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Land Property Rights, Spatial Form, and Land Performance: A Framework of Policy Performance Evaluation on Collective-Owned Construction Land and Evidence from Rural China

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Abstract: Alongside the proceeding of rural land system reform in China, it becomes more and more critical to conduct policy performance evaluations on collective-owned construction land for profitable use to reflect the achievements and deficiencies of the reform. Traditionally, land policy performance evaluation is based on the theory of "policy-performance", which fails to explain the mechanism of transaction costs. From the perspective of spatial planning, land use and the spatial form shaped by land development management and control are a representation of land property rights, as well as an expression of land policy performance. Thus, a correct understanding of the role of spatial form in the relationship between land policy and land performance is of great significance in accurately evaluating land policy performance and further improving land policies. Focusing on the interrelation among the three factors, this article highlights and elaborates on the intermediary role of spatial form between land property rights and land policy performance and puts forward the analytical framework of "land property right–spatial form–land policy performance". It then takes the case of Wujiang District of Suzhou in southern Jiangsu Province to prove the effectiveness of this analytical framework. The outcome of this study can serve as a supplement to "policy-performance" theory, which refines and deepens the analysis of transaction costs from the perspective of spatial planning. It may also help deepen the recognition of land policy performance through visualized presentations, providing a new perspective for performance evaluation in quantitative and qualitative ways.

Keywords: rural land system; collective-owned construction land; land policy performance evaluation; Southern Jiangsu; China

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1. Introduction

The land system is crucial for economic and social development and a critical spatial governance policy tool. The collective ownership system is the primary system for rural land in China, with rural collective economic organizations acting as the main bodies exercising ownership rights. According to the nature of land use, rural land can be divided into agricultural land and collective-owned construction land (CCL). CCL can be subdivided into homestead land[1], collective-owned public welfare construction land, and collective-owned commercial construction land. As part of reform and opening up, China has implemented various local reforms of the rural land system to adapt to ongoing socio-economic changes.

The reform of China's rural land system began with agricultural land. *The No. 1 Document 1982 of the Central Committee and the National Rural Work Conference* confirmed the legitimacy of the household contract responsibility system, which stimulated farmers' enthusiasm to participate in agricultural production and significantly improved the

efficiency of farm output. However, by the end of the 1980s, the shortcomings of this system gradually appeared, and new explorations were carried out one after another in some parts of China, such as the "three types of farmland system"[2] in southern Jiangsu and the "bidding contract system"[3] in the Pearl River Delta. These explorations aimed to promote large-scale agricultural land management, improve agricultural production efficiency, and inadvertently reserve land for rural industrialization in economically developed regions. In the 1990s, China entered a stage of rapid economic and social development. Rising incomes among farmers led to increased demand to expand homesteads [1], and the large-scale operation of agricultural land led by village collectives also made it easier to convert to non-agriculturalization. Thus, this contributed to the rapid development of rural non-agricultural industries [2], which brought about profound changes in the economic structure and lifestyles of rural areas and marked improvements in living conditions and village appearances. However, it also led to challenges like declining cultivated land, illegal constructions, and environmental pollution [3]. Therefore, the State Council successively issued *the Land Management Act of 1998* and *the Decision on Deepening Reform and Strengthening Land Management of 2004*, emphasizing the protection of agricultural land and preventing expansion into construction land. They also promote the transfer of land use rights and enhance the efficiency of rural construction land utilization. As a result, the scope of the state's rural land policy has expanded from agricultural land to CCL.

In 2011, China's urbanization rate surpassed 50%, marking the transition into the middle and late stages of urbanization. Under the background of regionally decentralized authoritarianism in the economic sphere [4], the negative impact of local short-term thinking and opportunism in rural non-farming development has grown more complex. This not only hinders the efficient use of rural construction land [5] but also leads to a "lock-in path of low-quality and low-efficiency" in economic, social, and spatial development [6], affecting both state interests and farmers. In 2013, the Third Plenary Session of the 18th Central Committee of the Communist Party of China adopted *the Decision of the Central Committee of the Communist Party of China on Some Major Issues Concerning Comprehensively Deepening the Reform*, which stipulates that "We will allow rural collective-owned commercial construction land to be sold, leased and appraised as shares, on the premise that it conforms to planning and its use is under control, and ensure that it can enter the market with the same rights and at the same prices as state-owned land" and "improve the rural homestead system through reform, and select several pilot areas to steadily and prudently push forward the mortgage, guarantee, and transfer of farmers' residential property rights, and expand the channels for farmers to increase their property income". The reform of the rural land system has thus entered a critical phase, with CCL becoming an essential object for deepening reform. Its reform performance significantly impacts the overall economic and social development in rural areas.

The object of rural land reform has been expanded from agricultural land to CCL. The reform's goals include boosting agricultural production efficiency, increasing incomes for farmers and operators, enhancing rural society's well-being, and maximizing the benefits from rural resources [7], and academics have begun to pay attention to the multidimensional effects of rural land reform. Recent studies highlight several positive outcomes: agricultural land reforms improve land resource allocation and enhance farmers' livelihood security [8]; land expropriation and homestead reform have served to reduce transaction costs and prevent conflicts [9]; and the new round of rural land reform that began in 2015 has had a positive effect in terms of enhancing the political interests of the country and promoting economic and social harmony and stability in the countryside [10]. Regarding CCL, scholars like Wu Xiaoyan [11] and Tang Jian et al. [12] have examined factors influencing the transition of homesteads to housing, noting inefficiencies in the CCL transfer system that hinder land transfers. Qiu Ye [13] analyzed various land systems in regions like the Pearl River Delta, Zhejiang, and Southern Jiangsu under different industrialization modes and borrowed the theory of Yujiro Hayami [14], using economic efficiency theory to argue how these systems optimize industrial production factor allocation and promote

local economic development. Western scholars [15] have shown that the CCL transfer system improves farmers' incomes and strengthens their property rights security.

The above study follows the basic logic of institutional economics, which asserts that a specific institutional pattern determines the transaction costs and thus the specific economic performance. It focuses on analyzing the quantitative output of land resources using the "policy-performance" framework. However, from a spatial planning perspective, the spatial arrangement shaped by land use and its development control serves as a reflection of land property rights and a medium for land performance.Land performance encompasses not just the economic productivity of land resources, but also the physical manifestation of the spatial environment influenced by land use. The traditional "policy-performance" theoretical framework overlooks spatial influences, leaving unanswered questions about whether and how space plays a role in the relationship between land systems and land performance and thus whether and how the assessment of land performance should include spatial form. This question is crucial for accurately evaluating the institutional outcomes of land reform and improving related policies.

Therefore, this study adopts a spatial planning perspective to analyze the "black box" mechanism of transaction costs. It explores how spatial form mediates land property rights and overall land performance. The goal is to develop an analytical framework for "land property right–spatial form–land policy performance" and validate its applicability using the case of CCL reform in W District, Southern Jiangsu Province, over the past 30 years.

The remainder of the paper is structured as follows: Section 2 introduces the theoretical framework, including the relationship between land property rights, spatial form, and land performance, and puts forward the integrated analytical framework. Section 3 shows the empirical study's research design to demonstrate the framework's effectiveness. In Sections 4 and 5, we show the results on policy, spatial patterns, and land performance and further reveal the relationship between these three aspects at three historical stages. Finally, Section 6 presents the conclusion of the paper.

2. Theoretical Framework of "Land Property Rights–Spatial Form–Land Performance"

Generally, performance refers to a comprehensive and systematic characterization of the achievements and effects of an organization or behavior [16]. In this paper, land performance refers to the positive or negative impact produced during land resource allocation and utilization. Rural land transfer, development, leasing, and other trading activities significantly influence rural economic and social development, all of which are regarded as land performance.

2.1. Land Property Rights and Land Performance

According to new institutional economics, institutions fundamentally determine long-term economic performance and historically drive improvements in productive efficiency and factor markets. Efficient institutions provide incentives for productive activities and reduce transaction costs. Conversely, they trigger lease-seeking behaviors and thus impose unreasonable constraints on productive activity, failing to achieve Pareto optimality [17].

