Dynamics, Mechanisms, and Benefits of Micro-Renewal in Urban Residential Areas: A Case Study of the Xiaoxihu Block in Nanjing

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Abstract
As urban development paradigms shift, micro-renewal focused on enhancing the built environment and fostering a sense of identity has become a transformative pathway in China's urbanization process. Residential spaces, being the most critical elements of urban structure, frequently face complex challenges in their micro-renewal efforts: the constraints on urban construction capacity limit the impetus for innovation; the lack of effective implementation mechanisms impedes the progression of regeneration; and the pursuit of short-term economic gains often traps these spaces, preventing the enhancement of comprehensive benefits. This paper employs the micro-renewal of the Xiaoxihu Block as a case study, examining the sources of renewal impetus, the mechanisms of action, and the enhancement of comprehensive benefits, with the aim of providing a feasible model for sustainable micro-renewal practices in residential settings. The research findings reveal that: (1) the driving force behind micro-renewal is the incremental value derived from the operation of existing spaces; (2) the mechanism of micro-renewal involves the full-cycle participation of multiple stakeholders in public affairs; (3) micro-renewal is a process that holistically elevates environmental, economic, and social benefits, engaging with a diverse array of stakeholders and yielding synergistic effects.

Keywords: micro-renewal, dynamics of micro-renewal, implementation mechanism, benefits of micro-renewal

1. Introduction

In 2015, the United Nations promulgated the Sustainable Development Goals, which underscore that urban renewal is a critical strategy for achieving urban sustainability in the pursuit of improved living conditions, environmental remediation, and economic revitalization. Historically, urban renewal in China's residential spaces has predominantly focused on the secondary development of land(Liu et al., 2020), involving the large-scale demolition and reconstruction of low-quality existing residential areas within cities(Lai et al., 2017). This approach has restructured the original land property rights. Government, market entities, and society constitute the primary stakeholders in this process of resource redistribution(Li et al., 2018). Local governments augment their fiscal revenues and operational capabilities through the land transfer fees and expanded tax revenues generated by urban renewal. Simultaneously, they reinforce the legitimacy of governance by maintaining and enhancing the overall welfare of society(Liu et al., 2020). Market participants are primarily concerned with economic and efficiency gains, leveraging increased development intensity post-renewal—such as the "one-for-many" demolition and construction approach—to capitalize on land value increments through expanded spatial availability. They also seek to minimize transaction costs by reducing the time required for demolition. For homeowners, the substantial monetary compensation from property demolition, the improvement of living conditions, and the resolution of employment issues typically serve as their incentives to engage in urban renewal. Consequently, economic considerations have been the primary drivers and benefits during the era of large-scale demolition and construction in urban renewal(Shen et

al., 2021). However, numerous scholars have pointed out that the over-construction associated with this approach can lead to environmental issues, including the destruction of traditional urban landscapes and natural ecosystems(Hui et al., 2018; Wang et al., 2016). Additionally, social equity concerns have emerged, such as the disregard for residents' renovation preferences(Hin & Xin, 2011), the loss of tenant spaces(Wong et al., 2018), the disruption of community networks(He & Wu, 2007), the disappearance of mixed-use spaces(Zhou et al., 2017), and the loss of reasonable residential densities(Lee et al., 2017).

With the transformation of urban development approaches, the Ministry of Housing and Urban-Rural Development (PRC) issued a notice in 2021 titled "On Preventing Large-Scale Demolition and Construction Issues in the Implementation of Urban Renewal Actions," which explicitly mandates the strict control of "large-scale demolition, substantial addition and subtraction, and extensive relocation" within urban renewal initiatives(Tang et al., 2022). An increasing number of scholars advocate for the proactive adoption of micro-renewal methods to address the challenges of urban residential space stock(Li et al., 2019). Specific practices in various cities reveal that more and more existing residential areas have limited potential for incremental growth, or are even required to undergo de-growth. Consequently, the use of small-scale, incremental micro-renewal strategies, which enhance quality through the renovation and renewal of smaller-scale environments within plots, has become a significant approach to invigorating the continuous renewal of entire regions. This method focuses on the gradual improvement of existing spaces rather than drastic transformations.

Under the guidance of the "organic renewal" concept, micro-renewal attentively addresses residents' daily needs through a gradual and progressive approach. It respects the spatial reutilization of the built environment and emphasizes multi-stakeholder co-governance. This methodology seeks to enhance the quality and management of existing urban spaces, while preserving their fundamental layout and cultural continuity through practical strategies and methods of renewal, repair, and protection(Wang et al., 2023). However, the micro-renewal of residential spaces in Chinese cities currently faces several challenges: (1) Micro-renewal efforts often struggle with a lack of funding sources. Market entities see little profit due to limited urban construction capacity, and residents encounter complexities related to property rights. These issues inherently restrict the motivation to initiate such projects(Jiang et al., 2020). (2) During the renewal process, difficulties arise in coordinating the opinions of various stakeholders and in the flaws inherent to different cooperation models, often impeding the smooth implementation of micro-renewal initiatives(Zhuang et al., 2019). (3) Residential micro-renewal tends to focus predominantly on beautifying and organizing the physical urban environment, falling short in achieving a comprehensive enhancement of benefits(Shen et al., 2021). Moreover, existing research typically approaches urban residential micro-renewal from singular perspectives such as practical pathway design(Hui et al., 2021) and space optimization strategies(Tan & Altrock, 2016). There is a notable lack of systematic research summarizing the drivers, mechanisms, and benefits of renewal, which are insufficient to meet the theoretical research needs of China's urban renewal path transformation.

