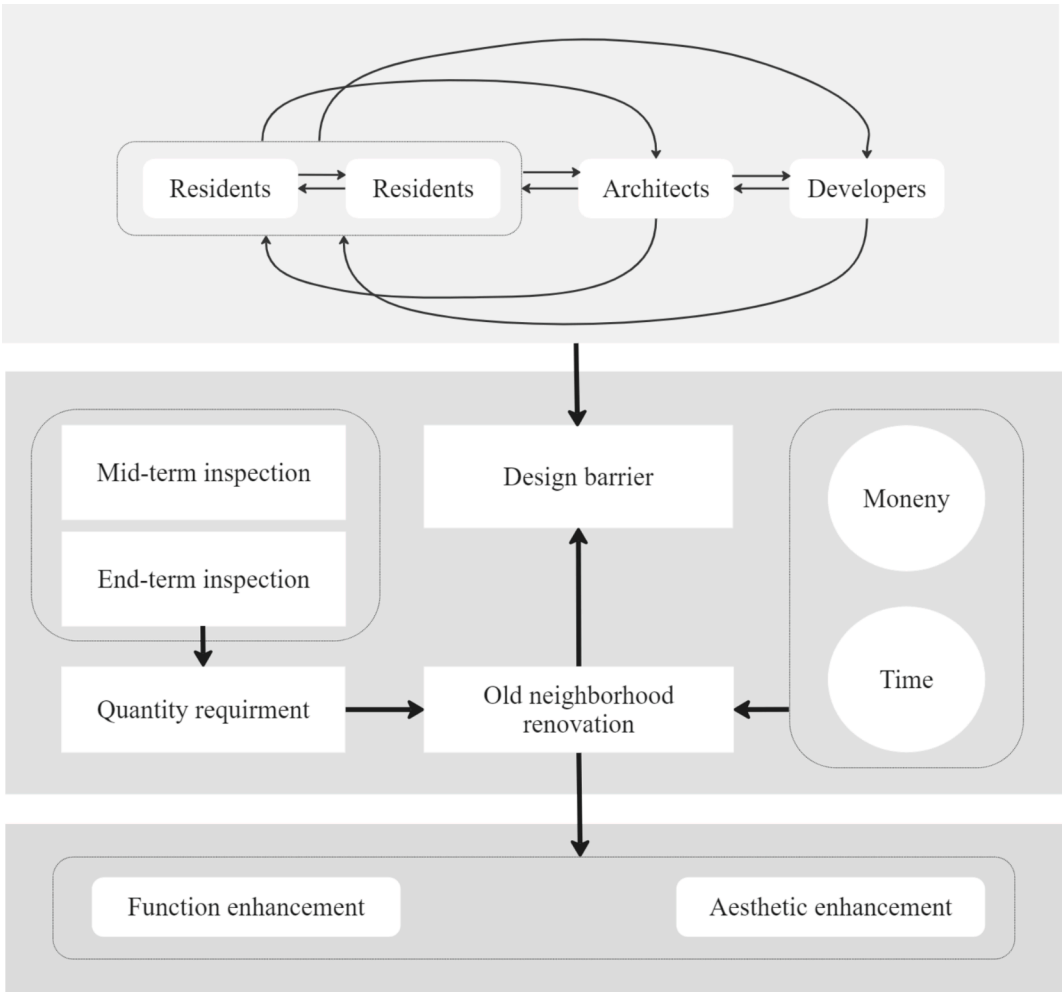

Fig. 11. Analyzing the factors causing the design barrier (The above-mentioned contents of this figure are extracted from references of [172,173,181,182,183]).

intensify efforts in disseminating and elucidating policy, enhancing residents' awareness and understanding of the policy to garner their support and cooperation. Simultaneously, establishing effective monitoring and feedback mechanisms allows for timely oversight and rectification of policy implementation, thereby ensuring the policy is effectively put into practice. In renovating old neighborhood, the adept execution of policy is a pivotal determinant of project success and sustainable development. By fully considering the stakeholders' needs, establishing robust communication mechanisms, and flexibly addressing barriers during execution, the barriers inherent in policy implementation can be overcome [178]. Such strategic measures propel the renovation of the old neighborhood and foster notable achievement in policy implementation.

4.3.4. Design barrier to differences in resident's perception

Residents continually perceive and respond to the aesthetic qualities of their living environment. A positive living environment elicits favorable aesthetic responses [179,180], representing fundamental reactions evoked by the built environment [181]. Hence, gaining insight into the interplay between the living environment and resident's aesthetic responses becomes crucial for successful urban design. However, current renovation efforts are constrained by performance-based criteria, such as timeliness and quantity, leading to a diminished emphasis on aesthetics. Additionally, the involvement of neighborhood residents in the design process of renovating old neighborhood remains limited.

