Article

Policy Innovation of Life Cycle Management of Industrial Land Supply in China

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Abstract: With the expansion of the scale of industrial land, China’s industrial economy continues to grow at a high speed, but the long-term homogeneous land supply policy has led to low land use efficiency. Exploring differentiated industrial land supply policy (DILSP) innovations can effectively address this issue. However, due to the limited practical cases, there are few studies on the policy innovations of industrial land supply. Based on the life cycle management (LCM) of industrial land (LCMIL), this study uses the policy analysis method to reform and innovate industrial land supply policy to solve the disadvantages of the current industrial land supply policy and proposes the DILSP as its basis. The research shows the following: (1) there are many problems in China’s current land supply policy, but policy innovation in some economically developed cities has achieved positive results, indicating that an effective institutional supply is the best way to solve these problems; (2) the process of industrial land utilization has obvious cyclical characteristics, and a complete process and differentiated supply policy framework based on “differentiated access evaluation, differentiated supply method, differentiated supply period, differentiated supply price, differentiated post-supply supervision” has a certain rationality and feasibility. This study provides an innovative solution to the shortcomings of China’s existing industrial land supply policy, and the idea of applying LCM theory to government policy-making also has a certain reference significance.

Keywords: industrial land; life-cycle management; different land supply policy; land-use efficiency

1. Introduction

With the rapid development of global industrialization and urbanization, land centered development has become a common phenomenon in many developing countries [1–3]. Since the implementation of reform and opening-up, China’s industrial economy has continued to rapidly grow, changing from a country dominated by agriculture to an industrial country [4]. From 1990 to 2018, the total area of construction land in China increased from 11,608 km² to 55,156 km², with an average annual growth of 3.75%. Industrial land plays a vital role in urban growth [5].

However, as there was no difference in the land supply policy, the efficiency of industrial land allocation and utilization has remained low for a long period of time, demonstrating a state of high consumption but low efficiency [6]. The reason for this is that the traditional industrial land supply policy adopts undifferentiated measures of this method in respect to [7,8], a valid period [9] and price [10] for supplying industrial land, and it ignores the differences between different regions, industrial sectors, and corporate operating capabilities, leading to a mismatch between supply and demand in industrial land [5]. Thus, it is difficult to achieve precise land supply and efficient land use [11]. Additionally, the current land supply policy rarely considers the cyclical characteristics
of industrial land use and does not specify the content and standards of supervision at each stage of land use when supplying land, which further leads to inefficiency in post-supply supervision [12,13]. Therefore, it is necessary to explore policy innovations for the differentiated supply of industrial land.

To solve the problem of low industrial land use efficiency, the land resources management department has implemented several land use policies in the past 20 years. In 2009, the former Ministry of Land and Resources and the Ministry of supervision proposed to choose different types of policies according to different types of industrial land, indicating the flexibility of industrial land use rights [14]. In 2015, the central government proposed reforming and improving the industrial land supply mode as well as exploring the implementation of a long-term lease before the transfer and the combination of both [8,15]; in the same year, the LCMIL was put forward and piloted in several major cities in China, including Beijing, Shanghai, and Hangzhou. Due to China’s long-term implementation of a homogeneous industrial land supply policy, industrial land has not been rationally used, and a great proportion of industrial land has become inefficient and idle. The exploration of differentiated supply policy innovation helps to create more accurate supply policies for different land types and uses, effectively reduce industrial land waste, and improve land-use efficiency. The proposal of this policy has attracted the attention of many scholars [16,17]; however, as the concept of LCM is mostly used in enterprises or industries [18], it is barely involved in the land management policy field. The LCMIL has become crucial and difficult work for local governments. There is an obvious periodicity in the use of industrial land. According to the periodic characteristics of industrial land, the formulation of more targeted differentiated land supply policies could achieve accurate and personalized land management and reduce the waste of land resources.

Combined with the LCM theory, this paper reconstructs the concept of LCMIL and DILSP, analyzes the problems and deficiencies in the current industrial land policy, and realizes DILSP innovation to adapt to the LCMIL. The specific analysis framework of this study is shown in Figure 1. Specifically, this study aims to apply LCM theory to land policy by means of an inductive analysis and a comparative analysis and proposes a DILSP framework to achieve accurate land supply and effective land use, so as to fill the LCM theory gap in the land policy field and make up for the deficiencies in the existing industrial land supply policy. The specific objectives of this study are to: (1) reconstruct the concept of the differentiated supply of industrial land based on LCM theory; (2) create an innovative DILSP design based on existing policy issues to adapt to LCMIL.