Therefore, the purpose of this paper is, based on an interpretation of the

essence of micro-renewal, to explore the following questions:

(1) What are the intrinsic drivers that initiate micro-renewal?

(2) What mechanisms ensure the implementation of micro-renewal?

(3) What are the comprehensive benefits that sustain micro-renewal?

This study delves into the dynamics, mechanisms, and benefits of urban micro-renewal, using the preservation and regeneration of Nanjing's Xiaoxihu Block as a case study. The research commences with a succinct literature review, followed by an exposition of the empirical data collection methods and a detailed description of the Xiaoxihu Block. The case study unveils intricate details concerning the driving forces, operational mechanisms, and resultant benefits, thereby elucidating the research findings. Consequently, this paper offers valuable insights and references for the strategic pathways and execution processes of urban renewal within the context of existing urban stock, making a noteworthy contribution to the scholarly discourse on urban renewal.

2. Urban micro renewal of residential areas

2.1 Spatial Logic of Urban Micro-Renewal

Since Molotch introduced the urban growth machine theory, this theoretical paradigm has become the dominant analytical framework for scholars to explain the driving forces behind urban development(Shen et al., 2021). Numerous scholars contend that spatial production is one of the most profitable means to achieve urban growth and serves as a primary catalyst for driving urban renewal projects(Liu et al., 2019). China's urban renewal during the period of incremental expansion also followed a similar logic of spatial production. However, as China's urbanization shifts from incremental development to stock renewal, the logic of spatial production based on real estate development and land finance profiteering is losing its economic foundation. The marginal value of land and various collateral assets as capital for spatial production is declining, and their mission is no longer confined to the regeneration of physical spaces such as old and derelict buildings(Shen et al., 2021). Resource integration and benefit reconstruction are among the key tasks of micro-renewal, with the logic of residential urban renewal shifting from spatial production to community building. Particularly in the context of the renewal of built environments, greater emphasis is placed on the social dimension, focusing on how to maintain the original social structure and property rights, facilitate collaboration and collective action among neighbors, and balance operability and fairness to enhance community vitality and the level of social governance. Consequently, the power of different stakeholders, the network of relationships and operational mechanisms, the role of social capital, and the comprehensive benefits generated by the micro-renewal process have become focal points of urban renewal in the new era.

2.2 Stakeholders in Urban Micro-Renewal

Influenced by the urban growth machine theory, most scholars have identified three key driving factors of urban development: municipal governments, business groups, and communities, as well as the relationships among them(Jiang et al., 2020; Liao & Liu, 2023; Wang et al., 2021; Zhuang et al., 2017). They have also examined how to balance between attracting investment to promote economic development and sharing the benefits. However, unlike the pursuit of economic benefits in urban renewal primarily involving land development, the purpose of micro-renewal is to

make comprehensive investments in and modifications to cities, renew urban functions, and repurpose urban space. It involves complex relationships among multiple stakeholders, which, aside from municipal governments, business groups, and community residents, also include designers, neighborhood committees, the media, and the public(Chou et al., 2023). It places greater emphasis on the granularity of distinct stakeholder groups. For example, residents could be further differentiated by their property rights, willingness to renew, and material conditions, while government departments entail multiple coordinating units such as the comprehensive planning bureau, the urban renewal bureau, and the housing bureau. Social organizations or individuals are no longer simply real estate dealers but involve multiple forces such as real estate, banks, and state-owned asset platforms(Li et al., 2024). Therefore, the management and coordination of stakeholders in urban renewal are particularly important.

2.3 Enhancing Benefits of Urban Micro-Renewal

Urban renewal is an inevitable process in urban development. Prior to 1860, the primary focus of urban renewal was to eliminate slums and improve the material living standards of residents. With the advancement of urbanization and the transformation of urban economic development models, the economic benefits brought about by land development have become the pursuit of both government departments and market entities. However, if the sole objective is to promote economic development, it is bound to harm the interests of vulnerable urban groups and lead to social injustice. Consequently, the goals of urban renewal have diversified to encompass social, environmental, and economic aspects(Chen et al., 2023; Nachmany & Hananel, 2023). On one hand, this involves the built environment as a carrier, with cautious and moderate modifications to the built environment to enhance the quality of living spaces, thereby addressing the supply-demand contradiction of public services, safeguarding the diverse demands of the people, and promoting social equity. On the other hand, it focuses on the management of complex property rights relationships during the process, striving to reach a consensus on renewal intentions and plans. The issues addressed by renewal have become more comprehensive and complex, providing optimized solutions and improving urban functions(Hao & Wang, 2023).

