"Three-Dimensional Land" : An Exploration of Policy Models for Promoting Long-Life Housing in Chinese Cities (Postprint)

Authors: Gao Xiaolu, Chen Wei

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Abstract

[Purpose/Significance] Currently, housing demand in China' s cities is shifting from quantitative growth to quality improvement, and from short-term reconstruction to long-term holding and operation. Against this backdrop, there is an urgent need to promote the transformation of housing supply models oriented toward long lifespan and high quality as policy directives. However, the promotion of long-lifespan housing faces contradictions with the land property rights system and issues such as excessively high initial costs. [Method/Process] Based on the analysis and reference to foreign experiences, this paper proposes a new technical policy model relying on the SI housing system (i.e., separation of structural framework and infill components), namely "three-dimensional land." This model distinguishes between the structural and infill components of long-lifespan housing, and treats the structural component as part of urban infrastructure, i.e., three-dimensional land. "Three-dimensional land" serves as a public resource managed by local governments or social organizations, and is leased to developers or residents for contract periods of less than 70 years. [Results/Conclusion] This concept represents an expansion of urban land resources. This model can not only substantially increase the total amount of spatial resources, but also facilitate intensive management of spatial resources by local governments, help resolve the problem of generating revenue through land sales in land management, contribute to the formation of high-quality urban assets and landscape environments, and promote the transformation of real estate development and housing production models in China.

Full Text

"Multi-dimensional Land" : A Policy Model for Promoting Long-Life Housing in Chinese Cities

Gao Xiaolu[1],[2], **Chen Wei**[3]
[1]Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing 100101
[2]University of Chinese Academy of Sciences, Beijing 100049
[3]Poly (Beijing) Real Estate Development Co., Ltd., Beijing 100073

Abstract

[**Purpose/Significance**] Currently, housing demand in Chinese cities is shifting from quantitative growth to quality improvement, and from short-term reconstruction to long-term holding and management. This necessitates a transition toward housing provision models that prioritize longevity and high quality as policy objectives. However, promoting long-life housing faces contradictions with the land property rights system and challenges related to high initial costs.

[**Method/Process**] This paper analyzes and draws lessons from international experience to propose a new technical policy model based on the SI housing system (separating structural skeleton from infill components), termed "multi-dimensional land." This model distinguishes the structural portion of long-life housing from the infill portion, treating the structure as part of urban infrastructure—in essence, as three-dimensional land. As a public resource managed by local governments or social organizations, this "multi-dimensional land" can be leased to developers or residents for terms shorter than 70 years.

[**Result/Conclusion**] This concept represents an expansion of urban land resources. The model can not only substantially increase the total stock of spatial resources but also facilitate intensive management of spatial resources by local governments, help resolve the problem of generating revenue through land sales, contribute to forming high-quality urban assets and landscape environments, and promote the transformation of real estate development and housing production patterns in China.

Keywords: multi-dimensional land; century housing; land property rights system; household value; housing construction
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1. The Urgent Need for Long-Life Housing and Implementation Challenges

After years of large-scale construction, China has essentially moved past the era of severe housing shortages, and both housing demand and supply models are

facing profound transformation. However, the average lifespan of urban residential buildings in China is only about 30 years, far below the 50-year minimum stipulated in the national *Residential Building Code* and the lifespans seen in Europe and the United States (most European countries exceed 80 years, while the U.S. averages 44 years). The short lifespan of housing, particularly the demolition of buildings still within their service life for profit-driven redevelopment, represents enormous waste of social resources and creates a heavy environmental burden. This model of social wealth accumulation, achieved at the cost of high consumption and emissions, is unsustainable, making it imperative to shift development patterns and extend building lifespans.

In this context, China' s Ministry of Housing and Urban-Rural Development has recently proposed a strategy for developing long-life, high-quality "century housing" based on lessons from Japan and other countries [**?**]. This strategy holds major practical significance for China' s sustainable socioeconomic development and the transformation of its housing industry. It can not only reduce the resource and environmental pressures of housing construction but also enhance resilience against natural disasters and environmental risks, maintain community stability, and mitigate demolition-related conflicts and disputes. Simultaneously, promoting century housing will drive the reorganization and optimization of housing development models.