Land is an essential factor of production, and an adequate supply of land factors is indispensable for the development of any industry. The land property rights system, with institutional and policy regulation of the composition of the land property rights system and its implementation [18], determines the allocation of land factors. This system is fundamental to a country's economic growth [15]. The empowerment of property rights and the exercise of property rights are at the core of the land property rights system [19]. Empowerment clarifies the rights of ownership and their interest structure. At the same time, exercise involves the practical use, operation, transfer, and transaction of property rights, as well as the distribution of the resulting benefits. Together, these aspects determine the structure and power of land property rights [20].

According to Coase, the essence of a transaction is the transaction of property rights, and different property rights systems create different transaction costs [21], as the land

property rights system clarifies the structure and authority of land property rights and determines the conduct and norms for all parties in land transactions. This framework reduces the transaction costs and provides incentives for and constraints on transactional behaviors, influencing land performance and societal operational efficiency. Thus, countries achieve their desired land performance through land property rights system arrangements (Figure 1). The "policy-performance" conceptual framework illustrates the direct effect of the land property rights system on land performance well, and relevant studies have empirically confirmed this view, for example, in China's relatively developed rural areas. The shareholding cooperative system promotes the large-scale operation of agricultural land by lowering transaction costs, boosting the rural collective economy's further development, and raising the average per capita income of rural households [22,23]. Conversely, the fragmentation of collective land use rights causes disorderly development of construction space and inefficient use of land resources. It hinders the development and growth of township enterprises in size [24]. In this process, the land performance of the property rights system is not only reflected in the economic performance of land elements but also characterized by the spatial form of land elements.

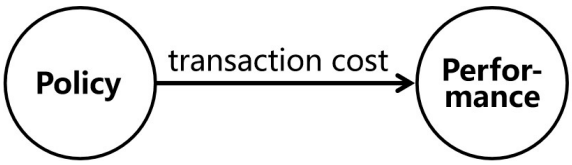


Figure 1. "Policy-performance" conceptual framework.

2.2. Spatial Form–Land Performance

Land is a production factor and a spatial factor, the material carrier of all human economic and social activities. Spatial form refers to the spatial layout patterns of land use, social groups, financial activities, and public facilities within a certain range [25]. Changes in spatial form encompass alterations in land use/land cover change, land use transitions, and spatial structure evolution. According to the related research, the importance of spatial form and its relationship with land performance is mainly reflected in the following two aspects.

First, spatial form visually represents the land's economic, social, and environmental performance. Humans purposefully transform, develop, and utilize land resources and their associated spatial resources based on the land's natural attributes and the developmental needs of society and the economy. The development activities generated to meet these needs often directly or indirectly alter the supply and utilization of land resources, thereby triggering changes in land use structure and function [26]. Spatial form is considered a mirror of human economic and social development and is the most direct manifestation of human production and living activities changing the natural geographic environment [27–29]. Suppose land use structure and spatial form are regarded as the dominant morphology[4]. In that case, they jointly characterize the recessive morphology, including land performance, such as economic development (input–output ratio, individual income), the social service level (public service), and the ecological environment [30,31]. As a result, spatial patterns are considered essential breakthrough points for revealing economic and social development and related environmental impacts [32–35].

Secondly, changes in spatial form directly or indirectly affect how land resources are allocated, as well as issues such as social equity and the ecological environment. The fortress cities of the 16th century in Europe were designed to improve urban defenses by adjusting the spatial form of cities. Today, modern cities advocate high-density spatial forms with mixed land use to save land resources, reduce energy consumption, and promote social equity [36,37]. Regarding the ecological environment, land use transitions will increase greenhouse gas emissions, significantly impacting climate change [38]. Based on the environmental Kuznets curve, Qu and Long [39] proposed a theoretical hypothesis that there is an interactive mechanism between land use transitions and economic and

ecological effects. They argued that there is a one-way Granger causality from urban land use to economic development and environmental pollution. And they have empirically demonstrated the influence of spatial form on land performance. Therefore, land performance exhibits a recessive morphology in explicit dominant forms while directly or indirectly being influenced by the spatial configuration.

2.3. Spatial Form–Land Property Rights

Spatial patterns map economic and social activities [40]. They are influenced by the typical role of elements, including the economy, culture, nature, location, social development processes, technical means, market demand, and other factors [41–43]. They are shaped by national strategies and systems across different scales [2,34,44]. China's rural land use system is transitioning towards more flexible policy directions. This shift will alter the structure, intensity of inputs, and layout forms of spatial organization [45]. Challenges in rural development, such as weakened social development, land underutilization, and inadequate infrastructure, are closely tied to existing institutional barriers [46]. Economic and social systems, particularly those related to land property rights, are crucial external factors influencing spatial evolution [26,47].

At the same time, urban–rural spatial transitions impact the land property rights system [48,49]. In China's rural areas, spatial reconfiguration directly or indirectly involves matching and arranging a series of resource allocation systems and macro policy environments such as the land system [50]. Rapid industrialization and urbanization accelerate land use change, triggering the growth of the land's value-added income and changes in rural residential and industrial spaces [51]. This necessitates reforming institutional arrangements to align with the transformation and development realities [52,53]. Therefore, the land property rights system as a social element directly leads to the transformation of spatial form [54], which both characterizes the spatial effects of the land property rights system and further optimizes the land property rights system through feedback.

2.4. The Analytical Framework of "Land Property Right-Spatial Form-Land Policy Performance"

The traditional "policy-performance" theory focuses on how property rights systems directly influence land performance, overlooking the role of spatial form in this relationship. This can be understood through the concept of mediation in psychology [55]. When factor X affects factor Y by influencing variable M, M acts as an intermediary. For example, "father's socio-economic status" affects "son's education level", which in turn affects "son's socio-economic status", and then "son's education level" plays an intermediary role [56]. According to the above theory and the previous analysis of the relationship between land property rights, spatial form, and land performance, spatial form emerges as a mediator between property rights and land performance, creating a mutual relationship (Figure 2). Spatial form is shaped by both the property rights system and land performance. It represents the spatial outcome of property rights and the spatial manifestation of land performance. For example, explicit spatial forms like land use structure and physical patterns symbolically depict the impact of property rights on economic efficiency, functional quality, ecological conditions, and other implicit spatial factors. Conversely, spatial form, influenced by property rights and reflecting land performance, can provide feedback to optimize property rights systems and either enhance or hinder land performance.

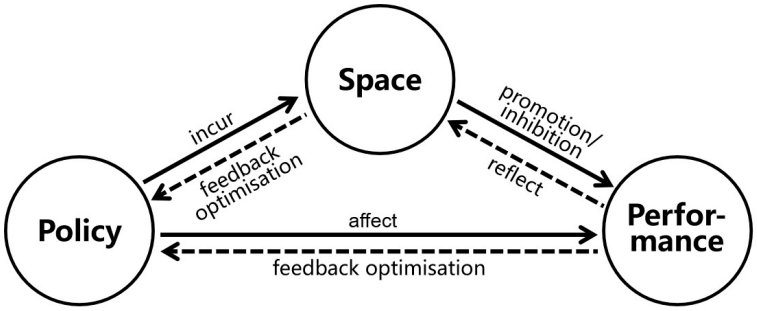


Figure 2. "Policy–Space–Performance" land policy performance evaluation framework.

3. The Research Design of the Empirical Study in W District of Southern Jiangsu

This paper selected the Wujiang District of southern Jiangsu as a case for practical research to verify the framework's effectiveness. In 2017 and 2018, the authors conducted field surveys of W District and focused on observing the process of rural CCL reform carried out in W District from 1992 to 2018 through interviews with relevant administrative departments and analysis of policy documents and systematically analyzed the changes in land property rights, spatial form, and land performance. Examining different stages within the same area avoids variations in history, culture, resource availability, and location that other case studies might introduce. Instead, it allows for a focused analysis of the relationships among land property rights, spatial form, and land performance.