Architectural aesthetics reflects a certain social ideology through architectural forms, utilizing elements such as group, space, form, proportion, scale, color, texture, and decorations to create specific artistic and aesthetic images that express the spirit of the times and social characteristics. With its inherent spiritual and practical essence, Architectural aesthetics can evoke aesthetic pleasure for individuals [182]. As illustrated in Fig. 11, the enhancement of aesthetic quality in the living environment through renovating the old neighborhood requires a substantial investment of time and resources. Over the past three years, the national guidelines have defined each province's annual quota for old neighborhood renovation, accompanied by intermediate and final completion assessments [183]. However, ongoing old neighborhood renovation initiatives primarily emphasize infrastructure and functional improvements at the policy level, frequently overlooking specific requirements for aesthetic enhancement. This results in an excessive pursuit of quantitative benchmarks in renovation projects, inadvertently sidelining the aesthetic value of old residential architecture. Furthermore, aesthetic viewpoints are subjective and differ among stakeholders, including residents, architects, and developers, each harboring distinct aesthetic preferences. Achieving aesthetic consensus amidst this diversity and formulating well-grounded renovation strategies necessitate extensive communication and coordination efforts. However, driven by optimized benefits and temporal efficiency, developers may be reluctant to involve residents in renovation decisions extensively. Similarly, residents, influenced by differing education levels and aesthetic disparities, may also be reluctant towards engagement.

The government can implement measures to promote aesthetic design in renovating the old neighborhood in response to design barriers. Firstly, the government can encourage renovation projects to prioritize creating a pleasant living environment while meeting basic life needs. This objective can be achieved through the involvement of professionals such as designers and landscape planners who can optimize the aesthetic aspects of the renovation plans. This approach will enhance the overall aesthetic quality of the neighborhood and increase resident's satisfaction with the renovation. Secondly, the government could contemplate extending the time frame for renovation, allowing ample time for meticulous aesthetic design. As old neighborhood renovation typically spans more prolonged periods, ensuring sufficient time for thoughtful design can lead to higher aesthetically valuable renovation outcomes. Additionally, construction enterprises play a crucial role during the renovation process. They can align their interests with the resident's preferences and opinions, actively listening to suggestions and making feasible adjustments. This collaborative approach can better meet residents' aesthetic requirements and ensure that the renovation results align with their expectations. Furthermore, as residents are the primary inhabitants, their active participation in the old neighborhood renovation design process is essential. To this end, the government and construction enterprises can organize workshops, neighborhood meetings, and other activities to encourage residents' active engagement. This engagement allows the resident to express their aesthetic requirements and design preferences. Such inputs and suggestions can help establish consensus, foster resident participation, and enhance their sense of ownership and belonging to the neighborhood. By implementing these measures, a more closely-knit collaborative relationship can be formed among the government, construction enterprises, and residents, all striving to enhance the aesthetics of the renovation projects. This approach can overcome design barriers, cultivate a satisfactory living environment, and establish a solid foundation for the successful implementation and sustainable development of old neighborhood renovation.

4.3.5. Management barrier to complex property rights and decision-making processes

The existing management barrier in renovating old neighborhood mainly arises from intricate property ownership and decision-making processes. From 1949 to 1978, public housing was the predominant urban residential neighborhood in China. However, the housing system underwent reform after the economic reforms 1978, resulting in various property ownership models. Commercial housing gradually took on a dominant role, leading to a coexistence of diverse property ownership types within Chinese cities. Furthermore, the renovation of public housing through housing reform and sales did not lead to a comprehensive transition of property rights. Consequently, situations emerged where unsold public housing units coexist, or multiple property units share the same neighborhood. For example, residential units might have been sold, but common areas such as hallways and communal facilities remain under the jurisdiction of either individual units or the housing management department [183]. These objective phenomena have rendered complexity to an old neighborhood's renovation and revitalization efforts, as illustrated in Fig. 12. When a neighborhood requires renovation, the intricate property ownership structures often impede the progress of relevant initiatives. Firstly, the lack of clear delineation of responsibilities and authority within public entities involved in renovation poses barriers in establishing accountability. The diverse array of property ownership types and managing bodies creates ambiguity concerning maintenance and renovation responsibilities for common areas, leading to ineffective management systems. Secondly, the complex property ownership structures also complicate the decision-making process for renovation and revitalization. Decisions encompassing multiple stakeholders require collaborative negotiations, and conflicts of interest between different property owners might impede the prompt progress of decisions [184].