**Figure 1. Analysis framework of the study.**

The remainder of this paper is as follows: Section 2 reviews previous studies about industrial land use policy and LCM. Section 3 presents the research methods, including
reconstructing the concept of differentiated supply of industrial land and analyzing the characteristic of the current industrial land supply policy under the LCM; Section 4 is the innovative design of DILSP; The conclusions and future research direction are summarized in Section 5.

2. Literature Review

2.1. Industrial Land Use Policy

Most countries in the world implement various policies to regulate land use [19,20]. Developed countries’ industrial land policy research focuses on sustainable development [21,22], while developing countries pay more attention to the management of urban development in the process of urbanization and industrialization [23,24]. Since the 20th century, the governments of some east Asian countries and regions have begun to implement industrial policies, which have played an important role in the development of the regional economy and the acceleration of the process of industrialization, in sharp contrast with western developed countries [25]. Looking at Japan, South Korea, and Taiwan, Japan’s industrial land policy mainly serves for industrial growth and rational distribution, which is reflected by its aims to increase the development of industrial land through policy design to meet the growing demand for industrial land [26]; the South Korean government played a leading role in allocating resources to specific chaebol and locations [27]; while Taiwan’s government helps small and medium-sized enterprises in areas rich in human resources for the construction of an industrial park [28]. The shortage of industrial land supply is a big problem for these countries and regions in the early stages of promoting industrialization. The local governments attempt to increase the effective supply of industrial land through various policies and measures, which is the most important aspect of industrial land policy in Japan, South Korea, and Taiwan [29]. Japan, Korea, and Taiwan have strong similarities to the Chinese mainland in terms of population, number of places, and the ordering of culture and industry development [30].

China’s local governments have absolute control over the scarcity of land resources [31], and the mismatch of financial power means that local governments gradually strengthen the guidance and allocation of different land transfer modes to develop the regional economy [32]. In recent decades, China’s industrial land policy has experienced great changes [30]. Some researchers have explored policy innovation regarding the land supply behavior of the local government [33], supply model [34], flexible valid period [35], and differentiated prices [36,37]. Meanwhile, other researchers have explored the mechanism of industrial land regulation from the aspects of land allocation efficiency [38], land use efficiency [26], the redevelopment of inefficient land [39,40], and the disposal of idle land [41]. Most studies have focused on adjustments to the land supply strategy [30,42]. With deepening research in this field, some scholars have noticed that a comprehensive and complete process based differentiated supply policy has more obvious advantages in improving land use efficiency [15,43].

2.2. Life Cycle Management

The term ‘life cycle’ was first proposed in the field of biological sciences (Joshi, 2000). In natural ecosystems, organisms experience birth, growth, maturity, aging, or death. Human beings can grasp the laws of development and evolution by understanding the law of the life cycle of living things. The concept of “life cycle assessment” first appeared in the late 1960s [44]. Life-cycle assessments are mostly used to assess the environmental impact related to each stage of the product life cycle [45]. LCM aims to integrate the complete value chain into this assessment on the basis of life cycle evaluation theory and establish a relationship between the sustainable management of organizations, products, and the creation of performance and business value [46]. LCM has also been applied to manufacturing, electricity, packaging, chemical industry, environment protection, etc. [47].

The development and production of enterprises are inseparable from land, and the different stages of land use are adapted to the life cycle of enterprises. Considering the
management of industrial land from the perspective of LCM, it has obvious advantages in the formulation of targeted control measures for industrial land at different life stages [15]. LCM is rarely used in government decision making or industrial land management [48]. To solve the contradiction between efficiency and equity in China’s industrial land renewal, some scholars have proposed the use of the dynamic LCM mechanism based on the life cycle of “withdraw-change-Redevelopment-withdraw” for industrial land, including access management, change control, public use, planning, and dynamic tracking evaluation [15].