3.1. Overview of the Research Area

W District is located in the southeast of Suzhou City, Jiangsu Province, bordering Shanghai to the east and Taihu Lake to the west and adjacent to Jiaxing and Huzhou to the south, in Zhejiang Province (Figure 3). It covers an approximate area of 1177 km^2, including one subdistrict and eight towns, with a resident population of 832,700 and a floating population of 979,200. In 2018, the regional GDP of W District was CNY 192.503 billion (approx. USD 26.527 billion).

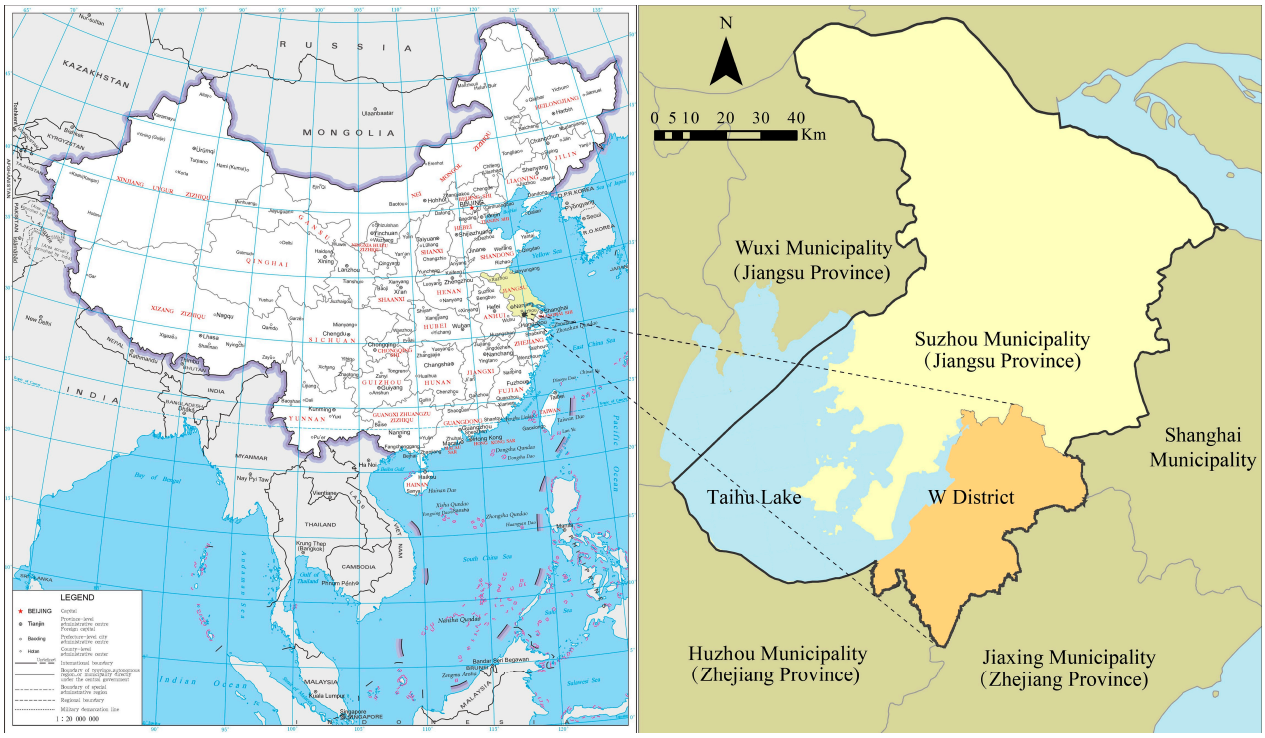


Figure 3. Location of W District in Jiangsu province.

3.2. Data Sources and Stage Division

The data collection for this empirical case included three main components: policy, spatial, and socio-economic data. In 2017 and 2018, the author conducted field surveys in W District and held semi-structured interviews with 17 government officials from relevant management departments, totaling over 680 min. Additionally, 72 policy documents were gathered for analysis. Spatial data of District W, such as land use status maps from 1992 and 2002, land survey data from 2010 and 2018, and public service facilities data obtained from the Baidu Map API interface, were also collected. Finally, statistical data covering the years 1992–2018 were extracted from the Statistical Yearbook of Wujiang District.

The land property rights, spatial forms, and land performance of W District can be quantitatively and qualitatively analyzed in three stages, 1992–2002, 2002–2010, and 2010–2018, using the data mentioned earlier. These stages correspond to critical periods in both national and local rural land reform efforts. In 1992, the administrative authority of W District was expanded, and it was upgraded from a county to a county-level city when China set the goal of establishing a socialist market economy system. Thus, rural land reform entered an intensive period this year. In 2002, W District began to implement a shareholding cooperative system. In 2010, the southern Jiangsu area completely introduced the "three concentrations" and "three replacements"[5] policies and entered the optimization stage.

3.3. Evaluation Indicators

3.3.1. Land Property Rights

Property rights empowerment for collective-owned commercial construction land in China involves the local government, village collectives, and the market. The interactions among these entities drive the evolution of property rights structures. Local governments and administrative bodies develop local land policies under national laws, organize economic activities, and maximize local revenues. Village collectives manage land assets within their jurisdiction to benefit the collective and individual villagers. The market, comprising enterprises and individuals, leases or assigns land, seeking to maximize profits through business activities. Due to China's special land ownership system, land property rights usually include land ownership rights, land use rights, and land gains rights, among which land use rights include the rights of possession, use, gains, and disposal. The right of disposal can be further categorized into transfer, rent, mortgage, and others (Figure 4). This study focuses on how property rights transfer among holders and how their rights expand or contract across different stages of empowerment and exercise.

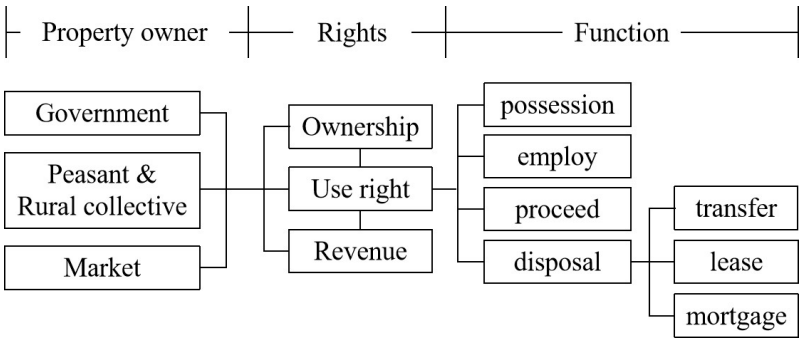


Figure 4. Rural collective-owned construction land property right system.

3.3.2. Spatial Form

Based on the previous section on the connotations of spatial patterns, this paper characterizes spatial patterns according to two dimensions: land use patterns and physical space patterns. Considering that the expansion of construction land has led to a decline in the scale of agricultural land and land fragmentation, this paper focuses on the changes in land

use intensity, the sources of land type changes, spatial structure, and land fragmentation over time (Figure 5).

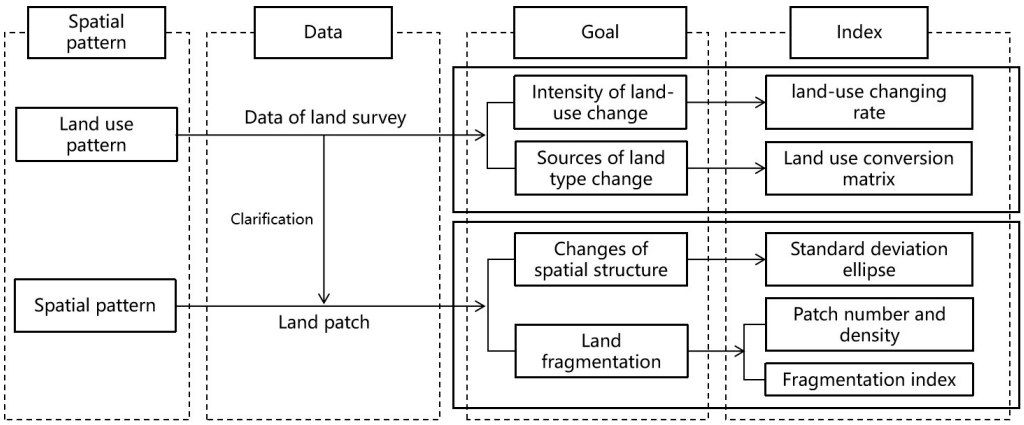


Figure 5. Analytical framework of spatial pattern.