3. Research methodology

The empirical analysis of this study is primarily based on case studies. The research selected the southern part of the old city of Nanjing as the study area because it is a typical urban area that has fully experienced the tumultuous modern renewal process of Nanjing (Table 1), and can be considered a microcosm of the renovation of urban residential areas in China(Bai & Xu, 2023). The selection of the Xiaoxihu Block as a specific case study is for two reasons. Firstly, the Xiaoxihu Block underwent a long 9-year renewal period, becoming the first relatively mature micro-renewal project in Nanjing, allowing us to track changes over different time stages. Secondly, a five-party communication and coordination platform was established during the renovation process of the Xiaoxihu Block. The renovation has garnered broad social attention from the media, scholars, non-governmental organizations and the public, reflecting complex benefit and mechanism issues in the regeneration process. The data mainly come from in-depth interviews, non-participatory observation, and archival research. From March to April 2024, semi-structured interviews and literature research were conducted. Respondents included local

residents, shop owners, designers, and tourists still residing in the Xiaoxihu Block.

Table 1. The Urban Renewal Process in Nanjing

Renewal Phase	Stage One	Stage Two	Stage Three	Stage Four
Time	1978-1990s	Early 1992-2000s	2000-2015	Post-2015
Characteristics of Renewal	Distress-Driven Demolition and Reconstruction	Growth of Agglomeration-Propelled Demolition and Reconstruction	Extensive Demolition and Construction	Incremental Micro-Renovation
Participant Entities	Government-Led	Government-Led	Government-Enterprise Collaboration	Multi-Stakeholder Engagement
Primary Contradictions	Alleviating Housing Shortages	Pursuit of Economic Benefits from Rent Gap	Land Development Symbolized by Culture	People-Centered Approaches Addressing Daily Resident Needs

The renovation of Xiaoxihu Block exemplifies a model of incremental micro-updates, pioneering innovative strategies for the conservation and activation of heritage resources within the district. Located in the southern region of Nanjing's Qinhuai District, occupying an area of 46,900 square meters, Xiaoxihu Block is designated as one of the 22 historical and cultural areas in the "Nanjing Historical and Cultural Name Protection Plan (2010-2020)" (Figure 1), specifically within the Da You Fang Lane Historical and Cultural Area.The Xiaoxihu Block predominantly consists of residential land. However, due to its long exclusion from the old city renovation plans, the once-storied historical and cultural area had fallen into disrepair, with numerous dilapidated and hazardous structures. This led to a chaotic spatial layout, an extremely high population density, and rampant illegal construction, transforming it into a "shantytown"(Dong et al., 2022).By 2016, the division of property rights into 216 plots resulted in extremely small housing units, most of which lacked essential living facilities such as independent kitchens and bathrooms.There are a total of 810 households (2,641 people) in the renewal site, with an average household living area of only 22.14 ㎡, and an average per capita living area of only 11.65 ㎡, which is much lower than the per capita living area standard of 40.1 ㎡ in Nanjing.Additionally, scattered within the renewal area are various property types stemming from historical legacies, including private homes, public housing owned by institutions, government-owned housing, and industrial enterprise properties. When overlaid with the spatial layout, this creates a highly convoluted relationship among property rights.