2.3. Literature Summary

In brief, existing studies have useful explorations on industrial land supply policy and regulation [41,49], and achieved positive results. However, there are still two deficiencies in these studies: first, they ignore the systematic characteristics of the DILSP, and the research results may be difficult to systematically solve existing problems. Secondly, it ignores the cyclical characteristics of industrial land use, which leads to its limited role in the supervision of industrial land use in the later stage. Therefore, the goal of this study is to innovatively use LCM to fill in this research gap by establishing a differential concept of industrial land-management policies.

3. Methods
3.1. Reconstruction of Concept

3.1.1. Life-Cycle of Industrial Land

The cyclical characteristics of industrial land use processes include the following four stages: A birth period, wherein local governments sell industrial land for a certain valid period to industrial enterprises; a growth period, where the industrial enterprises conduct factory construction and the production scale gradually expands; a mature stage, where the aims of the largest production scale and efficient use of land are achieved; a decline stage, wherein both the production scale and the land-use efficiency decrease until the land is transferred or repurchased by the government [50]. Therefore, based on the life cycle theory, the evolution process of industrial land can be regarded as its life cycle, including four stages of birth, growth, maturity, and decline. The different stages of industrial land use have distinct characteristics and huge differences in land use efficiency [51,52]. The schematic diagram of land use efficiency change in each stage is shown in Figure 2.

![Figure 2. Diagram of the changes in land use efficiency during the life cycle of industrial land.](image-url)

In the birth period, the industry is less dependent on land as a factor of production, but more dependent on capital, technology, labor, and other factors of production. The technical level, output capacity, and relevant infrastructure conditions are not perfect, so its land use efficiency is very low [53]. The rapid development of industry in the growth period produces a huge demand for land as a factor of production, and the birth period
accumulates a certain amount of technical capital and management skills, which can promote improvement in land-use efficiency during the growth period [54,55]. Although the industrial scale is stable in the mature period, based on the growth period, the intensity of industrial land and can be improved, and the efficiency of industrial land can indirectly be improved in the mature period [56,57]. The development potential of industries in the recession period is not as good as those in the mature period, resulting in a reduction in industrial investment in other production factors in the development stage and consequently land-use efficiency is further reduced [58]. Therefore, it is very important to formulate special policies for industrial land at different life stages according to the life cycle theory [59].

3.1.2. Differentiated Supply of Industrial Land

Table 1 shows various typical cities’ policy explorations regarding DILSP in recent years. From the review of policy innovations in typical cities, the positive policies can be summarized as follows: first, exploring and implementing differentiated admittance evaluation criteria according to industrial development orientation from the perspective of admittance evaluation. Second, from the perspective of industrial land supply mode, exploring and implementing a variety of different ideas, such as leasing before transfer, and the combination of leasing and transfer, to improve the level of market competition. Third, exploring and implementing transfer with a flexible supply period and appropriately shortening the land use period considering the supply period of industrial land. Fourth, exploring and implementing differentiated land price strategies to reduce the cost of enterprises in the real economy according to the differences in industrial sectors and considering the industrial land supply price. Fifth, establishing special post-supply supervision institutions, and exploring and implementing the LCMIL from the perspective of industrial land use supervision.

Table 1. Summary of the explorations on DILSP in typical cities.

<table>
<thead>
<tr>
<th>City</th>
<th>Policy Innovation</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shenzhen City, Guangdong Province</td>
<td>Differentiated supply methods and differentiated land prices</td>
<td>2013</td>
</tr>
<tr>
<td>Hangzhou, Zhejiang Province</td>
<td>Differentiated access</td>
<td>2014</td>
</tr>
<tr>
<td>Suzhou City, Jiangsu Province</td>
<td>Flexible term assignment</td>
<td>2016</td>
</tr>
<tr>
<td>Shanghai</td>
<td>Lease first and then assignment</td>
<td>2017</td>
</tr>
<tr>
<td>Foshan City, Guangdong Province</td>
<td>Life cycle management</td>
<td>2017</td>
</tr>
<tr>
<td>Changzhou City, Jiangsu Province</td>
<td>Double contracts management</td>
<td>2020</td>
</tr>
</tbody>
</table>

Through the analysis of the LCMIL and the summary of the differentiated supply policy utilized in typical cities, the concept of the DILSP should cover the entire process of industrial land from supply to supervision to satisfy the needs of the LCM, including differentiated access evaluation, differentiated supply methods, differentiated supply terms, differentiated supply prices, and differentiated post supply supervision measures. The proposed differentiated policies and specific measures corresponding to individual stages of the LCMIL are shown in Figure 3.