First, land use intensity and land use category changes are characterized by land use growth rates and land use conversion matrixes using land survey data. The rate of land-use change is calculated as the difference in the number of land types between the beginning and end of the study period, divided by the amount of land types at the beginning of the study period. The land use conversion matrix illustrates changes between adjacent periods, reflecting how land types expand and occupy space.

The rate of land use change (C) measures the expansion of land use in the plane dimension. It mainly expresses the intensity of the change in the land use amount in a study area within a specific time frame [57].

$$C = \frac{U_b - U_a}{U_a} \times \frac{1}{T} \times 100 \quad (1)$$

In the formula, U_a and U_b are the number of collective land types at the beginning and end of the study period, respectively, and T is the length of the study period.

Second, construction land patches were identified from the land survey data. Changes in the spatial structure and fragmentation of construction land are assessed using the standard deviation ellipse and landscape pattern index, respectively. Indicators such as the position of the center point and the angle of axis offset in the standard deviation ellipse can observe the expansion orientation of the construction land; the number and density of patches in the landscape pattern index are used to reflect the statistical characteristics of the land, and the fragmentation index is used to reflect the degree of land fragmentation.

3.3.3. Land Performance

According to the previous section about the connotation of land performance as a hidden spatial form, economic development, social equity, and ecological protection were selected as the evaluation dimensions for land performance (Figure 6).

In economic development, the financial benefits of the land and the relationship between input and output must be fully considered. The measurement index should be applied to horizontal and vertical comparisons over time between regions. Therefore, rural residents' per capita disposable income was chosen as the statistical index, the coupling coordination degree was chosen as the calculation index, and the entropy method was used to calculate the benefits of land input and output. Referring to the related research results [58,59], land input includes the scale of state-owned and collective land, and land output includes two points: the first is output value, comprising agricultural output value, industrial output value above a designated size, and the total retail sales of consumer goods; the second is taxation, meaning the total industrial and commercial taxation.

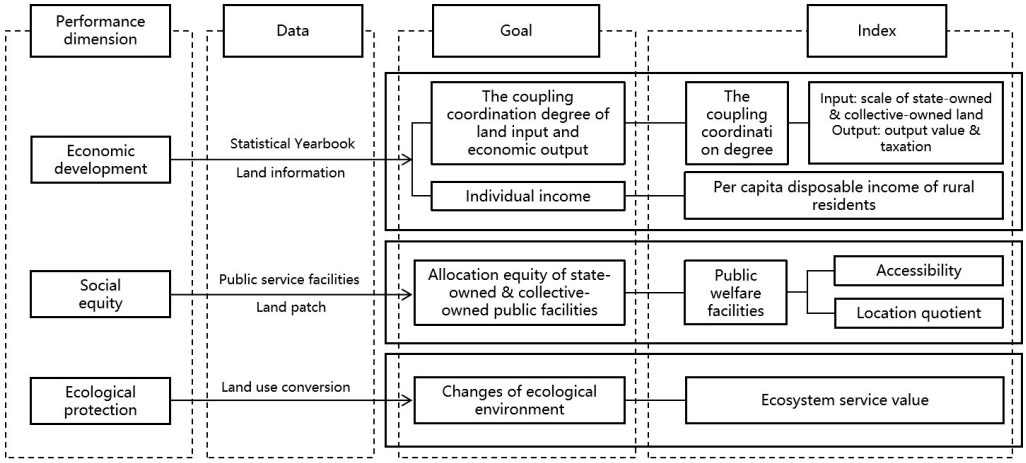


Figure 6. Analytical framework of land performance.

In social equity, the problem of damaging social interests has raised concern due to a decline in public services caused by rural land transformation, the relocation and annexation of villages, and construction land expansion in recent years. The accessibility and location quotient of public service facilities can, respectively, reflect the social equity and spatial equity of the public service supply. According to the classification method for the public welfare spectrum of public service facilities [60], there are two aspects of public service facilities: public welfare and market features. The ArcGIS 10.8 software was used to measure the proportion and location quotient of the area covered by public service facilities in the construction land diachronic.

In the dimension of ecological protection, the ecosystem service value (ESV) and contribution index of land use change to the ecological environment were quantitatively measured by involving the following aspects: the theory of ESV [61], the value equivalent table applicable to China [62,63], and the land use conversion matrix derived from calculation on the land survey data.

3.4. Methods of Analysis

3.4.1. Standard Deviation Ellipse

The standard deviation ellipse refers to the spatial distribution of a set of geographic elements in relation to x and y axes, which defines the distribution of all the elements in a graphically visualized ellipse. The method calculates the ellipse's semi-major and semi-minor axis, variance, and standard deviation through the average center and distribution distance of all the elements. Please see the following:

$$= \frac{\left[\sum_{i=1}^{n}(x_i-\overline{x})^2-\sum_{i=1}^{n}(y_i-\overline{y})^2\right]+\sqrt{\left[\sum_{i=1}^{n}(x_i-\overline{x})^2-\sum_{i=1}^{n}(y_i-\overline{y})^2\right]^2+4\left[\sum_{i=1}^{n}(x_i-\overline{x})^2\sum_{i=1}^{n}(y_i-\overline{y})^2\right]^2}}{2\sum_{i=1}^{n}\sum_{i=1}^{n}(x_i-\overline{x})\sum_{i=1}^{n}(y_i-\overline{y})} \quad (2)$$

$$\sigma_x = \sqrt{\sum_{i=1}^{n}\frac{\left[(x_i-\overline{x})\cos\theta-(y_i-\overline{y})\sin\theta\right]^2}{n}} \quad (3)$$

$$\sigma_y = \sqrt{\sum_{i=1}^{n}\frac{\left[(x_i-\overline{x})\sin\theta-(y_i-\overline{y})\cos\theta\right]^2}{n}} \quad (4)$$

In the formula, $(\overline{x},\overline{y})$ are the average centers of all the point elements; n is the number of point elements; θ is the rotation angle; σ_x and σ_y are the standard deviations on the x and y axes.

The semi-major axis of the ellipse displays the direction of the data distribution, and the semi-minor axis shows the range of the data distribution. The more significant the gap between the two axes (the greater the oblateness), the more pronounced the directivity of the data. Conversely, the directivity is less evident if the two axes are closer. The shorter the semi-minor axis, the more pronounced the centripetal force presented by the data. On the contrary, the longer the semi-minor axis, the greater the degree of dispersion of the data.

3.4.2. Landscape Fragmentation

The calculation process for landscape fragmentation is as follows:

$$FS = 1 - \frac{1}{ASI} \tag{5}$$

$$\text{Among which, } ASI = \frac{\sum_{i=1}^{m} A(i)SI(i)}{A} \tag{6}$$

$$SI(i) = \frac{P_i}{4\sqrt{A(i)}} \tag{7}$$

$$A = \sum_{i=1}^{m} A(i) \tag{8}$$

where FS is the fragmentation index of the patch shape of a certain landscape type, and the larger the FS value, the more fragmented the landscape. ASI is the average shape index of the landscape patch weighted by area. $SI(i)$ is the shape index of the landscape patch i. $P(i)$ is the perimeter of the landscape patch i. $A(i)$ is the area of landscape patch i. A is the total area of the landscape type. m is the number of patches of the landscape type.

3.4.3. The Coupling Coordination Degree of Land Input and Economic Output

The index system for the coupling coordination degree of land input and output is as follows (Table 1):

Table 1. Coupled coordination degree indicators.