However, implementing the "century housing" strategy under the existing policy system presents numerous practical difficulties in urban planning, land institutions, and urban management, which can be summarized in four main areas.

First, there is a conflict with rapid urban development and planning updates. Century housing requires high stability in land use. If planning changes or demolition occur after construction, not only would the goal of extending building lifespan be defeated, but greater waste would result. Yet China is in a critical period of large-scale, rapid urbanization, and the restructuring of population, industry, and socioeconomic systems is driving dramatic changes in urban spatial structure. To accommodate urban development needs, frequent adjustments to urban and land use plans are necessary and represent an objective requirement of the current development stage. This need is particularly acute in key development areas identified in urban strategies and in urban-rural fringe zones. Coordinating the conflict between century housing and rapid urban development represents a major challenge.

Second, high initial costs conflict with residents' payment willingness. To achieve the policy goals of long lifespan and high quality, century housing should feature good location, convenient transportation, durability, and design flexibility. Undoubtedly, these requirements will substantially increase housing costs. From the government' s perspective, if century housing can indeed deliver resource, environmental, and social benefits, subsidies are justifiable. From the customer' s perspective, if century housing truly enhances utility, this should translate into payment willingness. However, significant questions remain about whether century housing' s resource, environmental, and social benefits are substantial

enough and whether its costs can be converted into customer value. Constrained by socioeconomic development levels, a considerable gap exists between century housing costs and ordinary households' ability to pay.

Third, contradictions arise with the land use term system. China' s residential land is granted for 70-year terms. Within this 70-year period, land transfer is restricted by above-ground buildings. To enable land circulation, demolition must be used to resolve property rights conflicts, leading to excessively frequent and extensive demolition. Rising demolition costs, in turn, drive up real estate prices. Additionally, if occupants cannot be smoothly vacated upon expiration, land resource utilization efficiency is severely reduced. Specific disposal methods for land and above-ground buildings after the 70-year term expires remain uncertain. According to the *Property Law* implemented on October 1, 2007, residential land use rights are automatically renewed upon expiration. When the 70-year term ends, residents retain property rights to the buildings and can continue living there. While this protects residents' ownership rights, how to safeguard public interests and maximize utilization efficiency through rational land resource circulation remains an open question. In practice, society has raised many objections, such as requiring residents to pay land fees for the next use period, mandating free land surrender, or having local governments repurchase residual building rights. Without reasonable resolution of these conflicts with the land property rights system, promoting century housing is unrealistic.

Fourth, difficulties exist in housing renovation and maintenance. As buildings age, maintenance costs gradually increase, and beyond daily upkeep, periodic major repairs and component replacement become necessary. Most commercial housing in Chinese cities was built since the late 1990s and has not yet reached peak maintenance periods. However, experience from Japan and other countries shows that collective housing requires major renovation after 20-30 years of use; otherwise, serious deterioration occurs. Under current systems, housing renovation faces significant challenges. First is funding difficulty: the maintenance fund paid at purchase cannot cover major repairs beyond daily upkeep. Second, there is no clear agreement on maintenance timing within the 70-year term or on demolition and reconstruction after expiration. Additionally, renovation and reconstruction of collective housing requires unanimous consent from all residents, a problem that currently lacks necessary consideration.

Currently, government and academia have focused considerable attention on planning issues, proposing many solutions such as using scientific planning to guide century housing development and strengthening planning foresight and stability to reduce policy-driven demolition [**?**].

The author argues that in planning for long-life housing, the key is to adapt to each city' s socioeconomic development level and regulate construction proportions and spatial layouts. In economic policy, a rational incentive mechanism should be created for long-life housing development. Following the economic principle of "who benefits, who pays," the high-quality environment provided to consumers should primarily be realized through conversion to customer value.

Meanwhile, government should provide corresponding subsidies for its positive contributions to reducing resource consumption and maintaining urban vitality.

Furthermore, the century housing strategy should focus on public housing. In different housing types, the primary roles assumed by government, developers, and consumers vary. In public rental housing, the government acts as the primary client, has stronger capacity to bear initial costs, and can use credit and financial instruments to address high upfront expenses. Simultaneously, building long-life, high-quality public rental housing helps achieve unity of economic, social, and environmental benefits. In commercial housing, resident households are the direct client group with limited capacity to bear high initial costs. Therefore, using public rental housing as the breakthrough point for promoting century housing is the most feasible model.