Specifically, in the birth period of industrial land, first, the projects are classified and differentiated access management is implemented according to different project categories. Then, the appropriate land-supply mode is selected in combination with the input–output intensity of the project, and the land-use period is reasonably determined according to the industrial type and the grade difference of the above-mentioned projects, so as to improve the turnover efficiency of industrial land, and the differentiated land supply price is set according to the restrictions regarding the transfer year [59]. The growth period is identified according to the grade division of enterprise projects and the whole
project cycle; the allocation of land resources and other elements is reasonably guided; the working process of idle land disposal is formulated; special rectification is carried out on idle land; the allocation of land resources is further optimized, and full use is made of idle land [60]. In the mature period, the focus is on tracking the performance of the contract by the enterprise. Based on the bilateral contract, regular physical examination mechanisms for dynamic tracking are implemented and strengthened, the plot ratio and investment intensity of industrial land is monitored to ensure it meets the standards, and project construction progress and industrial development of the enterprise is monitored to reach the expected level. If the inspection fails to meet the standards, this is deemed a breach of contract, and must be rectified within a time limit or the relevant party is held accountable [61]. In the recession period, an evaluation system is built that considers the land use conditions and enterprise quality. Inefficient land is identified and classified according to the land-development intensity, land-use efficiency, and other indicators, and comprehensively improved and transformed through the original state-owned land users, market subjects [62], government, and other parties, conforming to the overall land-use planning and industrial development directions.

![Figure 3. The proposed concept framework of differentiated industrial land supply policies under the life cycle management.](image)

3.2. Characteristics of Current Policies
3.2.1. Land Supply Method

The transfer methods of industrial land include bidding, auction, and listing. At present, in many local project initiation procedures, it is necessary to have projects before land, and listing transfer has become the norm. Therefore, the transfer of industrial land is mainly carried out through listing, which reduces the market competition in the supply of industrial land. The traditional way of transferring industrial land is to sell it to enterprises according to a one-time policy and the longest term, and charge users one-time transfer fees [63]. This mode of industrial land supply uses a large amount of funds for enterprises, and the cost of using industrial land is high. Moreover, if the industrial cycle is adjusted in the middle and later stage or the enterprise is poorly operated, it is difficult for enterprises to exit, which indirectly causes idle land. This not only cannot meet the personalized and convenient land demand of industrial enterprises, but it is also not conducive to improving the economical and intensive use levels of industrial land. Although some reform policies have vigorously advocated for the transfer of land supply in various ways, such as leasing and leasing before giving, this has not been widely used due to the lack of implementation rules and supporting policies.
3.2.2. Land Supply Period

The current law stipulates that the maximum term of industrial land transfer shall not exceed 50 years. Relevant research shows that the average enterprise life cycle in national development zones is 11.6 years, and the average life cycle of industrial enterprises in provincial development zones is 15.8 years [63]. However, local governments do not consider the differences in industries and generally sell land for the maximum number of years, which is inconsistent with the life cycle law of industrial enterprises. According to the census data of industrial enterprises in Xinbei District, Changzhou City, Jiangsu Province in 2015 (Figure 4), among the 1766 enterprises with complete information on the establishment time and industrial output, the average life cycle of enterprises is 7.1 years, and more than 97% of industrial enterprises have a life cycle of no more than 20 years. The current law stipulates that the maximum validity period for industrial land transfer shall not exceed 50 years. However, the local governments did not consider the differences in industry sectors and generally supplied industrial land with the maximum number of years, which was inconsistent with the law of the life cycle of industrial enterprises [4]. Generally, the 50-year transfer period is much longer than the actual life cycle of the enterprise, resulting in the waste of industrial land and inefficient use of land. Additionally, the long land-use period may also induce the “land hoarding” behavior of industrial enterprises, significantly increasing the difficulties in the disposal of inefficient land and the financial pressure on the government to repurchase industrial land.