The Layer of Goals	The Layer of Elements	The Layer of Index	
The land's economic profit	Land input	State-owned construction land Collective-owned construction land	
	Land output	Gross Domestic Product	
		Output value	Industrial output value above a designated size Total retail sales of consumer goods
		Taxation	Total industrial and commercial taxation

The weight of each index can be established to, respectively, calculate the input and output level by employing the entropy weight method after a dimensionless data process.

$$U_t = \sum_{j=1}^{m} W_j P_{ij} \ (t = 1, 2) \tag{9}$$

In the formula, U_1 is the value level of land input, U_2 is the value level of land output, W_j is the weight of the j index, P_{ij} is the standardized value of the j index in town i, and m is the number of towns in the area.

The calculation of the coupling coordination degree is as follows:

$$C = U_1 \times \frac{U_2}{\left[\frac{(U_1+U_2)}{2}\right]^2} \tag{10}$$

$$T = \alpha U_1 \times \beta U_2 \tag{11}$$

$$D = \sqrt{C \times T} \tag{12}$$

In the formula, C is the coupling coordination coefficient, which reflects the degree of coordinated development of the land input system and the land output system, and D represents the coupling coordination degree. T represents the overall value of land use, and α and β, respectively, represent the weight of both the land input system and the land output system. The specific formula is:

$$\alpha = \frac{w_1}{(w_1 + w_2)}, \beta = \frac{w_2}{(w_1 + w_2)}. \tag{13}$$

In the formula, w_1 is the sum of the weight of various indexes in the land input system, and w_2 represents the sum of the weight of various indexes in the land output system.

4. Results of the Empirical Analysis

4.1. Land Policy and Property Rights

From the perspective of historical evolution, the goal of collective construction land reform in southern Jiangsu has gradually shifted from intensive land use and establishing a healthy land marketization path to comprehensive governance. This new goal takes into account optimization of the spatial structure and the protection of individual interests, which can be achieved through the reform of the property rights structure.

(1) Three types of farmland systems

The reform of CCL is based on the reform of agricultural land. W District put forward the "three types of farmland system" under the "household contract", dividing rural collective land into "grain farmland", "feed farmland", and "responsibility farmland". In 1989, W District stipulated the standards and requirements for the "three types of farmland" in The Opinions on Further Stabilizing and Improving Land Contracting. This policy changed the approaches to subdividing land and, in a sense, was an upward transfer of land ownership. Building on collective land ownership, village collectives gained further rights to manage and benefit from "responsibility farmland". Therefore, this policy laid the groundwork for the reform of the land system in southern Jiangsu.

(2) Establishing a healthy land marketization mode

In the middle of the 1990s, the reform of the rural construction land system became the focus of land reform to promote the effective use of rural construction land and meet the needs of urbanization. The former Ministry of Land and Resources approved the pilot plan for rural construction land reform, allowing transactions through rent, transfer, a shareholding system, joint ventures, mortgages, etc. In 1996, Suzhou promulgated and implemented the Interim Approaches to managing the Transfer of the Right of Rural Collective Construction Land Use in Suzhou. This policy innovatively proposed the unified management of state-owned urban construction land and rural CCL, introducing the two types of land into the same land market and exploring the paid and terminable transfer approaches to rural CCL. The same year, W District issued the Opinions on Deepening Reform and Revitalizing Inventory Construction Land. This stipulated that rural CCL in planned urban areas should be confiscated as state-owned construction land (SCL) and put on the land market. Land other than planned urban areas can be directly priced on the land market without changing ownership. This is a pioneering experiment on the "same market and same price" for two types of construction land conducted by the local government. Amendments to the Land Management Law were enacted and implemented in 1998, making it clear that the State may, by law, expropriate collective land in the name of public interest, clarifying that the right to change agricultural land to industrial or

commercial land was to be resumed by the State and realizing the control of land use through the compilation of land use planning and urban planning.

Changing from the transfer of inventory CCL to land expropriation, the local government has gradually retrieved the gains rights for the transfer of CCL and land expropriation and exercised gains control of the land for non-agricultural use. In the land lease process, the local government monopolizes on all the value-added gains from the lease of state-owned land, thus possessing complete land gains rights. In addition, the Suzhou Municipal Government enacted regulations on "large projects entering the development zone, and small projects using the inventory construction land". All the land in the development zone is state-owned land that has been appropriated, which means the value-added right of collective non-agriculture construction land has been almost entirely deprived. This practical approach increases the transaction costs of collective participation in land transfer and expropriation, reducing village collectives' willingness to transfer and expropriate collective construction land. However, the big land scissors difference and the legal land marketization path have encouraged the actions of land expropriation on the part the local government and constructed the complete logic of "nationalization first and then marketization" in southern Jiangsu.

(3) Comprehensive governance of construction land

In 2002, W District began to implement the "three types of cooperation"[6], including the land shareholding cooperative system to revitalize and intensively use collective construction land. Since 2004, some goals have been clarified, such as accelerating the urbanization of farmers, optimizing the structure and layout of land use, and promoting the effective protection and efficient use of rural land resources. The Suzhou Municipal Government has promulgated the Implementation Opinions on the Replacement of Rural Residential Housing with Commercial Housing to achieve these goals. In 2009, it also issued the Implementing Opinions on the Implementation of the Replacement of Rural Residential Housing with Commercial Housing and gradually established and improved the "three concentrations" and "three replacements" policies. During the same period, the State Council promulgated the Decision on Deepening Reform and Strengthening Land Management in 2006 to face the problem of a rapid increase in construction land and the massive occupation of cultivated land. Suzhou, recognized as a pioneer city by the former Ministry of Land and Resources, initiated pilot programs to balance the increases and decreases in construction land. Guided by maintaining agricultural land levels, limiting new construction land, and safeguarding farmers' interests, Suzhou explored innovative approaches to managing land resources.

At this stage, establishing a land shareholding cooperative in W District involved transferring the land contract rights to shares at a discounted price. Based on the "three types of farmland system", the village collectives further resumed the right to use the agricultural land while at the same time possessing the right to dispose of the land, enhancing agricultural development and efficiency. Farmers with shares are entitled to share dividends, guaranteeing their right to income from the agricultural land. Through the establishment of community shareholding cooperatives, village collectives have recovered collective assets from town collective asset management companies and unified their management and operation to ensure that collective assets are not occupied or lost. Village collectives have recovered the right of use, based on enjoying the right to collective assets ownership and entirely enjoying the right to income from collective assets. Although this act protects the operating income of the village collectives, the village collectives are only permitted to enjoy the various property rights associated with the collective assets. Their economic behavior is therefore limited to leasing and use, and they are not permitted to enjoy rights such as mortgages or to add new collective assets.

(4) Integrated consolidation of territorial land

To control the increasing size of the town and continuously optimise the structure of agricultural land, the spatial layout of building land and the layout of residential land in

the town and villages, the Department of Land and Resources of Jiangsu Province issued the Work Plan for "Double Upgrading" for Land Saving and Intensive Land Use in Jiangsu Province, and the Implementing Plan for the "Three Types of Optimization and Protection" Action of Suzhou in 2014. In addition, the Suzhou Municipal People's Government issued the Opinions on Accelerating the Transformation of Land Use Patterns and Deepening the Protection and Management of Land Resources in 2015. This initiative aims to promote better resource protection, sustainable development, and safeguarding rights by optimizing the structural layout of agricultural land, the spatial layout of construction land, and the land layout of residential land in towns and villages (three types of optimization and protection), thus promoting better spatial allocation of the land, maximizing land resources, and improving the ecological environment.

Under the "three types of optimization and protection" policy, several measures highlight how the government has managed land resources: First, the government does not charge additional land fees when increasing the plot ratio for renewing existing industrial land, thereby passing on the benefits of increased plot ratios to the market. Second, diversifying the industrial land supply allows the government to shift from one-time land revenues to continuous income streams, transferring some benefits to stakeholders. Last, allocating reserved land to collective economic organizations has boosted the village's collective assets. While the state retains ownership, granting increased land use rights includes transfer, lease, and mortgage rights, enhancing village collective benefits and government revenue from land sales.