Can the century housing strategy be promoted in the vast commercial housing market? The author contends that without an institutional and economic foundation for development, relying solely on government promotion or enlightened developers' selfless investment cannot be sustained. Therefore, an innovative technical policy solution must be explored to comprehensively address various issues centered on the land system.

2. Lessons from Japan' s SI Fixed-Term Land Lease Model

2.1 What is the SI Fixed-Term Land Lease Model?

The construction cost and maintenance issues associated with century housing also exist in other countries promoting such housing. In response, Japan' s National Institute for Land and Infrastructure Management developed a new housing model—the SI fixed-term land lease model—that offers valuable lessons for China.

The SI fixed-term land lease model utilizes the fixed-term land lease system (a time-limited land property rights system) to enable long-life SI housing to be implemented at lower prices. Developed by Japan' s Ministry of Construction' s Building Research Institute, this model has attracted attention for creatively using institutional design to substantially enhance SI housing feasibility [**?**].

In the SI system, S (Skeleton) and I (Infill) refer respectively to a building' s structural portion and infill portion. Through clear separation of these two components, the structural portion can achieve a lifespan exceeding 100 years while the infill portion can be flexibly changed. This structural system allows future demand changes to be met through infill updates without altering the structural frame, enabling long-term effective use of housing and realizing the century housing concept. As needed, building uses can even be flexibly changed (e.g., from residential to office) while keeping the structural frame unchanged. Due to its high flexibility, SI housing also offers significant advantages in meeting personalized design needs.

Fixed-term land lease rights refer to a system where, upon expiration of the

land contract, the lease is not renewed and the lessee is obligated to clear above-ground buildings and unconditionally return the land to the lessor [**?**]. Japan' s standard fixed-term land lease period is 50 years. Since the land is only leased rather than permanently purchased, fixed-term land prices are substantially lower than ordinary land prices [**?**]. This system bears some similarity to China' s current 70-year land property rights system, though China' s land property rights holder is the state rather than individuals.

Obviously, a conflict exists between above-ground buildings with lifespans exceeding 100 years and 50-year land contracts. To resolve this contradiction, SI fixed-term land leasing proposes that upon contract expiration, the lessee need only clear the infill portion and return the structural portion to the lessor. This essentially treats the infill portion as the above-ground building while regarding the structural portion, like the land, as permanent fixed assets. In other words, the lessor can jointly manage the land and SI housing structure as long-term assets. Upon expiration of the land and structure contract, the lessor can either reclaim them, rebuild the infill portion, and sell it to occupants in the original manner, or utilize the new SI housing as rental property.

2.2 Advantages and Implications of the SI Fixed-Term Land Lease Model

This approach delivers clear benefits to occupants, landowners, and communities. First, occupants can obtain high-quality housing tailored to their personalized needs while saving substantial expenses. Since the mid-1980s, land costs in major Japanese cities have accounted for more than half of total housing prices (including land and buildings). The SI fixed-term land lease model, by establishing a lease term, means consumers need not permanently pay for land and structural portions upfront. This provides a new option that can reduce SI housing prices by approximately one-third [**?**].

Second, for landowners, operating through SI fixed-term land leases facilitates flexible management of land assets. They need not worry about whether occupants will return the land on schedule upon contract expiration or whether above-ground buildings can be cleared. In practice, long-term land management is significantly affected by macroeconomic conditions. When housing is less scarce or the economy is sluggish, expensive land prices expose many landowners to the risk of finding no customers. The SI fixed-term land lease model substantially reduces such risks.

For communities, SI fixed-term land lease housing is also highly beneficial. In practice, land for collective housing is typically jointly owned by residents according to area. Consequently, the greatest difficulty in renovating and renewing collective housing is reaching consensus among residents in the same building. This has prevented large amounts of collective housing from receiving timely effective maintenance and renovation, leading to continuous building deterioration, out-migration of the elite class, and community decline. In SI fixed-term

land lease housing, responsibility for structural maintenance clearly belongs to the lessor. With a defined contract term, the landowner can conduct effective maintenance on the structural portion or rebuild the infill portion after a certain period, eliminating the need for resident deliberation. Therefore, SI fixed-term land lease housing helps maintain excellent living environments and preserve community vitality [**?**].