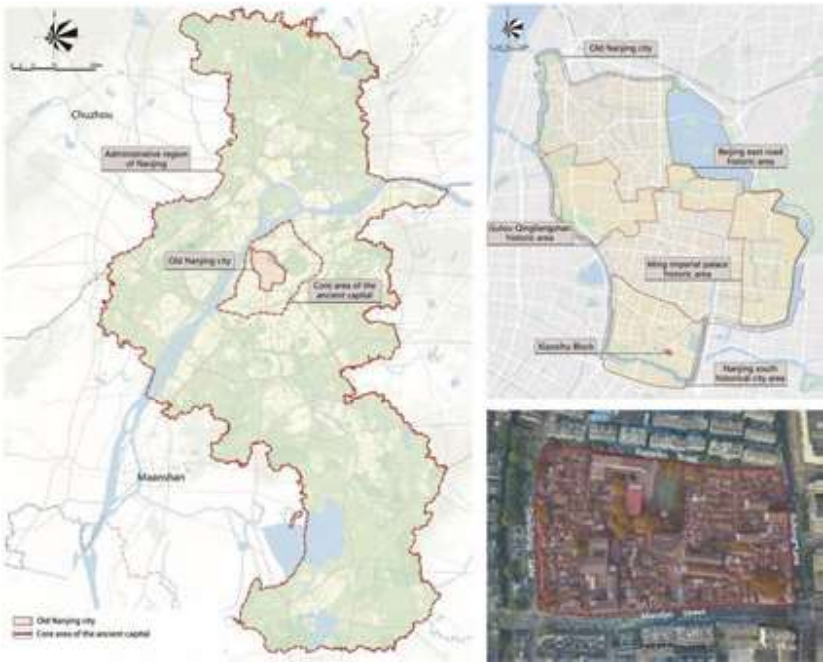

Fig. 1. Location and Boundaries of Xiaoxihu Block

The renewal of the Xiaoxihu Block commenced in 2015. To promote the regeneration of this area, the Nanjing City Planning Bureau and the Qinhuai District Government initiated a voluntary action program involving postgraduate students from three universities based in Nanjing to explore the methods of old city renewal in the southern part of the old city. In 2016, entrusted by the Qinhuai District Government and the implementing entity, the Nanjing Historic City Conservation Construction Group Co., Ltd., a team from Southeast University officially undertook the detailed planning and design of municipal facilities and demonstrative courtyards for Xiaoxihu Block. In 2017, following basic research and a survey of residents' preferences, the formal planning design and expropriation work began. The implementing entity conducted the expropriation, while the designer proposed preliminary planning solutions for the street system, municipal facilities, and public space layout. Residents were informed about the expropriation policies and expressed their relocation preferences. The expropriation work concluded in 2018, and the implementing entity began to advance the property rights transfer of expropriated land, planning the overall business format and layout. The designers completed the detailed constructive planning and planning results, formulated micro-renewal rules, and the government departments studied the micro-renewal work mechanism and policy innovation to ensure the smooth implementation of the micro-renewal process. The official micro-renewal construction started in 2019. The designer carried out the scheme design and rule formulation for key areas, the implementing entity conducted mapping and structural inspection of existing buildings, and initiated construction in key areas according to the planning scheme.

Residents participated in discussions on the scheme design during this process (Figure 2).

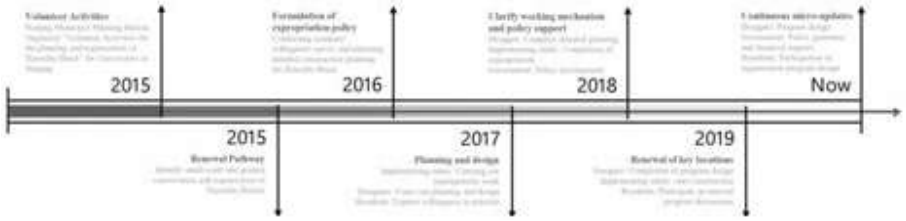

Fig. 2. The Renewal Process of Xiaoxihu Block

4. Dynamics, Mechanisms, and Benefits of Micro-Renewal

4.1 The Dynamics of Micro-Renewal: Determining the Initiation of Micro-Renewal

Urban renewal during the land development phase can achieve land value appreciation through capacity enhancement and functional replacement, thereby stimulating the market's motivation for renewal(Cao et al., 2023). In contrast, micro-renewal, constrained by strict spatial increment control, faces limited returns and can only realize marginal value appreciation through the reuse of existing spaces. The renewal of the Xiaoxihu Block, in addition to utilizing government financial subsidies, primarily relies on the operation of existing spaces for value enhancement, which is mainly reflected in the multifunctional utilization of existing buildings.

The architectural space reutilization in the Xiaoxihu Block's renewal is based on assessing the condition of use, functional classification, and spatial layout to reemploy building space resources for marginal profits. This is chiefly accomplished through functional replacement and enhancement. Functional replacement involves transforming underutilized buildings that no longer meet residents' needs into non-profit life support service facilities. The implementing entities achieve spatial value appreciation through the collection of space rent differentials and service fees. The former Chengnan Power Supply Company building, located at the intersection of Madao Street and Xiaoxihu Lane within the Xiaoxihu Block and rendered obsolete due to functional inadequacy, was vacated. Subsequently, designers repurposed it into a fire water tank, substation, and control center to fulfill the district's power and fire service needs(Dong & Han, 2022).

Functional enhancement, on the other hand, is achieved by reorganizing the functions of residential units and optimizing circulation layouts to improve the living environment. The renovated buildings can introduce commercial and other profit-generating facilities, capitalizing on space rent differentials for the accumulation of spatial assets(Liiu et al., 2022). The dilapidated housing located at the southeast corner of the Xiaoxihu Block, originally the significant Taoist temple Sanguantang, was redeveloped through an orderly site condition assessment. With the foundational goal of protecting and displaying historical sites, the renovation included the repair of traditional houses and the reorganization of street-facing properties to enhance the site's environmental quality. The introduction of hotels and restaurants among other business ventures has been designed to achieve financial balance (Figure 3).

Fig. 3. Comparison of Sanguantang before and after renovation

In summary, the value enhancement benefits of the redevelopment of existing space through the "investment-renovation-operation" model are primarily derived from three aspects: spatial rent differentials, basic property management, and revenue from value-added service management. A long-term, sustainable model of micro-profitable space operation fulfills the market entities' demand for economic viability.

4.2 The Implementation Mechanism of Micro-Renewal: Ensuring the Smooth Implementation of Micro-Renewal

Micro-renewal in urban residential areas not only requires attention to the enhancement of physical space quality but also necessitates the reconciliation of complex social interest conflicts. The decision-making process manifests itself in the multi-stakeholder participation throughout the full cycle of public affairs. Decisions are significantly influenced by the characteristics and relationships of the various participating entities, as well as the structure and mechanisms of the participation process.