The presence of these intricate property ownership patterns and decision-making processes gives rise to many barriers in renovating old neighborhood. To address these managerial barriers, a series of measures can be enacted: 1) Establishment of a collaborative participation mechanism: The government, relevant authorities, real estate developers, and residents must participate in the renovation of the old neighborhood collectively, engendering an atmosphere of negotiation and collaboration. The government can provide guidance and coordination, facilitating joint discussions on renovation strategies to ensure equitable consideration of the interests of all stakeholders. 2) Establishing a robust property management regulatory system: By instituting a system of supervision, a clear delineation of responsibilities and obligations for property management can be articulated. This will enhance management standards and augment the quality of property-related

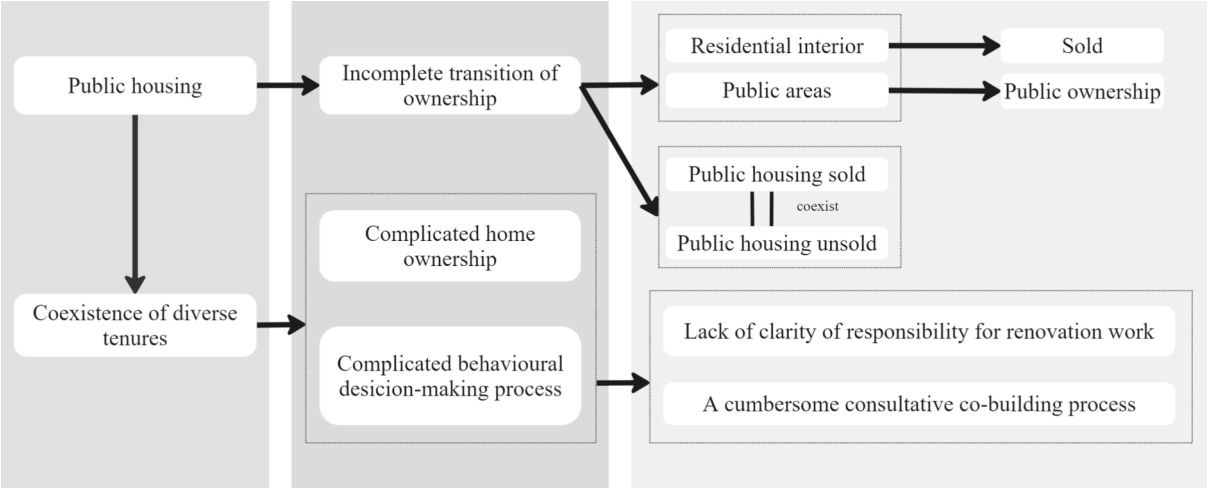

Fig. 12. Analyzing the factors leading to management barriers. (The above-mentioned contents of this figure are extracted from references of [183,184]).

services, contributing to the routine operations and maintenance of the old neighborhood. 3) Promotion of long-term resident engagement: By establishing forums such as symposiums and neighborhood workshops, the resident can voice their opinions and suggestions, actively participating in the decision-making process of renovation. Both the government and construction enterprises should listen to resident's needs, ensuring a thorough consideration of their interests. In summary, establishing a collaborative and inclusive multi-stakeholder engagement mechanism, implementing a robust property supervision framework, and promoting sustained resident involvement will help overcome management barriers in renovating the old neighborhood. This approach will propel the progression of renovation efforts smoothly, ultimately realizing the sustainable development goals of these endeavors. Within such a framework of collaboration and consensus, renovating the old neighborhood will better cater to residents' needs, creating an improved living environment.

4.4. Future research perspectives

As a complex but crucial topic, renovating old neighborhood offers numerous directions for in-depth exploration. To further advance the development of this field and address its barriers, forthcoming studies can concentrate on several key domains, combining diverse theories and methodologies to forge innovative solutions and establish scientific foundations for the enhancement of old neighborhood renovation.