Industrial land is not only a supporter of industrial development but also plays a key role as a tool for investment promotion. The competition for investment among cities in China is extremely fierce; therefore, some governments use low-cost industrial land to attract project investment. To avoid blind competition and prevent the loss of state-owned assets, China has set a minimum price for the transfer of industrial land [63]. However, this kind of price limit is relatively indistinguishable because it only considers the differences in the location of cities and land without considering the differences in industry orientation and the type of industry. Lower land prices weaken the enterprises’ enthusiasm to improve the efficiency of industrial land use and induce enterprises to use as much land as possible when choosing production factors. The large gap between the transfer price of land and its re-transfer price has also induced speculation by enterprises.

In addition, as shown in Figure 5, the price trends for industrial land, residential land, and commercial land from 2004 to 2018 show that the prices of residential land and commercial land gradually increased from 2004 to 2018. However, there is no significant change in the
price of industrial land, leading to a decreasing trend in the ratios of the price of industrial land to the prices of residential land and commercial land. In 2018, the ratio of the price of industrial land to the price of residential land was 11.78% while the ratio of the price of industrial land to the price of commercial land was 10.97%, indicating that the price of industrial land was relatively low.

![Figure 5](image_url)

Figure 5. Changes in the prices of industrial land, residential land, and commercial land from 2004 to 2018.

3.2.4. Post-Supply Supervision

Figure 6 shows the post-supply regulation of industrial land in the primary and secondary markets. Enterprises can obtain land from the government in the primary market through bidding, auction, and listing. Once they have obtained land, enterprises can operate independently, or transfer or lease land through the secondary market. The current post-supply supervision of the government mainly focuses on whether the enterprise starts and completes construction on time and whether it is constructed in accordance with the established plot ratio. The input and output status of enterprises during operation lacks a differentiated dynamic tracking mechanism. The post-supply supervision of industrial land needs to be jointly handled by the territorial government and the departments of natural resource, taxation, industry and commerce, environment, courts, banks, etc. Additionally, there is a lack of specialized agencies to coordinate and handle related affairs, which reduces the efficiency of supervision; for example, in Shanghai, only the land management department leads and participates in land supervision. Due to the lack of participation from other functional departments, the implementation focus of other types of projects cannot be effectively managed. Moreover, there is a lack of assessment standards and dynamic update mechanisms for differentiated post-supply supervision. In some places, such as Chengdu, Shenyang, etc., there is no agreement on the project growth period and the identification of inefficient land when supplying industrial land, resulting in there being no basis for supervision. In some other places, although the local governments have signed a project supervision agreement and formed a preliminary agreement regarding the above standards, it is impossible to scientifically evaluate the land use conditions over a long period due to the lack of a dynamic update mechanism for the assessment standards.
4. Policy Innovation

4.1. Policy Framework

Overall, through the concept reconstruction of the DILSP and the problem analysis of the current supply policy under the LCM theory combined with the investigation into DILSP innovation explorations in typical cities, this paper proposes an innovative framework for the DILSP based on the LCM theory looking at five aspects: differentiated admittance evaluation, differentiated supply method, differentiated supply period, differentiated supply price, and differentiated post-supply supervision. Before the supply of industrial land, industrial projects are divided into three types, including key projects, general projects, and prohibited projects according to the regional industrial development orientation and spatial layout planning. Differentiated access management is implemented according to the different project types. After the project is admitted, the differentiated land supply mode is determined according to the project type and input–output intensity, and the land-supply period in line with the enterprise life cycle should be formulated according to the different land-supply modes. Based on the access rating, supply mode, and supply period, the flexible transfer land price is determined according to the specific situation of the project. Finally, in each period of the industrial land cycle, differentiated post-supply supervision is implemented by setting up special supervision departments and signing supervision project agreements. The policy framework of differentiated industrial land supply is shown in Figure 7.
4.2. Admittance Evaluation

Admittance evaluation refers to the comprehensive evaluation of whether the input–output level of the project conforms to local standards and land supply conditions before the local government supplies land for industrial projects and decides whether the project is allowed to implement production [66]. In economics, market admittance is an institutional arrangement in which the government regulates the market through the intervention and control of market entities when the market system is abnormal. This is used to maintain market order and rationally allocate resources [38]. Under fair market competition, the requirements regarding industry type, investment intensity, investment scale, and output efficiency can be used as preconditions for land supply. Before the signing of the investment agreement for the project, project ratings should be jointly evaluated in the form of a centralized review by multiple departments. Project ratings should adhere to the principle of the coordinated development of resources and environment between regions, strictly prohibit high-polluting projects, strictly control high-energy-consumption projects, and give priority to the development of strategic emerging industries.