4.2.1 The Holistic Workflow Mechanism for Micro-Renewal

Micro-renewal represents a distinctive approach to urban renewal, with its workflow divided into two principal phases: the urban renewal coordination stage and the micro-renewal implementation stage. During the urban renewal coordination stage, cities in China have established an operational system that follows a "city renewal action plan - regional renewal scheme - specific project implementation" framework(Tang et al., 2024). The urban renewal coordination stage in Nanjing comprises three steps:

(1) Formulation of the renewal plan: The participating entities include municipal and district-level functional departments and sub-district offices. Municipal departments are responsible for drafting urban renewal guidelines, while district governments compile urban renewal action plans based on the current built environment. These plans provide the conceptual foundation for the implementation of renewal schemes. In 2015, the former Nanjing Municipal Planning Bureau and other departments proposed a shift from "top-down expropriation" to "bottom-up renewal," clarifying the overall principle of old city renovation to be "seeing objects, people, and life," which guided the "small-scale, progressive, courtyard-by-courtyard" micro-renewal transformation of the Xiaoxihu Block(Han & Shen, 2022).

(2) Compilation of the renewal scheme: After assessment by government departments, the designated implementing entities, under the premise of

safeguarding public interests, must conduct thematic research for the area and formulate a renewal scheme. The renewal work of the Xiaoxihu Block is carried out by the state-owned enterprise Libao Group, which has developed a detailed renewal scheme.

(3) Implementation of renewal projects: This process requires the determination of renewal objectives, funding models, and other requirements based on the scope and type of renewal.

The specific implementation phase of micro-renewal primarily comprises three procedures:

(1) Micro-renewal project planning: In the Xiaoxihu Block, due to complex property rights, applications for renewal, based on different types of property rights, are initiated by property owners or tenants. Concurrently, the Planning and Natural Resources Bureau approves the renewal applications according to the rule requirements and provides the applicants with planning indicators, business functions, and other technical conditions for renewal(Han & Shen, 2022).

(2) Micro-renewal design and construction: This typically involves stages of preliminary research, scheme design, decision-making, and implementation, aiming to develop a renewal plan based on the investigation of the current residential environment and the exploration of resident needs. In the Xiaoxihu Block, in accordance with the "small-scale, progressive" renewal concept, the fragmented 810 property units were reorganized into a two-tiered system of "planning control units" and "micro-renewal units" based on the road network pattern, legal property boundaries, and shared architectural relationships investigated onsite(Han & Shen, 2022)(Figure 4).

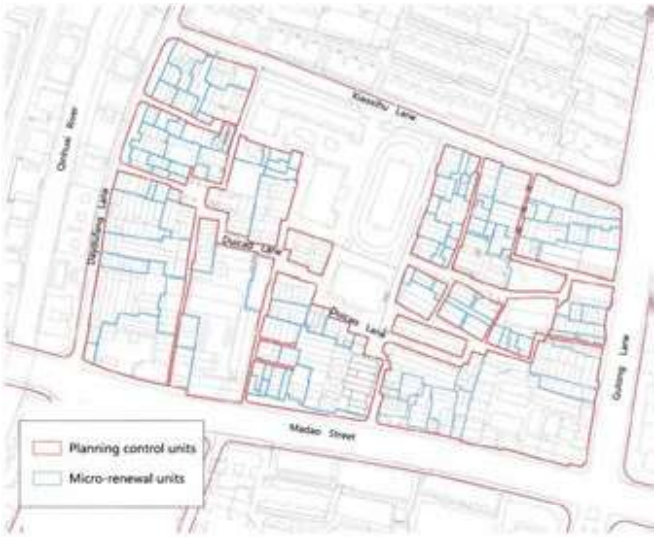

Fig. 4. Two-tiered system of Xiaoxihu Block

(3) Micro-renewal management and maintenance: This process mainly involves

the maintenance of physical space environments, such as public service facilities, with the aim of promoting sustainable governance of living spaces. As the renewal of the Xiaoxihu Block encompasses various models, its management and operation modes are also diverse: resident-led modes, which self-serve and self-manage through the establishment of public service teams and hosting themed events, stimulating residents' active engagement in community transformation; and government and market dual leadership modes, formed by multi-level government financial incentive funds and property management companies, creating a multi-governance pattern.

4.2.2 Multi-Stakeholder Collaboration

（1）Stakeholder Engagement

Micro-renewal, in essence, is a form of social governance where multiple stakeholders collaborate in decision-making. Its sustainability is achieved through a shared understanding of the most rational division of labor under each stakeholder's comparative advantages(Zhuang et al., 2019). In the renewal process of the Xiaoxihu Block, to better balance the interests and wishes of all parties, a five-party communication and coordination platform has been established after years of exploration and refinement. This platform includes government departments, residents, designers, community committees, and implementation entities (Figure 5).

Government departments play the role of guiding forces and key administrators in the micro-renewal of residential areas. In the renewal process of the Xiaoxihu Block, these departments can be categorized into two types based on their dominant roles: municipal and district-level functional departments, and sub-district offices. The initiator of the renewal is the Nanjing Municipal Government. However, as urban renewal deepens, the original horizontal management structure, characterized by inefficient collaboration between departments, has proven inadequate to address the diverse challenges. On the foundation of achieving phased success in the Xiaoxihu renewal, the governance model for urban renewal has been further refined. Nanjing established its first district-level Urban Renewal Office, assembling a streamlined yet professional team by drawing on the expertise of various departments. Operating under the principles of "centralized unity, collaborative coordination, and practical efficiency," the main responsibilities of this office include overseeing and coordinating urban renewal efforts across the district, thereby facilitating targeted progress in urban renewal. The establishment of the Qinhuai District Urban Renewal Office has provided effective decision-making support and policy provision for the renewal of the Xiaoxihu Block.