Based on research into Japanese lifestyles and living patterns, most implemented SI fixed-term land lease housing recommends a 30-year contract term. To address concerns that occupants might not clear the infill and return land and structures after the 30-year term, two options are designed for the 30-60 year period: First, if normal return is possible, the landowner rebuilds the infill portion and continues operating SI housing through fixed-term leases. Second, if normal return is not possible but occupants wish to remain, the landowner can repurchase the infill portion and allow occupants to continue living there as rental housing. In practice, the cost of repurchasing the infill portion can be offset by future rent. Thus, regarding SI housing utilization between 30-60 years, only individual negotiation between landowner and occupant is needed, which is far less difficult than requiring unanimous decisions from all residents.

In summary, the key points of the SI fixed-term land lease model—and the core concepts worth emulating for China' s century housing—are: First, it redefines the relationship among housing infill, structure, and land, breaking the traditional notion that infill and structural property rights must be unified. Occupants purchase the infill portion, while the SI housing structure, like land, is managed as a long-term asset by the landowner through leasing. Second, it clearly defines the SI housing use period (contract term) through contractual agreements, which clarifies the vacating obligations of users while separating the housing use period from building lifespan and land use terms. This effectively resolves contradictions between long building lifespans and actual household needs, land use terms, and facilitates smoother housing maintenance.

3. Exploring a Policy Model for Century Commercial Housing in Chinese Cities

3.1 The "Multi-Dimensional Land" Proposal

Drawing on Japan' s SI fixed-term land lease model and based on China' s land policies and commercial housing development characteristics, the authors propose a century housing model for China' s commercial housing development, termed the "multi-dimensional land" model.

This model employs the SI housing technical system to clearly separate the structural and infill portions of century housing. On this basis, we regard the structural portion as part of urban infrastructure—in other words, as three-dimensional land—to be owned and operated by local governments or socially authorized organizations.

Conceptually, "multi-dimensional land" represents an expansion of urban land resources. Like multi-level parking lots or elevated roads, the "multi-dimensional land" model can not only substantially increase the total amount of spatial resources but also help local governments intensively manage spatial resources. Simultaneously, "multi-dimensional land" with a century-long lifespan constitutes high-quality urban assets that greatly contribute to creating good urban environments.

As a public resource, "multi-dimensional land" should be leased to developers or residents through fixed-term contracts. The author argues that only by adhering to a leasing approach can the problem of local governments generating revenue through land sales be resolved and the normal maintenance and management of "multi-dimensional land" ensured.

3.2 Feasibility of "Multi-Dimensional Land"

In century housing development, "multi-dimensional land" development and infill development become distinctly different components with different actors. "Multi-dimensional land" development, similar to infrastructure like roads, is constructed by contractors commissioned by local governments and then transferred as long-term assets to housing developers for construction. Infill development is implemented by real estate developers and can be operated through sales, leasing, and other methods. The infill property rights contract term should be determined based on in-depth research into housing life cycles (including aging speed, maintenance needs, new technologies) and household life cycles, but should 原则上 facilitate reduced renovation difficulties and demolition conflicts while adapting to evolving household lifestyles. Additionally, infill property rights within the agreed contract term can be freely traded and sold in the market.

[Figure 1: see original paper]

Figure 1 compares the initial price structures of ordinary commercial housing and housing developed on "multi-dimensional land," assuming people can purchase housing through 20- or 30-year loans. The comparison between the left and right diagrams shows that combining strategies such as setting shorter housing contract terms, converting land prices into land rents, and amortizing "multi-dimensional land" costs over the contract period substantially reduces the initial costs of century housing. This demonstrates that the "multi-dimensional land" model better facilitates reasonable conversion of century housing customer value.

As part of urban infrastructure, "multi-dimensional land" could potentially operate outside the constraints of the 70-year residential land property rights limit, forming a new type of infrastructure. Century housing, as an entirely new asset, has no inheritance relationship with existing land or building property rights, facing relatively few institutional constraints. Therefore, it is theoretically completely feasible.