According to the regional industry development orientation and planning of spatial arrangement, industrial projects are divided into key projects, general projects, and prohibited projects. The governments implement differentiated admittance management for different types of projects, that is, a land-supply priority is given to key projects, then to general projects, and no land is given for prohibited projects. Among these three types of projects, key projects refer to strategic emerging industry projects, general projects refer to other projects that conform to the local industrial development orientation; prohibited projects refer to high-pollution, high-risk projects that do not conform to the local industrial development orientation and that are included in the negative list of industrial development. For key projects and general projects, the admittance standards including the investment...
intensity, investment scale, and output efficiency of industrial projects are formulated and differentiated industrial project admittance evaluation should be implemented. The industrial land admittance requirements are used as the basis for the assessment of land supply, and the minimum standards of industrial land input intensity and output efficiency are regularly updated each year.

4.3. Supply Method

According to the design requirements of the national top-level system, when supplying industrial land, it is necessary to flexibly determine the valid transfer periods and to choose appropriate supply methods including long-term leases, first leases after transfer, and a combination of lease and transfer to supply land according to project types and input-output intensity (Table 2). If industrial land is supplied by the supply methods of a long-term lease, lease-after-transfer, and combination of lease and transfer, it should meet the transfer conditions using the methods of bidding, auction, or listing before it can be transferred with the agreement-based method. Within the use period agreed upon in the contract regarding the right to use state-owned construction land, the land user can build permanent buildings (structures) with the approval of the relevant departments. When handling industrial project approval, urban planning permission, construction permission, and other procedures, the land lease contract and the land transfer contract are equally authentic. During the valid lease period agreed in the contract, if the lessee has paid the rent and completed the land use as agreed in the contract, the lessee can transfer, release, and mortgage the state-owned construction land with the consent of the lessor.

Table 2. Differentiated supply methods and their corresponding application scenarios.

<table>
<thead>
<tr>
<th>Land Supply Mode</th>
<th>Policy Innovation</th>
<th>Applicable Situations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible term assignment</td>
<td>The local government transfers the land use rights to the user within the statutory period.</td>
<td>General industrial projects</td>
</tr>
<tr>
<td>Long-term lease</td>
<td>The local government leases the land use rights to the user during the contract period.</td>
<td>General industrial projects standardized factory projects</td>
</tr>
<tr>
<td>Lease first and then assignment</td>
<td>The local government leases the land use rights to the user first, and then assigns this to the user when the project output benefits meet the requirements.</td>
<td>General industrial projects standardized factory projects</td>
</tr>
<tr>
<td>Combination of lease and assignment</td>
<td>The local government lease part of the land use rights to users and then assigns the other part to users.</td>
<td>Large-scale, multi-plot and long-term projects</td>
</tr>
</tbody>
</table>

4.4. Supply Period

Formulating differentiated supply periods and establishing an industrial land supply system that conforms to the law of enterprise development and the life cycle of the industry could promote the rational allocation of land resources and prevent industrial enterprises from speculating on land resources [63]. Table 3 shows the valid periods of industrial land for different supply modes. The valid period of land use should be reasonably determined according to industry types and project ratings. The service life of land transferred within a flexible period should be higher than the legal maximum service life; if the land is used in the form of a long-term lease, it should be implemented following the requirements regarding “Proposals on Regulating the Lease of State-owned Land”, and the lease term should not exceed 20 years; where the land is used in the form of a first-lease-after-transfer or a combination of lease and transfer, the time limit for a single contract for the lease part shall not exceed 20 years. In addition, if the land is supplied with a long-term lease, first-lease-after-transfer, or combination of lease and transfer, its use conditions should
be evaluated within the specified time. The land can be renewed if the indexes of input and output and others meet the preset conditions; otherwise, a rectification must be made within a specified time limit. If the rectification still fails to meet the requirements, the lease contract will be terminated, and the land will be recovered within a certain time limit.

Table 3. Comparison of industrial land valid periods for different supply methods.