Residents are the direct beneficiaries of urban micro-renewal in residential areas. Due to the complex property rights relationships within the Xiaoxihu Block, residents can be further categorized into private property owners, public housing tenants, and actual occupants, among others. The neighborhood is characterized by high population density, low income levels, and an aging population, leading to diverse opinions on staying or leaving, as well as varying needs for preservation and regeneration. Given the significant individual differences in residents' needs and their limited decision-making capabilities, most of them participate indirectly in the micro-renewal process through surveys or consultations.

Community committees play a significant role in the urban renewal process of the Xiaoxihu Block. On one hand, they provide flexibility and the possibility for residents to assert equal discourse rights. On the other hand, they ensure the effectiveness of micro-renewal planning and governance while also shortening decision-making times, thereby facilitating the implementation of projects.

Designers act as coordinators in the micro-renewal process, with the Xiaoxihu Block renewal primarily involving designers and community planners. The government-appointed responsibility planners play a leading role, providing professional guidance and technical services in planning and construction within their scope of responsibility, along with coordinating non-technical tasks. From a neutral perspective, they proactively identify and solve problems based on their professional expertise.

Implementing entities in residential micro-renewal, such as developers, investors, and property management companies, operate on market principles. They are responsible for financial support, construction supervision, and the routine management and maintenance post-update. These entities significantly impact the quality of the urban built environment and the improvement of infrastructure. In the Xiaoxihu Block renewal, the Libao Group is in charge of implementation.

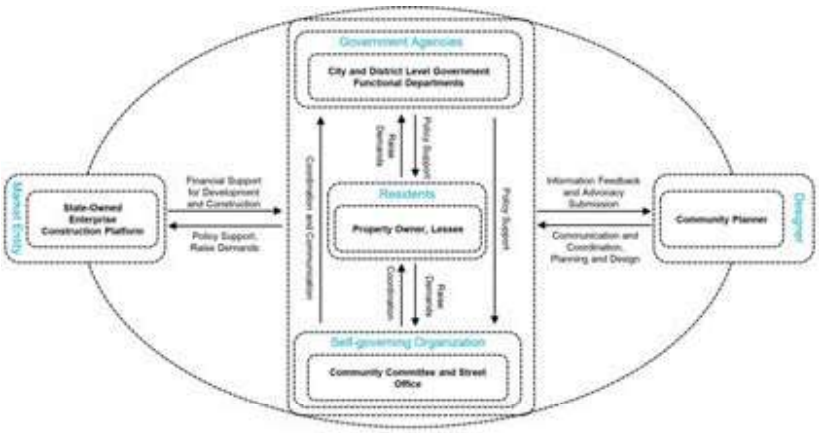

Fig. 5. Multilateral Governance Structure of the Five-Party Consultation Platform

（2）Participation Processes and Models

The complexity of the network involving diverse stakeholders determines that micro-renewal is a systematic project. Based on the diverse characteristics of residential buildings and land property rights in the Xiaoxihu Block, the implementation models for renewal can be categorized into three types: government-led, public-private partnership, and resident-initiated. The government-led model refers to the dominant role played by government departments throughout the entire micro-renewal process, directly intervening in specific processes and steps through coordination, construction, and operational management(Tan et al., 2020). In the Xiaoxihu Block renewal, this model primarily focuses on the renovation of old public

housing and public infrastructure. This process offers advantages such as process control and stable outcomes but also presents structural barriers to public participation and collaborative decision-making. The public-private partnership model involves the implementation entities taking a leading role in funding, planning, action, and operational management during the micro-renewal process(Huang & Jiao, 2018). For example, the "Shared Courtyard" in the Xiaoxihu Block is a public-private partnership initiative for residents unwilling to relocate but lacking the capacity for renovation. The implementation entity funds the transformation of private courtyards, and the homeowner agrees to open the courtyard to neighbors and tourists, taking on the responsibility of trimming the surrounding greenery. The resident-initiated model involves community self-governance organizations or residents as the renewal subjects, with responsibility planners and other social forces conducting planning and design, while government departments formulate policies and provide financial support. This model is primarily used for the renewal of privately-owned housing. The "Xu Residence" at 39 Madao Street is the first demonstration case of autonomous renewal in the Xiaoxihu Block, with a four-step technical renewal path: 1) the property owner submits a renewal application; 2) the government provides planning conditions and financial subsidies; 3) the renewal plan is compiled; 4) the renewal, construction, and renovation are carried out.

4.3 Comprehensive Benefits of Micro-Renewal: The Process Determining Sustainability

Micro-renewal represents a departure from the traditional model of urban renewal focused on the capitalization of space through incremental development. Instead, it moves towards a phase centered on the enhancement of comprehensive benefits with a human-centric approach. The positive impacts of micro-renewal are primarily manifested in three dimensions: environmental, social, and economic benefits.