4.4.1. Stakeholder analysis and interest coordination

Future research can emphasize an in-depth analysis of the diverse stakeholders involved in renovating old neighborhood, scrutinizing their interests and expectations. These stakeholders encompass government departments, residents, real estate developers, design institutions, and other departments, potentially leading to divergent interests during the renovation process. Stakeholder theory and analytical methods can be applied to study the interests, power dynamics, and collaborative mechanisms among these various stakeholders. By delving deep into the positions and motivations of different stakeholders, a scientifically sound basis can be provided for achieving a balance of interests and promoting mutually beneficial outcomes. This, in turn, can catalyze sustainable development practices in old neighborhood renovation. Comprehensive stakeholder analysis will not only enhance understanding but also contribute to the development of effective strategies for interest coordination, fostering collaboration among stakeholders, and ensuring successful and sustainable outcomes in the renovation process.

4.4.2. Diversified financial and financing models

Financial and funding matters present significant barriers in the renovation of old neighborhood. Future research should delve into diversified economic and financing models to address the problem of limited and singular funding sources for renovation projects. Researchers can combine project financing theories and practical applications to investigate models involving public–private partnerships, social investments, fund bonds, and other collaborative approaches while exploring mechanisms for fund collaboration between governments, enterprises, and residents. Considering the multifaceted interests entailed in renovation projects, a comprehensive suite of assessment methods can be employed to evaluate the merits, drawbacks, and feasibility of different financing models. This comprehensive evaluation process will offer a scientific underpinning to financial decision-making. It will contribute to the development of resilient and adaptive financial strategies, ensuring the availability of adequate resources for successful and sustainable old neighborhood renovation.

4.4.3. Policy implementation effectiveness evaluation and optimization

In examining the barriers during policy implementation, prospective research endeavors hold the potential to fortify the assessment of policy implementation outcomes. Qualitative and quantitative methods can be employed to analyze the effectiveness of policy implementation and identify barriers. Additionally, drawing insights from policy evaluation theories and methods, a thorough exploration of bottlenecks and shortcomings in policy implementation could serve as a basis for offering recommendations to optimize policy outcomes. It is noteworthy that policy implementation involves coordination across multiple departments. In light of this, future studies could focus on establishing cross-departmental and cross-level policy coordination mechanisms to enhance execution efficiency and effectiveness. This approach will contribute to a more comprehensive understanding of the policy landscape, facilitating the identification of areas for improvement and the formulation of strategies to overcome implementation barriers in old neighborhood renovation.

4.4.4. Participatory design and aesthetic value

In addressing the design barriers in renovating an old neighborhood, future research could investigate the incorporation of participatory design methods and delve deep into resident's aesthetic needs and perceptions. Active engagement with residents in this manner can provide invaluable insights into their expectations and demands regarding aesthetic elements, thus serving as the foundation for developing corresponding aesthetic guidelines. Furthermore, an additional avenue for investigation could explore integrating local culture and historical

context into the renovation process. This integration holds the potential to enhance the cultural adaptability and aesthetic resonance of design propositions. Participatory design empowers residents to engage substantively in renovation decision-making and heightens their sense of belonging and satisfaction within the neighborhood. Research in this area will contribute not only to the refinement of aesthetic aspects in old neighborhood renovation but also to fostering a more inclusive and resident-centric approach, ultimately leading to more successful and sustainable outcomes for the old neighborhood renovation practices.

4.4.5. Management mechanism optimization and resident participation

Addressing the management barriers in renovating the old neighborhood, future research could explore the establishment of management mechanisms adapted to the characteristics of the old neighborhood. Drawing upon theories and methods of neighborhood governance, this study could investigate strategies for nurturing residents' self-governance and organizational capabilities in old neighborhood, aiming to achieve neighborhood co-governance. Establishing platforms such as symposiums and neighborhood workshops could guide residents to actively participate in opinion solicitation, proposal formulation, construction management, and ongoing maintenance processes. This approach ensures the comprehensive consideration of resident's interests and enhances the quality and sustainability of renovation projects.