4.2. Spatial Patterns

Spatial governance's goal in reforming the collective construction land system mainly focuses on controlling the scale of newly added construction land, controlling the possession of cultivated land, and optimizing the spatial patterns. From the perspective of changes in spatial patterns, the characteristics are presented below.

First, the scale of newly added construction land increases and then decreases, and the proportion of SCL has continued to increase. Between 1992 and 2018, the spatial distribution of the newly added state-owned and collective-owned construction land in W District indicates that its scale of construction land has increased from 159.81 km^2 to 421.69 km^2 (Table 2), and the proportion of construction land in the administrative area has increased from 12.91% to 30.94%. This spatial distribution also demonstrates that the growth scale of SCL has always been much higher than that of collective-owned construction land, rising from 74.24 km^2 to 275.33 km^2, and its proportion increased from 46.46% to 71.91%. However, the scale of collective-owned construction land has increased slowly from 85.57 km^2 to 107.57 km^2, and its proportion has decreased from 53.54% to 28.09%. Further analysis of the land use conversion matrix shows that cultivated land and water surfaces are the primary sources of construction land expansion. In the three time periods of 1992–2002, 2002–2010, and 2010–2018, the cultivated land area converted into construction land was 32.26 km^2, 70.88 km^2, and 24.19 km^2. Meanwhile, the area of water surfaces converted into construction land was 16.35 km^2, 32.78 km^2, and 24.04 km^2, respectively. This means the cultivated land area has decreased by 126.43 km^2 and the water area has reduced by 72.4 km^2 during these 26 years.

Table 2. The growth of construction land.

Year	Construction Land Scale	Growth Scale (km^2)	Average Annual Growth (km^2)	Average Annual Growth Rate (%)
1992	159.1	-	-	-
2002	208.89	49.79	4.98	2.75%
2010	326.42	117.53	14.69	1.77%
2018	382.9	55.88	6.99	1.99%

Secondly, the space for construction land has gradually concentrated, and the space structure has been continuously optimized. Based on the relatively high plaque fragmentation radix in 1992 for construction land, the plaque density and fragmentation have continued to decrease, and the regularity of the plaque boundary has remained almost the same (Figure 7). Furthermore, the center point of the standard deviation ellipse has constantly shifted to the central city, uninterruptedly rotating counterclockwise in the same direction, and the center point offset distance has increased year by year, which indicates that the spatial structure has presented uninterrupted and rapid changes (Figure 8).

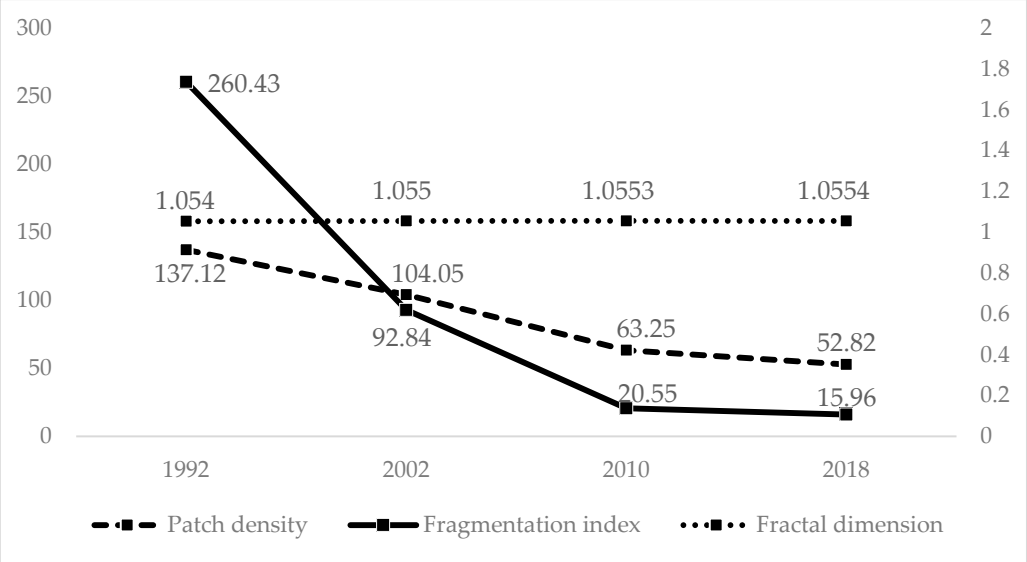


Figure 7. Change in landscape pattern index of construction land.

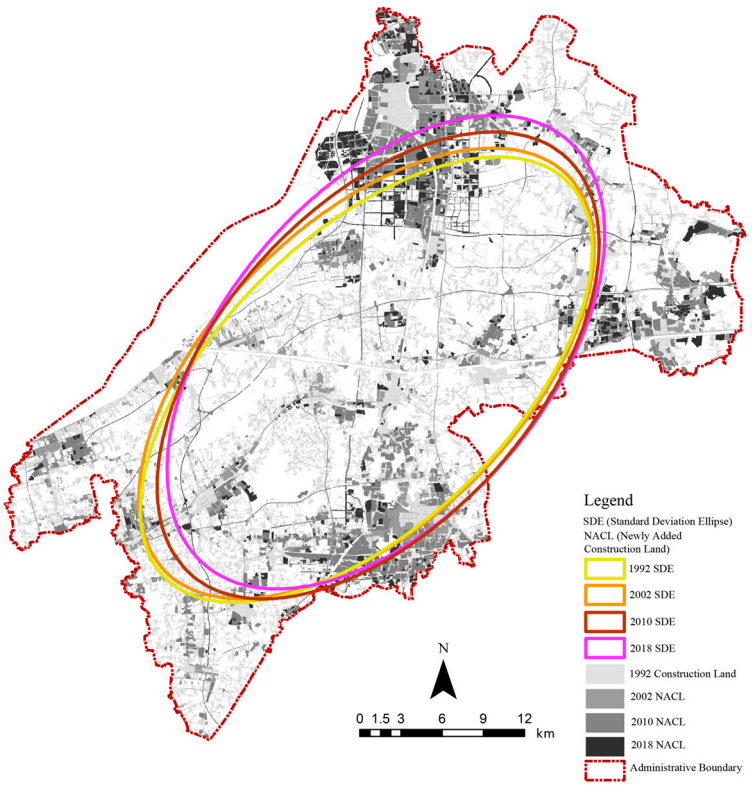


Figure 8. Change in standard deviation ellipse of construction land.

4.3. Land Performance

The comprehensive effectiveness and externality of construction land reform can be discovered through the changes in W District and its social interests between 1992 and 2018.

According to the index system mentioned above, individual income growth can be reflected via the rural per capita disposable income, the balance of rural residents' savings, and social security, which insurance settlement expenses can reflect. The rural per capita disposable income stagnated following the rapid growth between 1992 and 1995. However, it has grown uninterruptedly and rapidly after 2000 with non-agriculturalization and the reform of the agricultural land system (Figure 9). Its average annual growth rate is 12.43%, lower than the average yearly GDP growth rate of 15.41% and the per capita average annual GDP growth rate of 15.05%. Between 1992 and 2018, the balance of rural residents' savings increased from CNY 981 million (approx. USD 135 million) to CNY 104.547 billion (approx. USD 14.41 billion), with an average annual growth rate of 18.88%. The insurance settlement expenses went up from CNY 15.961 million (approx. USD 2.2 million) to CNY 1.506 billion (approx. USD 0.21 billion), an average annual increase of 18.34%. This far exceeds rural residents' per capita disposable income and the average yearly GDP growth rate, showing the relative lag in farmers' income behind the rapid growth in social security.