However, specific implementation schemes require in-depth discussion at the legal level. Various potential issues during implementation also need more detailed and comprehensive research through comparative studies and social experiments.

4. Conclusion and Outlook

The author contends that the "multi-dimensional land"model is highly applicable in Chinese cities, and its promotion effectiveness may far exceed that of Japan, which is based on a privatized land ownership system.

First, China is in a historical stage of rapid economic growth and urbanization with strong housing demand and large-scale real estate development, providing the socioeconomic foundation for large-scale promotion of the "multi-dimensional land" model.

Second, it enables flexible land resource utilization adapted to demographic structural changes and social development. Since the 1970s, China has implemented family planning policies, substantially adjusting population structure and household composition. Currently, the phenomenon of several elderly people having only one grandchild is common. After years of adjustment, the ratio of total urban housing units to total households has continuously improved, and through affordable housing construction and market-based supply methods including commercial housing ownership and leasing, the shortage of total supply has been basically alleviated. Since the late 20th century, China has entered an aging society while still not wealthy, and the aging rate continues to accelerate. It is projected that by 2050, one-third of the national population will be over 60 years old [**?**]. Undoubtedly, household consumption concepts must adapt to these demographic structural changes. Rather than having not particularly wealthy grandparent and parent generations purchase long-life housing to leave to their children, it is better to purchase comfortable housing with shorter terms suited to their own needs.

Third, from social and environmental perspectives, this model helps shape good urban environments, reduce resource waste, and maintain urban vitality. To guide people to live long-term securely in city centers and maintain urban competitiveness requires housing with convenient location, spaciousness, high quality, flexible adaptability to future lifestyle changes, and good building maintenance and community character. Typically, these requirements substantially increase housing costs. However, under the "multi-dimensional land" model, structural portion rents are amortized throughout the occupancy period, consumers only need to bear initial costs for the infill portion, and because the structural portion is separated and infill contract terms are shortened, initial housing costs can be effectively reduced. These measures will effectively improve housing affordability, enhance human settlement quality, increase real estate market stability, and contribute to land conservation, energy savings, and reducing demolition waste of structural portions.

Fourth, it facilitates maintenance and management of collective housing and prevents community decline. As the main structure of collective housing, "multi-dimensional land" is regarded as part of urban infrastructure with clear maintenance and management responsibilities. Like road and green space maintenance, local governments or publicly commissioned organizations can conduct periodic repairs and maintenance, with costs primarily covered by "multi-dimensional land" rental income and supplemented by local infrastructure construction funds. Infill portion maintenance in collective housing mainly involves controlling aging conditions and maintenance costs within manageable ranges by shortening contract terms. Upon contract expiration, occupants no longer own infill property rights, which can either be cleared and rebuilt or continue to be used by original or other households through leasing. By eliminating property rights complications, the "multi-dimensional land" owner becomes the sole decision-making entity and can make rational judgments based on infill aging conditions. Therefore, under the "multi-dimensional land" model, both collective housing structures and infill portions can receive effective maintenance and management, providing guarantees for maintaining good living environments and community vitality.

Fifth, implementing the "multi-dimensional land" model will bring about differentiation in the housing industry. From industrial division to industrial differentiation and then to product differentiation is a general law of industrial upgrading and development. The promotion of "multi-dimensional land" will inevitably drive significant adjustment of the housing industry, promoting division of labor among industries for "multi-dimensional land" construction, management, and maintenance, infill development, and operation. It will drive standardization and quality improvement of "multi-dimensional land," spur development and technological progress of infill component products, and promote consumer-demand-oriented improvements in housing design quality. Due to differentiation in housing types, housing information and intermediary service industries will also undergo certain changes.

In summary, "multi-dimensional land" provides a meaningful and feasible specific pathway for implementing century commercial housing in China. However, as a new concept, "multi-dimensional land" implementation, operation, and management have no precedents. At the policy level, in-depth research is needed on legal systems, spatial resource management, urban landscape environments, living patterns, housing demand evolution patterns, maintenance costs, and cycles. Meanwhile, successful implementation and promotion require active cooperation among relevant government departments, central and local governments, developers, builders, and academia through joint research efforts.

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Note: Figure translations are in progress. See original paper for figures.