<table>
<thead>
<tr>
<th>Land Supply Method</th>
<th>Contract Period (Year)</th>
<th>Maximum Period (Year)</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible term assignment</td>
<td>10–50</td>
<td>50</td>
<td>10–30 years for general industrial projects</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30 to 50 years for important industrial projects</td>
</tr>
<tr>
<td>Long-term lease</td>
<td>5 + X</td>
<td>20</td>
<td>Lease for 5 years first, then up to 15 years after meeting the requirements</td>
</tr>
<tr>
<td>Lease first and then assignment</td>
<td>5 + X</td>
<td>Lease 5</td>
<td>Assignment 25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lease for 5 years first, then assignment for up to 25 years after meeting the requirements</td>
</tr>
<tr>
<td>Combination of lease and assignment</td>
<td>Lease 20</td>
<td>Lease 20</td>
<td>Half of the land is leased for a maximum of 20 years, and the other half is assigned for a maximum of 30 years</td>
</tr>
</tbody>
</table>

4.5. Supply Price

The determination of differentiated supply prices aims to reduce the cost of real economy enterprises, give full play to the leverage of land prices, guide the allocation of industrial land to key industries and key enterprises for industrial transformation and upgrading with structural and differentiated land supply, and guarantee the development of key projects and other strategic emerging industries, headquarters economies, and advanced manufacturing industries [62].

According to the stipulations of the “Technical Specification for Land Price Evaluation of the Right to Use State-owned Construction Land”, the government should comprehensively determine the reserve price based on the land evaluation results and industrial policies before supplying industrial land. For the industrial types that the state supports, the government should follow the differentiated market pricing and policies, revise the prices considering the principle of preferential treatment after assessing the normal market prices of individual land types, and finally, determine the reference prices based on the constraints of the relevant policies. Therefore, based on the aforementioned differentiated admittance rating, supply method, and supply period, it is advisable to adopt a valid period-based correction coefficient and an industrial development orientation-based correction coefficient to calculate the land transfer (lease) price. The calculated price should not be lower than the national minimum price standard for industrial land transfer (i.e., period-based revised price standard). The land price calculation formula is listed as follows:

\[ P = P_0 \times k_1 \times k_2 \]

where \( P \) represents the land transfer (lease) price, \( P_0 \) represents the 50-year land market evaluation price, \( k_1 \) represents the valid-period-based correction coefficient, and \( k_2 \) represents the industrial-development-orientation-based correction coefficient.

(1) The valid-period-based correction coefficient. According to the current land appraisal regulations for the calculation of the valid-period-based correction coefficient, the land restoration rate is calculated at 4.9%, that is, the current bank loan interest rate for more than 5 years. Under other equal conditions, the 10-year, 20-year, 30-year, and 40-year land prices of certain industrial lands are 41.85%, 67.79%, 83.86%, and 93.82% of the 50-year land price, respectively. Taking the 30-year transfer as an example, its land price has reached
83.86% of the 50-year land price. The reduction in land price is not obvious, which will significantly affect enterprises’ willingness to choose the 30-year industrial land. Therefore, from the perspective of reducing the initial cost of real economy enterprises, it is appropriate to learn from the experience of Shenzhen, Suzhou, Foshan, and other cities, where the annual linear conversion method is adopted to determine the floor price of land transfers or land leases on the basis of their being no lower than the lowest industrial land-transfer price. The relationship between the flexible land price and the 50-year land price is shown in Table 4.

Table 4. The price relationship between flexible land transfer and 50-year land.

<table>
<thead>
<tr>
<th>Flexible Lease Term</th>
<th>The Ratio of the Flexible Land Price to the 50-Year Land Price under the Current Lease Valuation Method</th>
<th>The Ratio of the Flexible Land Price to the 50-Year Land Price under the Linear Conversion Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>41.85%</td>
<td>20.00%</td>
</tr>
<tr>
<td>20</td>
<td>67.79%</td>
<td>40.00%</td>
</tr>
<tr>
<td>30</td>
<td>83.86%</td>
<td>60.00%</td>
</tr>
<tr>
<td>50</td>
<td>93.82%</td>
<td>80.00%</td>
</tr>
</tbody>
</table>

(2) The industrial-development-orientation-based correction coefficient. To formulate differentiated industrial-development-oriented-based price correction coefficients, the projects that were identified as key projects in the differentiated admitsance evaluation that conform to the industry development orientation, including strategic emerging industries, high-tech industries, advanced manufacturing industries, and other industrial policy-encouraged categories, are given preferential support for land prices. According to the “Shenzhen Land Price Measurement Rules (Trial)” and other cities’ land price adjustment experiences, the industrial-development-oriented-based correction coefficient is set to 0.8–1.0. For general projects, land prices should be appropriately increased to promote their transformation and the upgrading of industries and to transfer and eliminate some enterprises. The correction coefficient is set to 1.1–1.5.