4.3.1 Environmental Benefits of Micro-Renewal

（1） Enhancing the Quality of Residential Space Environment

The improvement of residential space environment quality is a direct manifestation of the goals in micro-renewal projects, particularly in residential areas, where it is closely associated with the local residents and stakeholders. In the case of the Xiaoxihu Block renewal, the following three aspects were prioritized:

1)Optimizing structural safety: The three-story east-west oriented brick-concrete public housing, located at the corner of Duicaoxiang, a T-shaped main alley in the middle of the Xiaoxihu Block, has aged over 30 years, with deteriorating structural integrity and poor living conditions. The renovation aimed to provide living spaces for the local residents' on-site resettlement and elderly care. The regeneration of the resettlement houses employed a combination of masonry structure renovation and steel structure addition on the top floor(Figure 6)(Bao et al., 2023). Through inspection, maintenance, and reinforcement of the building structures, a more stable and secure living environment was provided for the residents.

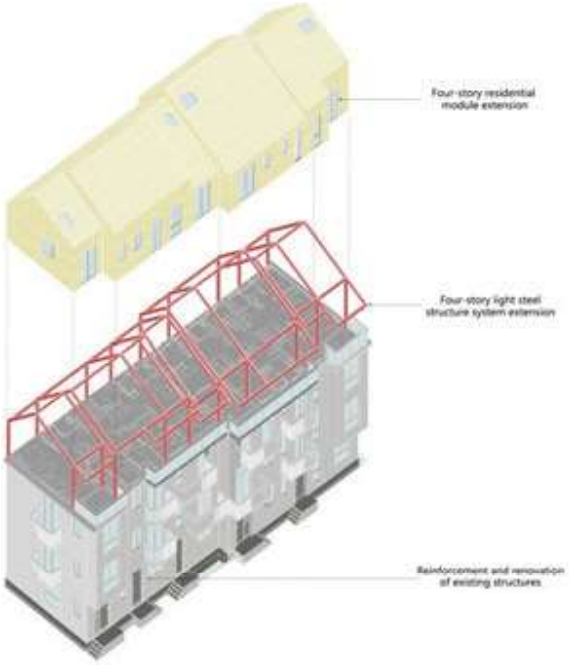

Fig. 6. Architectural structure optimization

2) Improving architectural functionality: The existing residential buildings in the Xiaoxihu Block addressed the aforementioned issues through two measures: On one hand, specific horizontal and vertical modifications, such as external wall additions, interior consolidations, and mezzanine installations, were implemented to increase the per capita living area and address the lack of kitchen and bathroom facilities. For example, in the renovation of the relocated resettlement houses, the inefficiently used space under the pitched roof and above the stairwell was redeveloped, transforming 18 previously "two-bedroom dark living rooms" into 23 fully lit units of various types, achieving an integrated enhancement of the building's functions and performance. On the other hand, the interior spaces were reconfigured with flexible methods such as movable partitions to improve circulation(Bao et al., 2023).

3) Enhancing building performance: The optimization of existing building exteriors and the application of green renovation technologies were employed to increase natural light and improve thermal insulation and heat preservation capabilities. In the reconstruction of the relocated resettlement houses within the Xiaoxihu Block, the added fourth floor posed potential light and sightline obstructions for other residents. The final adjustments included sealing and raising the windows of all balconies, twisting the walls to change the direction of the windows, and other methods to avoid interference and ensure ventilation and natural light(Bao et al., 2023) (Figure 7).

Fig. 7. Pre- and post-renovation relocation housing

In summary, the Xiaoxihu Block renewal project exemplifies a comprehensive approach to improving the quality of residential space environment, focusing on structural safety, architectural functionality, and building performance to create a more livable and sustainable urban community.

（2） Optimizing Outdoor Space Environment

The optimization of outdoor space environment primarily involves the improvement of infrastructure, the streamlining of road and traffic systems, and the enhancement of public space quality.

1)Improving infrastructure: For an extended period, the Xiaoxihu Block has grappled with outdated infrastructure and low environmental quality, necessitating urgent improvement and enhancement. To address this, the design team developed the "Micro-Utility Tunnel" technology within the narrow historical alleys. Unlike traditional direct burial of utility lines, this approach employs underground micro-utility tunnels for the installation of municipal utility lines, resolving the conflict between the small scale of historical alleys and the installation of utility lines, and addressing the management challenges of post-maintenance and update expansion .

2) Streamlining road and traffic systems: The Xiaoxihu Block project renovated the Xiaoxihu Alley and Duicaoxiang on the east side of the neighborhood to serve as lanes for motor vehicles and micro-fire engines, setting the narrowest width at 3 meters and the smallest turning radius at 3 meters for the cross-shaped internal streets. This configuration formed two main guiding axes in the north-south and east-west directions, reducing fire safety risks in historical areas while also providing possibilities for the installation of municipal infrastructure and the special passage needs of motor vehicles.

3) Enhancing public space quality: Along the north-south and east-west main guiding axes within the Xiaoxihu Block, designers have refurbished the paving, introduced public seating and sculptures, and created a pleasant atmosphere for leisure, thereby upgrading the neighborhood's external image for public display.