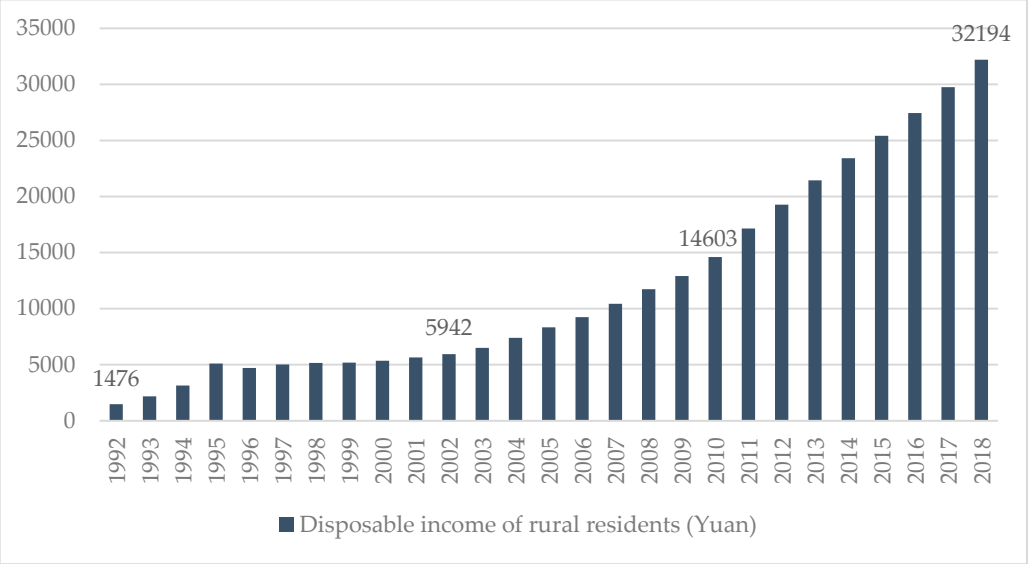


Figure 9. Change in per capita disposable income of rural residents.

Economic development, social equity, and ecological protection can reflect the performance in terms of social interests. First, economic performance stabilizes and then declines. As shown in Table 3, the coupling coordination degree of land input and economic development generally stabilized at about 0.72 and then decreased to 0.534 year by year in W District from 1992 to 2001. Then, according to the Suzhou W District Town and Village Layout Plan, the towns where new towns, development zones, and high-tech zones are located (towns A, B, C, and D) are regarded as critical towns, and the other towns (towns E, F, G, and H) are considered general towns to observe the changes in the degree of coordination of the coupling of the various towns. Among them, the coupling coordination degree of key towns maintained a high level, while the general towns decreased significantly. Between these two groups, the gap gradually became more extensive, showing a certain spatial polarization of the land's economic performance between key towns and ordinary towns.

Table 3. The coupling degrees between construction land and economic development from 1992 to 2018.

District W		1992 0.722	2022 0.720	2010 0.621	2018 0.534
Key town	Town A	0.940	0.886	0.744	0.731
	Town B	0.818	0.888	0.736	0.743
	Town C	0.811	0.853	0.809	0.732
	Town D [1]	0.550	0.495	0.502	0.499
Ordinary town	Town E	0.729	0.721	0.572	0.479
	Town F	0.650	0.597	0.511	0.346
	Town G	0.651	0.664	0.556	0.408
	Town H	0.626	0.652	0.538	0.421

[1] Town D was mainly developed for tourism before it was incorporated into the development zone of Area W in 2013, and its economic performance was lower than that of other key towns.

5. Discussion

Overall, the nearly 30-year-long reform of CCL in W District of Southern Jiangsu Province is a process of "policy–space–performance" interaction and a continuous feedback loop.

5.1. 1992–2002: Weakened Collective Property Rights, Spatial Aggregation, and Performance Stability under Land Nationalization

Since 1992, the big land scissors difference and the legal land marketization path have encouraged the actions of land expropriation on the part of the local government. The scale of construction land in Area W has increased from 159.81 km^2 to 209.59 km^2, with an average annual growth of 4.98 km^2 and an average yearly growth rate of 2.75% (Table 2). The SCL grew by 40.88 km^2, much higher than that of the CCL, and the share of the CCL decreased from 53.54% to 44.91%. Behind this is the continuous weakening of collective property rights.

From this stage, institutional reforms in the CCL transfer and land acquisition have promoted the rapid growth of SCL. The increase in construction land in this period was concentrated in the periphery of townships and villages along major highways, and the central river systems were well preserved and not occupied at a large scale. The average density of patches in 2002 was 104.05/km^2, less than that of 137.12/km^2 in 1992, indicating that the fragmentation of construction land in Area W did not further expand during this period. This reflects the positive effects of the land property rights system reform on spatial patterns. However, restrictions on the transfer of CCL have reduced farmers' incentives to participate in industrialization, leading to stagnation or even a decline in coordination between the coupling of land inputs and economic outputs. Rural residents' per capita disposable income stagnated after rapid growth in 1992–1995, demonstrating the inhibiting effect of space on land performance.

5.2. 2002–2010: Collective-Owned Asset Consolidation, Spatial Expansion, and Performance Differentiation under the Shareholding Cooperative System

However, the transfer of stock construction land and the land expropriation system collectively constrain and reinforce the scale of collective assets. Consequently, the returns on collective assets are narrowed, thereby eliminating the opportunity for village collectives that had insufficient collective holdings during the period of township enterprises to enhance their village returns. To some extent, this approach has led to a spatial differentiation in economic performance. Key towns with industrial parks and development zones have increased and maintained a high coupling coordination degree. In contrast, towns have experienced a rapid decline (Table 3), and the occupation of cultivated land and water has led to a more rapid decline in the ESV. The "three concentrations and three replacements" policy and the reforms of the shareholding cooperative system have promoted the rapid

growth of SCL and further spatial agglomeration while also demonstrating the direct effect of property rights on improving the coverage and balance of public service facilities.

5.3. 2010–2018: Strengthened Collective-Owned Property Rights, Spatial Optimization, and Performance Improvements under Stock Renewal

At this stage, the "three types of optimizations and protection" policy launched in W District aimed to control the scale of newly added construction land, resolving the spatial differentiation of economic performance and the rapid decline in ecological quality that emerged in the previous stage. The transfer of use and gains rights has effectively increased the renewal scale and transfer rate of the stock construction land, thereby increasing the per capita disposable income of farmers and partially improving the coupling coordination degree, expanding the coverage of public service facilities, and slowing the rate of decline in ecological environment quality. This is reflected in the increase in the per capita disposable income of farmers from CNY 14,603 (approx. USD 2012) to CNY 32,194 (approx. USD 4436), the increase in the proportion of both SCL and CCL covered within 500 m of public welfare facilities from 65.23% and 36.06% to 71.57% and 51.36% (Figure 10), and the moderate decline in the ESV (Figure 11). These data demonstrate the multiple contributory effects of stock space renewal on economic, social, and ecological performance.

Overall, reforms in the transfer and acquisition of CCL since 1992 have spurred rapid growth in SCL. However, these reforms initially hindered economic performance by addressing spatial fragmentation. In response, the second phase introduced the "three concentrations and three replacements" and reforms in the shareholding cooperative system, partly resolving the fragmentation issues and enhancing social outcomes. Yet the "nationalization first and then marketization" model limited CCL expansion, leading to slower economic income growth for individual farmers and disparities in economic performance across regions. The third phase, characterized by the "three types of optimization and protection" policy, aims to scale up the renewal of existing construction land by decentralizing government authority, yielding positive economic, social, and ecological impacts.