4.6. Post-Supply Supervision

Post-supply supervision of industrial land means that local governments supervise and manage the use of supplied land according to land-use contracts and promote the rational use of land by land users according to the agreed upon input–output conditions [67]. According to the LCMIL requirements, differentiated post-supply supervision policies are implemented during the growth, maturity, and decline stages of industrial land, including the identification of differentiated growth periods, restriction of land disposal, and project completion evaluation, in addition to the dynamic tracking of land use, identification of inefficient land, disposal of inefficient land, etc. The implementation of differentiated post-supply supervision policies is mainly achieved in two different ways.

A special post-supply supervision functional department could be established to coordinate the post-supply supervision of industrial projects. The post-supply supervision functional department can be led by the natural resource management department with participation from multiple departments, such as investment promotion, taxation, industry and commerce, environment, courts, and banks. The post-supply supervision office is responsible for organizing and coordinating post-supply supervision of industrial land, while the relevant departments are responsible for the implementation of specific supervision measures at each land-use stage.

In addition, a supervision agreement for project land can be signed to realize the management of industrial land in the form of a dual contract. After the project admittance is passed, the project land supervision contract needs to be signed when signing the contract for paid land use. The content of the supervision contract includes implementation details such as the project production evaluation, the dynamic tracking of land use, and
the identification and disposal of inefficient land. According to the regional industry development orientation and industry characteristics, using the survey data of industrial enterprises and industrial land, the government establishes a differentiated post supply supervision and evaluation system and dynamic update mechanism for industrial land, and implements differentiated post supply supervision according to the evaluation results. The government then uses various disposal measures for project land depending on the evaluation results. The disposal measures include continued land use, an extension of the land lease period, a rectification within a time limit, and a withdrawal of land use.

5. Conclusions

The current industrial land supply system has dire problems in terms of supply method, supply period, supply price, and post-supply supervision, which severely restrict improvements in the efficiency of land resource allocation and industrial land use efficiency. Promoting the policy innovation of differentiated industrial land supply is an inevitable choice to meet the needs of the macro-development environment, to seek the high-quality development of the regional economy, and to break through the bottleneck of land resources development. Within the scope of the national top-level system design, we explore DILSP policy innovations with the practical experience of typical regions. The policy innovations focus on differentiated admittance standards, differentiated supply methods, differentiated supply valid periods, differentiated supply prices, and differentiated post-supply supervision. The proposed DILSP has a corresponding legal basis and is in line with the direction of the current supply-side structural reform and the market-oriented allocation reform of factors, which can effectively promote the LCM of industrial land. At present, there are both opportunities and challenges for the exploration and implementation of DILSP.

According to the analysis of policy and the literature, there are few differentiated industrial land supply policies in China. Moreover, the cyclical industrial land-use law is usually ignored. As a result, there are many limitations in the current industrial land-supply policy that draw attention to its inefficient application. Based on a full consideration of LCM, the DILSP proposed in this study is highly targeted and innovative and plays an important role in improving the efficiency of industrial land use in China.

The primary advantage of formulating DILSP based on the LCM is that when formulating industrial land supply policies, local governments should consider the industrial land-use and needs management at the same time and promote rational land use according to the changes in land-use efficiency. The difficulty of formulating a DILSP based on the LCM is in balancing the accuracy and the efficiency of differentiated land-supply policy and requires further study. Moreover, the actual effectiveness of the supply methods such as a long-term lease, first-lease-after-transfer, and a combination of lease and transfer, are yet to be evaluated.

In addition, the policy innovation of the DILSP proposed in this study is mainly based on China’s unique urban land system, namely, on the public ownership of land. This makes it difficult to apply in other non-public countries. However, some specific parts of the proposed DILSP could be implemented in other countries and may play a positive role, such as improving the admittance standards of industrial land and strengthening post-supply supervision.

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