In summary, the optimization of outdoor space environment in the Xiaoxihu Block focuses on the enhancement of infrastructure, the improvement of traffic flow, and the elevation of public space quality, aiming to create a more livable, safe, and aesthetically pleasing urban environment.

4.3.2 Economic Benefits of Micro-Renewal

（1）Direct Economic Benefits

The direct economic gains in the renewal of the Xiaoxihu Block stem from the secondary development of existing space. This encompasses several key aspects:

1) Enhancing space operation efficiency and reducing costs: Due to the government's innovative property rights policy, the implementation entities in the Xiaoxihu Block can obtain the right to operate existing buildings and land without altering the original ownership relationships and land use rights. This reduces and avoids costs and risks associated with interest negotiations during property rights changes, thereby improving the efficiency of space utilization.

2) Diversifying industrial formats and increasing operational revenue: The functional transformation and efficient use of existing space resources in the Xiaoxihu Block aim to meet the needs of residents. The renovation or reconstruction of street courtyards after voluntary relocation by residents has added one community activity center, one comprehensive control center, two non-heritage cultural and creative studios, two learning spaces, two distinctive homestays, and nearly ten small shops to the neighborhood. The introduction of small-scale commercial and daily life convenience services has broken the homogeneity of format clustering. By targeting and addressing residents' differentiated needs, it has achieved high rental rates and operational vitality, diversifying business formats while increasing space operational revenue.

In essence, the direct economic benefits of the Xiaoxihu Block renewal are realized through the efficient use and functional transformation of existing space, leading to increased operational efficiency, cost reduction, and revenue growth.

（2）Indirect Economic Benefits

The indirect economic benefits of the Xiaoxihu Block renewal are the intangible gains resulting from the enhancement of the living environment. These benefits encompass the appreciation of residential space rents and property values, as well as the increase in cultural gains.

1) Appreciation of residential space rents: The improvement in living space environments and the enhancement of infrastructure due to the efficient use of existing space in Xiaoxihu can generate positive externalities and spatial spillover effects. This can lead to an increase in spatial rent differentials and potential ground rent levels.

2) Increase in cultural gains: The micro-renewal of the Xiaoxihu Block, while preserving the physical carriers such as the style and texture of the area, has given rise to new cultural scenes. The introduction of cultural and creative product shops, teahouses, and other cultural-displaying businesses within the neighborhood has realized the interactive integration of culture and economy.

In summary, the indirect economic benefits of the Xiaoxihu Block renewal are manifested in the appreciation of residential space rents and property values, as well as the enrichment of cultural scenes, contributing to the overall economic and cultural vitality of the area.

4.3.3 Social Benefits of Micro-Renewal

The human-centric urban micro-renewal for residential areas tends to promote the co-development of spatial renewal and social governance. This process increases resident participation, enhancing their satisfaction and sense of belonging.

(1) Multi-stakeholder participation: Unlike the "top-down" urban renewal mode that involves large-scale demolitions and constructions, the renewal of the Xiaoxihu Block emphasizes multi-stakeholder participation. Residents, especially during the stages of land expropriation and scheme design, transition into voluntary participants, collaborating and taking joint actions with the government and community planners.

(2) Innovative and diverse approaches: The renewal process integrates residents' wishes and explores various innovative paths, such as the lively "Co-living Courtyard" and "Shared Courtyard" models.

(3) Improvement of social population structure: The micro-renewal of living spaces can improve the social population structure. The enhancement of the physical spatial environment in Xiaoxihu after the micro-renewal has diversified the supply of rental housing and tenant groups, significantly influencing social population changes. The culture-led improvements have attracted creative industries and young people to the area, triggering "social mixing" and balancing the population structure against the backdrop of "double aging" (an aging population and aging infrastructure).

Cultivation of Grassroots Autonomous Mechanisms: Micro-renewal can nurture grassroots autonomous mechanisms and promote sustainable community governance. The five-party collaboration platform established during the renewal process of the Xiaoxihu Block serves as the main platform for residents to participate in community construction and contribute ideas. A community planner workstation was also established after the renewal, facilitating residents' collective participation in community affairs.

5. Discussion and conclusion

This study focuses on the conservation and regeneration of the Xiaoxihu Block in Nanjing. By reviewing literature and collecting empirical data, it delves into the renewal process and detailed dynamics of the Xiaoxihu Block, summarizing the intrinsic motivations, mechanisms, and comprehensive benefits of urban residential micro-renewal. The findings indicate: The driving force behind urban residential micro-renewal stems from the value appreciation of existing spaces, primarily through spatial operations. This can be achieved by the combined use of architectural space and the efficient enhancement of land value. The mechanism of micro-renewal involves the participation of multiple stakeholders in the entire cycle of public affairs. Decision-making is significantly influenced by the characteristics and relationships of different stakeholders and the structure and mechanisms of the participation process. And the about benefit, micro-renewal is a process that collectively enhances environmental, economic, and social benefits. The effects of these benefits are diverse and synergistic, targeting multiple entities. The study aims to provide a viable and effective model for sustainable practices in urban residential micro-renewal.

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