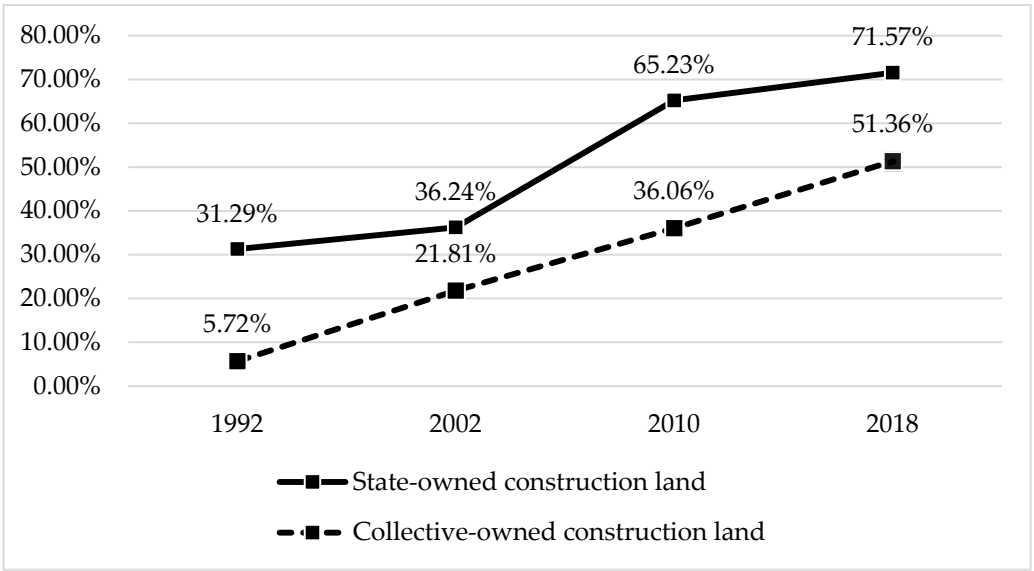


Figure 10. Change in proportion of state-owned and collective-owned construction land covered by public welfare facilities within 500 m.

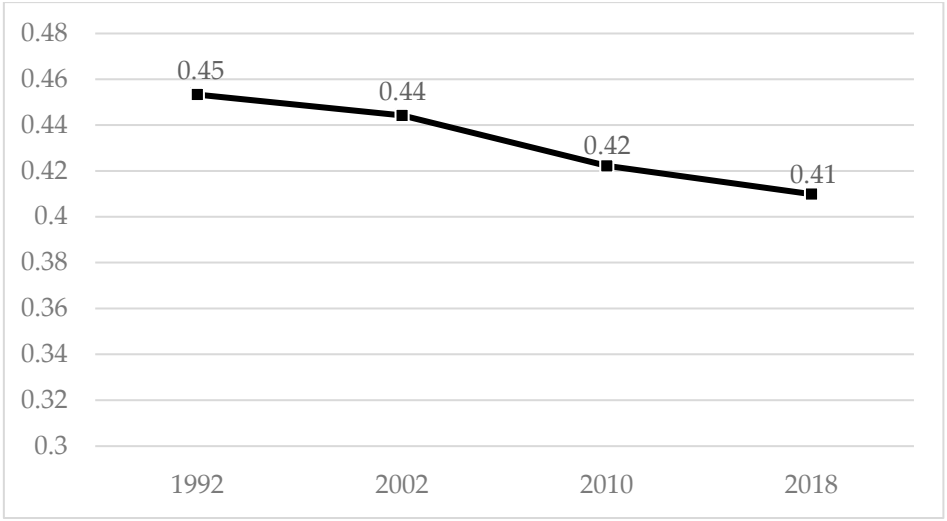


Figure 11. Change in ecosystem service value (ESV).

6. Conclusions

Traditional assessments of land system performance often use the "policy-performance" framework, yielding abstract mathematical results. This paper defines and clarifies the role of spatial form in the relationship between the two and proposes an analytical framework of "land property right-spatial form-land policy performance". The framework is illustrated through a case study of W District in Southern Jiangsu. The objectives of the construction land reform in Southern Jiangsu, such as controlling new construction land expansion, avoiding the occupation of cultivated land, and optimizing the spatial structure, have been gradually achieved. Progress has been made in reducing spatial fragmentation, slowing the decline in ecological benefits, and enhancing social security and public services for farmers. However, there are drawbacks: the "nationalization before marketization" model has limited rural participation in land market activities, resulting in slower growth of farmers' incomes compared to overall economic development. Additionally, the "townships and districts in one" development model has led to spatial polarization in economic growth.

The empirical analyses conducted in W District, Suzhou, across three time periods confirm several key relationships. Firstly, policies influence spatial arrangements, while spatial form affects performance. Additionally, the findings highlight the mediating role of spatial form between the land system and its performance. Land property rights shape spatial forms and can either facilitate or hinder land performance. Spatial form, as a spatial carrier, is the external manifestation of land property rights and land use performance. It reflects the result of the policy and land performance, serving as a morphological expression of both. Therefore, this paper argues that the performance of the land system should consider both the system's objectives and the wider societal impact. The paper suggests creating an evaluation framework that incorporates both the system's objectives and its societal impact. Furthermore, it emphasizes the importance of space as both a governance objective and a tool for land policy. The paper asserts that space should be integrated as an intermediary element in assessing institutional performance to promote quality development. It also recommends using evaluation indicators suitable for longitudinal analysis to assess land systems with continuity and relevance over time.

This practical research reflects the weakness of the analytical framework proposed in this paper. First, although this paper quantitatively measured land performance and spatial form, it was constrained by quantifying the property rights system and collecting statistical data. The mediating role of spatial form between the property rights system and land performance is still primarily understood qualitatively. Future research should aim to overcome the existing theoretical challenges in quantifying property rights to enable a quantitative assessment of this mediating effect. Secondly, the South Jiangsu region has

experienced rapid economic and social development since China's reform and opening up. However, different areas within China have explored varied approaches under the unified national system. Existing literature has examined local land system practices, highlighting distinctions among regions like the Pearl River Delta, Southern Jiangsu, Zhejiang Province, and the Beijing–Tianjin–Hebei region. Empirical demonstration of the mediating role of spatial form across these diverse regions remains a critical focus for future studies.

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Notes

1 It is worth defining the meaning of homestead land, the household contract responsibility system, and collective-owned commercial construction land. Homestead land is collective-owned construction land used by rural villagers to construct dwellings and their ancillary facilities, including housing, ancillary houses, and courtyards. In terms of land category management, it belongs to collective-owned construction land. The household contract responsibility system is a form of agricultural production responsibility in which farmers contract land and other means of production and production tasks from collective economic organizations (mainly villages and groups) on a household basis. At this stage, it is a fundamental economic system in rural China.Rural collective-owned commercial construction land refers to rural construction land of a productive and operational nature, including rural collective construction land used by rural collective economic organizations to set up enterprises using the construction land identified in the overall land use plan of the township (town) or to jointly organize enterprises or businesses with other units or individuals in the form of land use rights in shares, joint ventures, and so on.

2 The "three types of farmland system" comes from *The Opinions on Further Stabilizing and Improving Land Contracting*, issued by Suzhou City in 1989. This system includes the grain and feed farmland distributed to farmers and the responsible farmland used for land-at-scale management. The existing literature review on moderate-scale land management can be traced back to the "two types of farmland system" in Pingdu, Shandong Province.

3 Shunde, Guangdong, started to deepen its reform of the contracting responsibility system in 1989, such as replacing collective free subcontracting with centralized paid contracting and changing long-term contracting to short-term contracting, subcontracting to bid contracting, and scattered contracting to tract contracting. The village collective has taken back the farmland contracted by the farmers and conducted bidding in the village. The village collective sub-rents the land to contract farmers, charges the contract rent, and then allocates the contract rent to the village collective members or as part of public welfare undertaken by the village collective, including paying a social insurance scheme to the farmers.

4 The dominant morphology of a region refers to the major land use types and their quantitative and spatial structure during a specific period of time. On the other hand, the recessive morphology refers to a land use pattern that depends on explicit analysis, testing, examination, and investigation to be understood. This includes multiple attributes, such as quality, property rights, operation methods, inputs, outputs, and functions.

5 In the policy of "three concentrations" and "three replacements", the "three concentrations" policy refers to the concentration of farming households in communities, contracted agricultural land in large-scale management, and industrial enterprises in parks. The "three replacements" refer to the replacement of collective asset ownership rights and distribution rights with shares in community cooperatives; the replacement of land contracting and management rights with basic social security or with the right to exchange shares; and the replacement of homestead use rights with urban housing, with money, with industrial buildings for secondary and tertiary industries, or with shares in community cooperatives.

[6] The "three types of cooperation" refers to the shareholding cooperatives implemented in southern Jiangsu. It includes land shareholding cooperatives, community shareholding cooperatives, and professional shareholding cooperatives, respectively, for agricultural land management, collective management assets, and professional assets of grain and oil.

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