4.4.6. Exploring international perspectives on old neighborhood renovation

Old neighborhood renovation presents varying experiences across different countries and regions, highlighting the importance of examining this topic from an international perspective in future research. For example, conducting a comparative analysis of policy formulation and implementation between China and the EU region could offer valuable insights. By thoroughly examining the similarities and differences in policy frameworks, subsidy measures, and regulatory systems, researchers can gain a comprehensive understanding of the advantages and limitations of each region's approach to renovation. This comparative study has the potential to provide valuable experiences and policy recommendations for improving renovation endeavors in both regions. Moreover, a comparative analysis of the adoption of old neighborhood technologies between China and the EU could yield significant insights. Scrutinizing developments in areas such as energy-efficient materials, intelligent equipment, and green building technologies can elucidate potential opportunities and barriers for international technological exchanges and collaboration. By identifying disparities and commonalities, researchers can offer guidance for enhancing technological innovations in China's old neighborhood renovation efforts. Additionally, investigating socio-cultural factors influencing old neighborhood renovation in China and the EU is essential. Through a comparative examination of differences in residents' participation, cultural perceptions, and aesthetic preferences, researchers can gain a deeper understanding of the social dynamics and cultural influences within diverse cultural contexts. This comparative analysis can inform strategies for fostering community engagement and addressing cultural considerations in renovation projects, contributing to more effective renovation initiatives. Renovating the old neighborhood is a complex field requiring interdisciplinary knowledge and approaches for comprehensive research. Subsequent research should emphasize the application of in-depth theoretical frameworks and methodological approaches, conducting thorough and multidimensional investigations into renovating the old neighborhood to advance the development and practice in this domain. By delving into comprehensive stakeholder analyses, diversifying financial and financing models, evaluating the effectiveness of policy implementation, investigating participatory design and aesthetic value research, optimizing management mechanisms, and engaging residents, a more scientifically practical guidance and support system for the renovation of the old neighborhood can be provided, ultimately contributing to the goal of urban sustainable development.

5. Conclusions

This study aims to provide an updated understanding on old neighborhood renovation status in China and to conduct an in-depth analysis of encountered barriers while presenting measures to address them. Through a critical literature review, it is evident that the current focus of old neighborhood renovation predominantly revolves around enhancement-oriented projects, with significant attention given to environmental enhancement, construction, building energy efficiency renovation, and elevator installation. Additionally, studies have explored sponge city renovation, resident participation, resident satisfaction, and the post-renovation value change of the neighborhood. Old neighborhood faces a wide range of social, financial, policy implementation, design, and management barriers throughout the renovation process, rooted in conflicting interests among stakeholders. Specific barriers are influenced by factors like low resident participation, distrust towards the renovation process, aesthetic differences among involved parties, and the complexity of property rights.

This study proposes a set of solutions in response to various barriers encountered in renovating old neighborhood. Firstly, resolving social barriers requires the government to be guided and supervisory. The government should disseminate information about renovation projects through multiple channels to foster resident engagement. This collaborative approach, involving all societal stakeholders, will ensure the smooth progression of old neighborhood renovation. Secondly, surmounting financial constraints calls for the exploration of diversified funding approaches. Beyond reliance on national fiscal support, the government should actively seek participation from social and private capital sources. To address inadequate management systems, renovating and revitalizing the old neighborhood should establish a collaborative and inclusive multi-stakeholder engagement mechanism alongside a robust property management oversight system tailored for these areas. This includes enhancing a "neighborhood-based" comprehensive governance model that coordinates diverse stakeholders at the street level and utilizes a multi-faceted approach to harmonize and coordinate efforts. Simultaneously, addressing barriers during policy implementation, expanding the scope of policy execution, and respecting resident's interests and opinions can foster widely-accepted policies. Confronting design barriers, governmental bodies should incentivize aesthetic improvements in the renovation process, allowing for flexible timelines. Construction enterprises should moderate profit motives to create a living environment that aligns with residents' aesthetic preferences. Furthermore, proactive resident engagement, understanding, and participation in renovation projects can counter biases and suspicions, enhancing comprehension and support for renovation efforts. Ultimately, resolving management hurdles necessitates establishing multi-party cooperation mechanisms. Different stakeholders should collaboratively engage in renovating, managing, and maintaining these old neighborhoods. Government oversight of property management companies should be reinforced to ensure the fulfillment of management responsibilities and the provision of high-quality services to residents.

This study holds significant theoretical and practical value for renovating old neighborhood in China. By conducting an in-depth analysis of the current situation, implementation barriers and proposing practical solutions, this paper offers valuable insights for relevant decision-makers and practitioners in this field. Furthermore, it identifies specific gaps within the current research landscape, outlining future research directions, and providing crucial perspectives to advance the progress of old neighborhood renovation. Ultimately, this meticulous research will contribute to the seamless integration of urban renovation and sustainable development, creating a more favorable living environment for residents.

CRediT authorship contribution statement

Yishuang Liang: Writing – original draft, Software, Methodology,

Investigation, Formal analysis, Data curation, Conceptualization. **Queena K. Qian:** Writing – review & editing, Supervision, Methodology, Investigation, Conceptualization. **Bo Li:** Writing – original draft, Supervision, Methodology, Investigation. **Yaning An:** Writing – original draft, Methodology, Investigation. **Lei Shi:** Writing – review & editing, Supervision, Methodology, Investigation, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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